OMB Number: 4040-0001
Expiration Date: 12/31/2022

APPLICATION FOR FEDERAL ASSISTANCE
SF 424 (R&R)

3. DATE RECEIVED BY STATE

State Application Identifier Maryland

1. TYPE OF SUBMISSION

☐ Pre-application ☒ Application ☐ Changed/Corrected Application

4. a. Federal Identifier

b. Agency Routing Identifier

c. Previous Grants.gov Tracking ID

2. DATE SUBMITTED 10/09/2020

Applicant Identifier

5. APPLICANT INFORMATION

Organizational DUNS: 8799413180000

Legal Name: Morgan State University

Department: Math

Division: Academic Affairs

Street1: 1700 E. Cold Spring Lane

Street2:

City: Baltimore

County / Parish: Maryland

State: MD: Maryland

Province:

Country: USA: UNITED STATES

ZIP / Postal Code: 21251-0001

Person to be contacted on matters involving this application

Prefix: Dr.

First Name: Farin

Middle Name:

Last Name: Kamangar

Suffix:

Position/Title: Interim Assistant Vice President for Research

Street1: 1700 E. Cold Spring Lane

Street2:

City: Baltimore

County / Parish: Maryland

State: MD: Maryland

Province:

Country: USA: UNITED STATES

ZIP / Postal Code: 21251-0001

Phone Number: 301-655-9280

Fax Number: 443-885-8280

Email: farin.kamangar@morgan.edu

6. EMPLOYER IDENTIFICATION *(EIN) or (TIN):* 52-6002033

7. TYPE OF APPLICANT: H: Public/State Controlled Institution of Higher Education

Other (Specify):

Small Business Organization Type ☐ Women Owned ☐ Socially and Economically Disadvantaged

8. TYPE OF APPLICATION:

☒ New ☐ Resubmission

☐ Renewal ☐ Continuation ☐ Revision

If Revision, mark appropriate box(es).

☐ A. Increase Award ☐ B. Decrease Award ☐ C. Increase Duration ☐ D. Decrease Duration

☐ E. Other (specify):

Is this application being submitted to other agencies? Yes ☐ No ☒ What other Agencies?

9. NAME OF FEDERAL AGENCY: Office of Procurement Operations - Grants Divi

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: 97.062

TITLE: Scientific Leadership Awards

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

DHS SLA for Minority Serving Institutions

12. PROPOSED PROJECT:

Start Date: 11/16/2020

Ending Date: 09/30/2023

13. CONGRESSIONAL DISTRICT OF APPLICANT MD-007

14. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION

Prefix: Dr. First Name: Jonathan Middle Name:

Last Name: Farley Suffix:

Position/Title: Associate Professor

Organization Name: Morgan State University

Department: Math Division: Academic Affairs

Street1: 1700 E. Cold Spring Lane

Street2:

City: Baltimore County / Parish: Maryland

State: MD: Maryland Province:

Country: USA: UNITED STATES ZIP / Postal Code: 21251-0001

Phone Number: 443-885-3473 Fax Number:

Email: Jonathan.Farley@morgan.edu

15. ESTIMATED PROJECT FUNDING

a. Total Federal Funds Requested	465,657.00
b. Total Non-Federal Funds	0.00
c. Total Federal & Non-Federal Funds	465,657.00
d. Estimated Program Income	0.00

16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES ☒ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE: 10/12/2020

b. NO ☐ PROGRAM IS NOT COVERED BY E.O. 12372; OR

☐ PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. By signing this application, I certify (1) to the statements contained in the list of certifications* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances * and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious. or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

☒ **I agree**

The list of certifications and assurances, or an Internet site where you may obtain this list, is contained in the announcement or agency specific instructions.

18. SFLLL (Disclosure of Lobbying Activities) or other Explanatory Documentation

Add Attachment | Delete Attachment | View Attachment

19. Authorized Representative

Prefix: Dr. First Name: Farin Middle Name:

Last Name: Kamangar Suffix:

Position/Title: Interim Assistant Vice President for Research

Organization: Morgan State University

Department: Sponsored Programs & Research Division: Research & Economic Developmen

Street1: 1700 E. Cold Spring Lane

Street2:

City: Baltimore County / Parish: Maryland

State: MD: Maryland Province:

Country: USA: UNITED STATES ZIP / Postal Code: 21251-0001

Phone Number: 301-655-9280 Fax Number: 443-885-8280

Email: farin.kamangar@morgan.edu

Signature of Authorized Representative: Completed on submission to Grants.gov

Date Signed: Completed on submission to Grants.gov

20. Pre-application Add Attachment | Delete Attachment | View Attachment

21. Cover Letter Attachment Add Attachment | Delete Attachment | View Attachment

BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 02/28/2022

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. DHS-20-ST-062-001		$	$	$ 155,219.00	$	$ 155,219.00
2.						
3.						
4.						
5. Totals		$	$	$ 155,219.00	$	$ 155,219.00

Standard Form 424A (Rev. 7- 97)
Prescribed by OMB (Circular A -102) Page 1

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY (1) DHS-20-ST-062-001	(2)	(3)	(4)	Total (5)
a. Personnel	$ 37,347.00	$	$	$	$ 37,347.00
b. Fringe Benefits	6,455.00				6,455.00
c. Travel	5,000.00				5,000.00
d. Equipment					
e. Supplies	4,000.00				4,000.00
f. Contractual	2,000.00				2,000.00
g. Construction					
h. Other	79,592.00				79,592.00
i. Total Direct Charges (sum of 6a-6h)	134,394.00				$ 134,394.00
j. Indirect Charges	20,825.00				$ 20,825.00
k. TOTALS (sum of 6i and 6j)	$ 155,219.00	$	$	$	$ 155,219.00
7. Program Income	$	$	$	$	$

Authorized for Local Reproduction

Standard Form 424A (Rev. 7- 97)
Prescribed by OMB (Circular A -102) Page 1A

SECTION C - NON-FEDERAL RESOURCES

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e)TOTALS
8. DHS-20-ST-062-001	$	$	$	$
9.				
10.				
11.				
12. TOTAL (sum of lines 8-11)	$	$	$	$

SECTION D - FORECASTED CASH NEEDS

	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	$ 155,219.00	$ 38,805.00	$ 38,805.00	$ 38,805.00	$ 38,804.00
14. Non-Federal	$				
15. TOTAL (sum of lines 13 and 14)	$ 155,219.00	$ 38,805.00	$ 38,805.00	$ 38,805.00	$ 38,804.00

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT

(a) Grant Program	FUTURE FUNDING PERIODS (YEARS)			
	(b)First	(c) Second	(d) Third	(e) Fourth
16. DHS-20-ST-062-001	$ 155,219.00	$ 155,219.00	$	$
17.				
18.				
19.				
20. TOTAL (sum of lines 16 - 19)	$ 155,219.00	$ 155,219.00	$	$

SECTION F - OTHER BUDGET INFORMATION

21. Direct Charges:

22. Indirect Charges:

23. Remarks:

OMB Number: 4040-0007
Expiration Date: 02/28/2022

ASSURANCES - NON-CONSTRUCTION PROGRAMS

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0040), Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET. SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant, I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.

2. Will give the awarding agency, the Comptroller General of the United States and, if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.

3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.

4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.

5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§4728-4763) relating to prescribed standards for merit systems for programs funded under one of the 19 statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C.F.R. 900, Subpart F).

6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C.§§1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. §§290 dd-3 and 290 ee- 3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §§3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and, (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.

7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally-assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

8. Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §276c and 18 U.S.C. §874), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally-assisted construction subagreements.

10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is $10,000 or more.

11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. §§7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended (P.L. 93-523); and, (h) protection of endangered species under the Endangered Species Act of 1973, as amended (P.L. 93-205).

12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.

13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. §470), EO 11593(identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. §§469a-1 et seq.).

14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.

15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. §§2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.

16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§4801 et seq.) which prohibits the use of lead-based paint in construction or rehabilitation of residence structures.

17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act Amendments of 1996 and OMB Circular No. A-133, "Audits of States, Local Governments, and Non-Profit Organizations."

18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations, and policies governing this program.

19. Will comply with the requirements of Section 106(g) of the Trafficking Victims Protection Act (TVPA) of 2000, as amended (22 U.S.C. 7104) which prohibits grant award recipients or a sub-recipient from (1) Engaging in severe forms of trafficking in persons during the period of time that the award is in effect (2) Procuring a commercial sex act during the period of time that the award is in effect or (3) Using forced labor in the performance of the award or subawards under the award.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	TITLE
Completed on submission to Grants.gov	Interim Assistant Vice President for Research
APPLICANT ORGANIZATION	DATE SUBMITTED
Morgan State University	Completed on submission to Grants.gov

Standard Form 424B (Rev. 7-97) Back

RESEARCH & RELATED BUDGET - Budget Period 1

OMB Number: 4040-0001
Expiration Date: 12/31/2022

ORGANIZATIONAL DUNS: 8799413180000 **Enter name of Organization:** Morgan State University

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period: 1** **Start Date:** 11/16/2020 **End Date:** 09/30/2021

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Jonathan		Farley		84,122.00		1.00		9,347.00	3,926.00	13,273.00

Project Role: PI

Additional Senior Key Persons: Add Attachment Delete Attachment View Attachment

Total Funds requested for all Senior Key Persons in the attached file

Total Senior/Key Person 13,273.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
1	Secretarial/Clerical				10,000.00	900.00	10,900.00
3	Faculty Mentors				18,000.00	1,629.00	19,629.00
4	**Total Number Other Personnel**					**Total Other Personnel**	30,529.00

Total Salary, Wages and Fringe Benefits (A+B) 43,802.00

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

Equipment item	Funds Requested ($)

Additional Equipment: Add Attachment Delete Attachment View Attachment

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel

		Funds Requested ($)
1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	5,000.00
2.	Foreign Travel Costs	
	Total Travel Cost	5,000.00

E. Participant/Trainee Support Costs

		Funds Requested ($)
1.	Tuition/Fees/Health Insurance	38,592.00
2.	Stipends	36,000.00
3.	Travel	5,000.00
4.	Subsistence	
5.	Other	
5	**Number of Participants/Trainees** — **Total Participant/Trainee Support Costs**	79,592.00

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	3,000.00
2.	Publication Costs	1,000.00
3.	Consultant Services	2,000.00
4.	ADP/Computer Services	
5.	Subawards/Consortium/Contractual Costs	
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.		
9.		
10.		
	Total Other Direct Costs	6,000.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	134,394.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
MTDC	38.00	54,802.00	20,825.00
		Total Indirect Costs	20,825.00

Cognizant Federal Agency
(Agency Name, POC Name, and POC Phone Number)

DHHS, Joel Mckenzie, 214-767-3261

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	155,219.00

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	155,219.00

L. Budget Justification

(Only attach one file.) Budget Justification.pdf

Add Attachment | Delete Attachment | View Attachment

RESEARCH & RELATED BUDGET - Budget Period 2

OMB Number: 4040-0001
Expiration Date: 12/31/2022

ORGANIZATIONAL DUNS: 8799413180000 **Enter name of Organization:** Morgan State University

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period: 2** **Start Date:** 10/01/2021 **End Date:** 09/30/2022

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Jonathan		Farley		84,122.00		1.00		9,347.00	3,926.00	13,273.00

Project Role: PI

Additional Senior Key Persons: Add Attachment Delete Attachment View Attachment

Total Funds requested for all Senior Key Persons in the attached file

Total Senior/Key Person 13,273.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
1	Secretarial/Clerical				10,000.00	900.00	10,900.00
3	Faculty Mentors				18,000.00	1,629.00	19,629.00
4	**Total Number Other Personnel**					**Total Other Personnel**	30,529.00

Total Salary, Wages and Fringe Benefits (A+B) 43,802.00

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

Equipment item	Funds Requested ($)

Additional Equipment: Add Attachment Delete Attachment View Attachment

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel

		Funds Requested ($)
1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	5,000.00
2.	Foreign Travel Costs	
	Total Travel Cost	5,000.00

E. Participant/Trainee Support Costs

		Funds Requested ($)
1.	Tuition/Fees/Health Insurance	38,592.00
2.	Stipends	36,000.00
3.	Travel	5,000.00
4.	Subsistence	
5.	Other	
5	**Number of Participants/Trainees** — **Total Participant/Trainee Support Costs**	79,592.00

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	3,000.00
2.	Publication Costs	1,000.00
3.	Consultant Services	2,000.00
4.	ADP/Computer Services	
5.	Subawards/Consortium/Contractual Costs	
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.		
9.		
10.		
	Total Other Direct Costs	6,000.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	134,394.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
MTDC	38.00	54,802.00	20,825.00
		Total Indirect Costs	20,825.00

Cognizant Federal Agency
(Agency Name, POC Name, and POC Phone Number)

DHHS, Joel Mckenzie, 214-767-3261

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	155,219.00

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	155,219.00

L. Budget Justification

(Only attach one file.) Budget Justification.pdf

Add Attachment | Delete Attachment | View Attachment

RESEARCH & RELATED BUDGET - Budget Period 3

OMB Number: 4040-0001
Expiration Date: 12/31/2022

ORGANIZATIONAL DUNS: 8799413180000 **Enter name of Organization:** Morgan State University

Budget Type: ☒ Project ☐ Subaward/Consortium **Budget Period: 3** **Start Date:** 10/01/2022 **End Date:** 09/30/2023

A. Senior/Key Person

Prefix	First	Middle	Last	Suffix	Base Salary ($)	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
Dr.	Jonathan		Farley		84,122.00		1.00		9,347.00	3,926.00	13,273.00

Project Role: PI

Additional Senior Key Persons: Add Attachment Delete Attachment View Attachment

Total Funds requested for all Senior Key Persons in the attached file

Total Senior/Key Person 13,273.00

B. Other Personnel

Number of Personnel	Project Role	Months Cal.	Months Acad.	Months Sum.	Requested Salary ($)	Fringe Benefits ($)	Funds Requested ($)
	Post Doctoral Associates						
	Graduate Students						
	Undergraduate Students						
1	Secretarial/Clerical				10,000.00	900.00	10,900.00
3	Faculty Mentors				18,000.00	1,629.00	19,629.00
4	**Total Number Other Personnel**					**Total Other Personnel**	30,529.00

Total Salary, Wages and Fringe Benefits (A+B) 43,802.00

C. Equipment Description

List items and dollar amount for each item exceeding $5,000

Equipment item	Funds Requested ($)

Additional Equipment: Add Attachment Delete Attachment View Attachment

Total funds requested for all equipment listed in the attached file

Total Equipment

D. Travel

		Funds Requested ($)
1.	Domestic Travel Costs (Incl. Canada, Mexico and U.S. Possessions)	5,000.00
2.	Foreign Travel Costs	
	Total Travel Cost	5,000.00

E. Participant/Trainee Support Costs

		Funds Requested ($)
1.	Tuition/Fees/Health Insurance	38,592.00
2.	Stipends	36,000.00
3.	Travel	5,000.00
4.	Subsistence	
5.	Other	
5	**Number of Participants/Trainees** — **Total Participant/Trainee Support Costs**	79,592.00

F. Other Direct Costs

		Funds Requested ($)
1.	Materials and Supplies	3,000.00
2.	Publication Costs	1,000.00
3.	Consultant Services	2,000.00
4.	ADP/Computer Services	
5.	Subawards/Consortium/Contractual Costs	
6.	Equipment or Facility Rental/User Fees	
7.	Alterations and Renovations	
8.		
9.		
10.		
	Total Other Direct Costs	6,000.00

G. Direct Costs

	Funds Requested ($)
Total Direct Costs (A thru F)	134,394.00

H. Indirect Costs

Indirect Cost Type	Indirect Cost Rate (%)	Indirect Cost Base ($)	Funds Requested ($)
MTDC	38.00	54,802.00	20,825.00
		Total Indirect Costs	20,825.00

Cognizant Federal Agency
(Agency Name, POC Name, and POC Phone Number)

DHHS, Joel Mckenzie, 214-767-3261

I. Total Direct and Indirect Costs

	Funds Requested ($)
Total Direct and Indirect Institutional Costs (G + H)	155,219.00

J. Fee

Funds Requested ($)

K. Total Costs and Fee

	Funds Requested ($)
Total Costs and Fee (I + J)	155,219.00

L. Budget Justification

(Only attach one file.) Budget Justification.pdf

Add Attachment | Delete Attachment | View Attachment

RESEARCH & RELATED BUDGET - Cumulative Budget

	Totals ($)	
Section A, Senior/Key Person		39,819.00
Section B, Other Personnel		91,587.00
Total Number Other Personnel	12	
Total Salary, Wages and Fringe Benefits (A+B)		131,406.00
Section C, Equipment		
Section D, Travel		15,000.00
1. Domestic	15,000.00	
2. Foreign		
Section E, Participant/Trainee Support Costs		238,776.00
1. Tuition/Fees/Health Insurance	115,776.00	
2. Stipends	108,000.00	
3. Travel	15,000.00	
4. Subsistence		
5. Other		
6. Number of Participants/Trainees	15	
Section F, Other Direct Costs		18,000.00
1. Materials and Supplies	9,000.00	
2. Publication Costs	3,000.00	
3. Consultant Services	6,000.00	
4. ADP/Computer Services		
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations		
8. Other 1		
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		403,182.00
Section H, Indirect Costs		62,475.00
Section I, Total Direct and Indirect Costs (G + H)		465,657.00
Section J, Fee		
Section K, Total Costs and Fee (I + J)		465,657.00

Budget Justification
Title: DHS SLA for Minority Serving Institutions
Project Period: November 16th, 2020 - September 30th, 2023
MSU PI: (Dr. Jonathan Farley)

YEAR 1

A. PERSONNEL - $37, 347

SENIOR PERSONNEL:

Principal Investigator (Dr. Jonathan Farley): $9,347
Associate Professor, Dr. Jonathan Farley, at MSU, will be the Principal Investigator (PI) of this project and will provide overall direction and oversight of the project including drafting and dissemination of results. He will request 1 academic month release time per year and is requesting $9,347. In addition to overall project responsibility, he will supervise two Mathematics Graduate Student Researchers (GSRs) working on the project.

Co-Principal Investigator (Dr. Candice Marshall): No Salary Requested. Director of Actuarial Science, Dr. Candice Marshall, at Morgan State University, will be the Co-Principal Investigator (Co-PI) of this project. She will commit 10 weeks per year. In addition to overseeing her responsibility on the project, she will assist the PI as outlined in the research proposal and co-supervise the GSRs.

Co-Principal Investigator (Dr. Zeinab Bandpey): No Salary Requested. Mathematics Lecturer, at Morgan State University, will be the Co-Principal Investigator (Co-PI) of this project. She will commit 10 weeks per year. In addition to overseeing her responsibility on the project, she will assist the PI as outlined in the research proposal and co-supervise the GSRs.

OTHER PERSONNEL:
Part-time Program Coordinator: TBD. $10,000.
This person will assist with the program administration and operations and will work 10 hrs. a week at a rate of $20 an hour.

Faculty: TBD. $18,000
Three faculty members will serve as mentors and supervise student research projects.
Each faculty member will receive $3,000 per semester for a total of $6,000 a year for their services.

B. FRINGE BENEFITS: $6,455

Fringe benefits charge for faculty working during the academic year is 42% and fringe benefit charge for part time personnel is 9%.

C. TRAVEL: $5,000

Domestic: A travel budget of $2,500 is requested for a PI and Co-PIs to travel to the annual meeting (DHS COE summit) for purposes of collaboration with DHS COE. Travel is also included here for meetings with COE research collaborators at the **Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State University** and other HS agency representatives who may be helpful in developing student internships. Other travel budget $2,500 would include trips to DHS facilities and centers of excellence and conferences to present research such as the Joint Math Meetings.

Estimated breakdown of costs to Arizona State University are as follows.

Trips	**Days**		**PI**	**Co-PIs**	
1	2		1	2	
Airfare	**Meals**	**Hotel**	**Taxi**	**Parking**	**Total:**
$1,200	$56*2*3= 336	$135*2*3 = 810	$94	$60	$2,500

D. EQUIPMENT: N/A

E. SUPPLIES: $4,000

Materials and Supplies:

A material and supplies budget of $3,000 is requested for the acquisition of supplies such as laptops to support the research described in the proposal. We will purchase 1 laptop at $1,000 and software such as Matlab and Python. MATLAB costs $860 per year and we anticipate a cost of around $1,200 for Python.

Publication costs: $1,000

We anticipate the data generated from this study will result in a publication in a peer-reviewed journal and the funds requested is to cover the publication cost.

F. CONTRACTUAL: $2,000

This will cover the cost of travel and accommodation for guest speakers who come to Morgan State University to share information about DHS initiatives and careers with the students. Dr. Ross Maciejewski from Arizona State University as well as Dr. Amy Bennett and Beth Jones will be invited to participate.

G. CONSTRUCTION: N/A

H. OTHER: $79,592

PARTICIPANT SUPPORT COSTS:

2 graduate students will each receive $2,000 a month for 9 months during the academic year for support while working on DHS related research.

3 undergraduate students will receive tuition and fees for doing research on DHS

research topics during the academic year. Tuition and fees vary based on whether students are in state or out of state. Average tuition and fees for a semester is $6,432 per semester. We will provide support for the fall and spring semesters so each student will receive $12,864 per year for tuition and fees.
Travel amount $5,000 is also included here for students to attend meetings with COE research collaborators at Arizona State University and to attend the annual DHS COE summit.

The breakdown of estimated costs for 3 students to attend a meeting is as follows:

Trips	**Days**		**Students**		
1	2		3		
Airfare	**Meals**	**Hotel**	**Taxi**	**Parking**	**Total:**
$1,200	$56*2*3= 336	$135*2*3 = 810	$94	$60	$2,500

I. TOTAL DIRECT CHARGE: $134,394

J. INDIRECT CHARGE: $20,825

Indirect costs are based on University negotiated rates with the cognizant federal authority and are applied at a rate of 51% for the entire project period using the modified total direct cost (MTDC) formula as per the approved rate agreement dated 05/27/2017. Modified total direct costs exclude equipment, capital expenditures, charges for patient care, student tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

K. TOTALS $155,219

YEAR 2

A. PERSONNEL - $37, 347

SENIOR PERSONNEL:

Principal Investigator (Dr. Jonathan Farley):
Associate Professor, Dr. Jonathan Farley, at MSU, will be the Principal Investigator (PI) of this project and will provide overall direction and oversight of the project including drafting and dissemination of results. He will request 1 academic month release time per year and is requesting $9347. In addition to overall project responsibility, he will supervise two Mathematics Graduate Student Researchers (GSRs) working on the project.

Co-Principal Investigator (Dr. Candice Marshall): No Salary Requested. Director of Actuarial Science, Dr. Candice Marshall, at Morgan State University, will be the Co-Principal Investigator (Co-PI) of this project. She will commit 10 weeks per year. In addition to overseeing her responsibility on the project, she will assist the PI as outlined in the research proposal and co-supervise the GSRs.

Co-Principal Investigator (Dr. Zeinab Bandpey): No Salary Requested. Mathematics Lecturer, at Morgan State University, will be the Co-Principal Investigator (Co-PI) of this project. She will commit 10 weeks per year. In addition to overseeing her responsibility on the project, she will assist the PI as outlined in the research proposal and co-supervise the GSRs.

OTHER PERSONNEL:

Part-time Program Coordinator: TBD. $10,000.
This person will assist with the program administration and operations and will work 10 hrs a week at a rate of $20 an hour.

Faculty: TBD. $18,000
Three faculty members will serve as mentors and supervise student research projects. Each faculty member will receive $3,000 per semester for a total of $6,000 a year for their services.

B. FRINGE BENEFITS: $6,455

Fringe benefits charge for faculty working during the academic year is 42% and fringe benefit charge for part time personnel is 9%.

C. TRAVEL: $5,000

Domestic: A travel budget of $2,500 is requested for a PI and Co-PI to travel to the annual meeting (DHS COE summit) for purposes of collaboration with DHS COE. Travel is also included here for meetings with COE research collaborators at the **Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State University** and other HS agency representatives who may be helpful in developing student internships. Other travel $2,500 would include

trips to DHS facilities and centers of excellence and conferences to present research such as the Joint Math Meetings.

Estimated breakdown of costs to Arizona State University are as follows.

Trips	**Days**		**PI**	**Co-PIs**	
1	2		1	2	
Airfare	**Meals**	**Hotel**	**Taxi**	**Parking**	**Total:**
$1,200	$56*2*3= 336	$135*2*3 = 810	$94	$60	$2,500

D. EQUIPMENT: N/A

E. SUPPLIES: $4,000

Materials and Supplies: A material and supplies budget of $3,000 is requested for the acquisition of supplies such as laptops to support the research described in the proposal. We will purchase 1 laptop at $1000 and software such as Matlab and Python. MATLAB costs $860 per year and we anticipate a cost of around $1,200 for Python.
Publication costs: $1,000
We anticipate the data generated from this study will result in a publication in a peer-reviewed journal and the funds requested is to cover the publication cost.

F. CONTRACTUAL: $2,000

This will cover the cost of travel and accommodation for guest speakers who come to Morgan State University to share information about DHS initiatives and careers with the students. Dr. Ross Maciejewski from Arizona State University as well as Dr. Amy Bennett and Beth Jones will be invited to participate.

G. CONSTRUCTION: N/A

H. OTHER: $79,592

PARTICIPANT SUPPORT COSTS:

2 graduate students will each receive $2,000 a month for 9 months during the academic year for support while working on DHS related research.

3 undergraduate students will receive tuition and fees for doing research on DHS research topics during the academic year. Tuition and fees vary based on whether students are in state or out of state. Average tuition and fees for a semester is $6,432 per semester. We will provide support for the fall and spring semesters so each student will receive $12,864 per year for tuition and fees.

Travel amount $5,000 is also included here for students to attend meetings with COE research collaborators at Arizona State University and to attend the annual DHS COE summit.

The breakdown of estimated costs for 3 students to attend a meeting is as follows:

Trips	**Days**		**Students**		
1	2		3		
Airfare	**Meals**	**Hotel**	**Taxi**	**Parking**	**Total:**
$1,200	$56*2*3= 336	$135*2*3 = 810	$94	$60	$2,500

I. TOTAL DIRECT CHARGE: $134,394

J. INDIRECT CHARGE: $20,825

Indirect costs are based on University negotiated rates with the cognizant federal authority and are applied at a rate of 51% for the entire project period using the modified total direct cost (MTDC) formula as per the approved rate agreement dated 05/27/2017. Modified total direct costs exclude equipment, capital expenditures, charges for patient care, student tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

K. TOTALS: $155,219

YEAR 3

A. PERSONNEL - $37, 347

SENIOR PERSONNEL:

Principal Investigator (Dr. Jonathan Farley): $9,347
Associate Professor, Dr. Jonathan Farley, at MSU, will be the Principal Investigator (PI) of this project and will provide overall direction and oversight of the project including drafting and dissemination of results. He will request 1 academic month release time per year and is requesting $9,347. In addition to overall project responsibility, he will supervise two Mathematics Graduate Student Researchers (GSRs) working on the project.

Co-Principal Investigator (Dr. Candice Marshall): No Salary Requested. Director of Actuarial Science, Dr. Candice Marshall, at Morgan State University, will be the Co-Principal Investigator (Co-PI) of this project. She will commit 10 weeks per year. In addition to overseeing her responsibility on the project, she will assist the PI as outlined in the research proposal and co-supervise the GSRs.

Co-Principal Investigator (Dr. Zeinab Bandpey): No Salary Requested. Mathematics Lecturer, at Morgan State University, will be the Co-Principal Investigator (Co-PI) of this project. She will commit 10 weeks per year. In addition to overseeing her responsibility on the project, she will assist the PI as outlined in the research proposal and co-supervise the GSRs.

OTHER PERSONNEL:

Part-time Program Coordinator: TBD. $10,000.
This person will assist with the program administration and operations and will work 10 hrs. a week at a rate of $20 an hour.

Faculty: TBD. $18,000
Three faculty members will serve as mentors and supervise student research projects. Each faculty member will receive $3,000 per semester for a total of $6,000 a year for their services.

B. FRINGE BENEFITS: $6,455

Fringe benefits charge for faculty working during the academic year is 42% and fringe benefit charge for part time personnel is 9%.

C. TRAVEL: $5,000

Domestic: A travel budget of $2,500 is requested for a PI and Co-PIs to travel to the annual meeting (DHS COE summit) for purposes of collaboration with DHS COE. Travel is also included here for meetings with COE research collaborators at the **Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State University** and other HS agency representatives who may be helpful in developing student internships. Other travel budget $2,500 would

include trips to DHS facilities and centers of excellence and conferences to present research such as the Joint Math Meetings.
Estimated breakdown of costs to Arizona State University are as follows.

Trips	**Days**		**PI**	**Co-PIs**	
1	2		1	2	
Airfare	**Meals**	**Hotel**	**Taxi**	**Parking**	**Total:**
$1,200	$56*2*3= 336	$135*2*3 = 810	$94	$60	$2,500

D. EQUIPMENT: N/A

E. SUPPLIES: $4,000

Materials and Supplies:
A material and supplies budget of $3,000 is requested for the acquisition of supplies such as laptops to support the research described in the proposal. We will purchase 1 laptop at $1,000 and software such as Matlab and Python. MATLAB costs $860 per year and we anticipate a cost of around $1,200 for Python.
Publication costs: $1,000
We anticipate the data generated from this study will result in a publication in a peer-reviewed journal and the funds requested is to cover the publication cost.

F. CONTRACTUAL: $2,000

This will cover the cost of travel and accommodation for guest speakers who come to Morgan State University to share information about DHS initiatives and careers with the students. Dr. Ross Maciejewski from Arizona State University as well as Dr. Amy Bennett and Beth Jones will be invited to participate.

G. CONSTRUCTION: N/A

H. OTHER: $79,592

PARTICIPANT SUPPORT COSTS:
2 graduate students will each receive $2,000 a month for 9 months during the academic year for support while working on DHS related research.
3 undergraduate students will receive tuition and fees for doing research on DHS research topics during the academic year. Tuition and fees vary based on whether students are in state or out of state. Average tuition and fees for a semester is $6,432 per semester. We will provide support for the fall and spring semesters so each student will receive $12,864 per year for tuition and fees.
Travel amount $5,000 is also included here for students to attend meetings with COE research collaborators at Arizona State University and to attend the annual DHS COE summit.

The breakdown of estimated costs for 3 students to attend a meeting is as follows:

Trips	**Days**		**Students**		
1	2		3		
Airfare	**Meals**	**Hotel**	**Taxi**	**Parking**	**Total:**
$1,200	$56*2*3= 336	$135*2*3 = 810	$94	$60	$2,500

I. TOTAL DIRECT CHARGE: $134,394

J. INDIRECT CHARGE: $20,825

Indirect costs are based on University negotiated rates with the cognizant federal authority and are applied at a rate of 51% for the entire project period using the modified total direct cost (MTDC) formula as per the approved rate agreement dated 05/27/2017. Modified total direct costs exclude equipment, capital expenditures, charges for patient care, student tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

K. TOTALS $155,219

RESEARCH & RELATED Senior/Key Person Profile

PROFILE - Project Director/Principal Investigator

Prefix: Dr. * First Name: Jonathan Middle Name:

* Last Name: Farley Suffix:

Position/Title: Associate Professor Department: Math

Organization Name: Morgan State University Division: Academic Affairs

* Street1: 1700 E. Cold Spring Lane

Street2:

* City: Baltimore County: Maryland

* State: MD: Maryland Province:

* Country: USA: UNITED STATES * Zip / Postal Code: 21251-0001

* Phone Number: 443-885-3473 Fax Number:

* E-Mail: Jonathan.Farley@morgan.edu

Credential, e.g., agency login:

*** Project Role:** PD/PI **Other Project Role Category:**

*** Attach Biographical Sketch** FarleyResume.pdf Add Attachment Delete Attachment View Attachment

Attach Current & Pending Support Add Attachment Delete Attachment View Attachment

PROFILE - Senior/Key Person 1

Prefix: Dr. * First Name: Candice Middle Name:

* Last Name: Marshall Suffix: Ph.D.

Position/Title: Directer of Actuarial science Department: Mathematics

Organization Name: Morgan State University Division: Academic Affairs

* Street1: 1700 E Cold Spring Ln

Street2: Key 165

* City: Baltimore County: Baltimore City

* State: MD: Maryland Province:

* Country: USA: UNITED STATES * Zip / Postal Code: 212510001

* Phone Number: 4438854298 Fax Number: 4438858216

* E-Mail: candice.marshall@morgan.edu

Credential, e.g., agency login:

*** Project Role:** Co-PD/PI **Other Project Role Category:**

*** Attach Biographical Sketch** Bio Marshall-2.pdf Add Attachment Delete Attachment View Attachment

Attach Current & Pending Support Add Attachment Delete Attachment View Attachment

RESEARCH & RELATED Senior/Key Person Profile

PROFILE - Senior/Key Person 2

Prefix: Dr. * First Name: Zeinab Middle Name:

* Last Name: Bandpey Suffix: Ph.D.

Position/Title: Lecturer Department: Mathematics

Organization Name: Morgan State University Division: Academic Affairs

* Street1: 1700 E Cold Spring Ln

Street2: Carnegie G56

* City: Baltimore County: Baltimore City

* State: MD: Maryland Province:

* Country: USA: UNITED STATES * Zip / Postal Code: 212510001

* Phone Number: 4436000361 Fax Number: 4438858216

* E-Mail: zeinab.bandpey@morgan.edu

Credential, e.g., agency login:

*** Project Role:** Co-PD/PI **Other Project Role Category:**

*** Attach Biographical Sketch**	Zeinab. bio.pdf	Add Attachment	Delete Attachment	View Attachment
Attach Current & Pending Support		Add Attachment	Delete Attachment	View Attachment

ADDITIONAL SENIOR/KEY PERSON PROFILE(S)	Research and Related Sen	Add Attachment	Delete Attachment	View Attachment
Additional Biographical Sketch(es) (Senior/Key Person)		Add Attachment	Delete Attachment	View Attachment
Additional Current and Pending Support(s)		Add Attachment	Delete Attachment	View Attachment

OMB Number: 4040-0001
Expiration Date: 12/31/2022

Jonathan D. Farley, D.Phil. (Oxon.)

Department of Mathematics
Morgan State University
Phone: +1 (443) 885-3473 (work)
1700 E. Cold Spring Lane
Baltimore, MD 21251
Email: jonathan.farley@morgan.edu

"Jonathan Farley…is a model of excellence for young people of all backgrounds, but especially African-Americans who may see their intellectual potential in him. Harvard is proud to honor his achievements and acknowledge his fine example."

— *Professor S. Allen Counter, Harvard University (Jet Magazine, July 2004)*

EDUCATION

University of Oxford, D.Phil. (Mathematics), 1995.

Harvard University, A.B. in Mathematics (*summa cum laude*), 1991.

RESEARCH INTERESTS

- Combinatorics, Lattice Theory and the Theory of Ordered Sets
- Applications of combinatorics in homeland security and counterterrorism

HONORS AND AWARDS

§ Proteus Monograph Series Fellows Program, 2007 (for writing the monograph *Toward a Mathematical Theory of Counterterrorism: Building the Perfect Terrorist Cell*).
§ *Seed* Magazine Science "Icon", 2006 (for being one of "15 people who have shaped the global conversation about science in 2005").
§ Key to the City of Columbia, South Carolina (state capital), 2005.
§ Harvard Foundation Distinguished Scientist Award, 2004 (for "outstanding achievements and contributions in the field of mathematics"), medal presented on behalf of the President of Harvard University. City of Cambridge, Massachusetts proclaims March 19, 2004 to be "Dr. Jonathan David Farley Day."
§ U.S.-U.K. Fulbright Distinguished Scholar Award, one of only four Americans to win this award this year; used while at the University of Oxford, 2001-2002.
§ Senior Mathematical Prize and Johnson Prize, University of Oxford, 1994 (for "the dissertation of the greatest merit" by a mathematics graduate student under 25).
§ Harvard Class Rank: 2nd highest average in a class of about 1,600 students. Harvard Record: 29 A's, 3 A-'s.

ACADEMIC APPOINTMENTS

Morgan State University, Associate Professor, Department of Mathematics, 2013-.

Research Institute for Mathematics (Maine), Institute Researcher, 2012-2014.

University of Maine, Associate Professor, School of Computing and Information Science and Department of Mathematics and Statistics, 2011-2012.

University of Maine, Associate Professor, Department of Computer Science, 2010-2011.

Johannes Kepler Universität Linz (Austria), Research and Teaching Fellow, Institut für Algebra, 2008-2009, 2009-2010.

California Institute of Technology, Visiting Professor, Department of Mathematics, 2007-2008.

The University of the West Indies (Jamaica), Professor, Department of Mathematics and Computer Science, 2006-2007.

Stanford University, Science Fellow, Center for International Security and Cooperation, 2005-2006.

Indian Institute of Technology-Bombay (India), Visiting Professor, Department of Mathematics, 2005 (Summer).

Harvard University, Visiting Scholar, Department of Mathematics, 2005.

Massachusetts Institute of Technology, Visiting Associate Professor, Department of Applied Mathematics, 2003 and 2004.

Vanderbilt University, Assistant and Associate Professor with Tenure, Department of Mathematics, 1996-2005.

Mathematical Sciences Research Institute, Berkeley, California, Postdoctoral Fellow, 1995-1997.

RESEARCH GRANTS AND CONTRACTS

Proteus Monograph Series Fellows Program, 2007. $20,000

National Science Foundation grant (with Ralph McKenzie), 1999-2002. Est. $150,000

National Science Foundation Graduate Research Fellowship (for study at University of Oxford, 1991-1995).

COURSES TAUGHT

Calculus 1; Calculus 2; Multivariable Calculus; Discrete Math (for math students); Discrete Math (for computer science students); Linear Algebra; Abstract Algebra (undergraduate and graduate level); Special Topics in Combinatorics and Discrete Mathematics; Computers, Ethics, and Society

SELECTED JOURNAL PUBLICATIONS AND BOOK CHAPTERS

1. Jonathan David Farley, "Another Problem of Jónsson and McKenzie from 1982: Refinement Properties for Connected Powers of Posets," *Algebra Universalis* (to appear).

2. Jonathan David Farley, "Evolutionary Dynamics of Bee Colony Collapse Disorder: First Steps toward a Mathematical Model of the Contagion Hypothesis," *Journal of Advances in Agriculture* 7 (2017), 1050-1056.

3. Jonathan David Farley, "Quasi-completeness and localizations of polynomial domains: A conjecture from 'Open problems in commutative ring theory,'" *Bulletin of the Korean Mathematical Society* 53 (2016), 1613-1615.

4. Jonathan David Farley and Dominic van der Zypen, "A Problem of Hartmanis on Generalized Partitions," *Baltic Journal of Modern Computing* 3 (2015), 268-272.

5. Jonathan David Farley, "Strictly Order-Preserving Maps into Z, I: A Problem of Daykin from the 1984 Banff Conference on Graphs and Order," *Mathematica Pannonica* 25 (2014-2015), 17-39.

6. Jonathan David Farley, "Distributive Lattices of Small Width, I: A Question of Rosenberg from the 1981 Banff Conference on Ordered Sets," *Mathematica Pannonica* 24 (2013), 231-242.

7. Jonathan David Farley, "A Problem (Attributed to Rado) from Mirsky's 1971 Monograph *Transversal Theory* and a Conjecture from the 1982 *Proceedings of the American Mathematical Society*," *Mathematica Pannonica* 24 (2013), 3-14.

8. Jonathan David Farley (2012). "How Al Qaeda Can Use Order Theory to Evade or Defeat U.S. Forces: The Case of Binary Posets," in Evangelos Kranakis (Ed.), *Advances in Network Analysis and Its Applications* (pp. 299-306). Vienna, Austria: Springer Verlag.

9. Jonathan David Farley, "Solution to conjectures of Schmidt and Quackenbush from 1974 and 1985: tensor products of semilattices," *Mathematica Pannonica* 22 (2011), 135-147.

10. Jonathan David Farley, "Maximal sublattices of finite distributive lattices. III: a conjecture from the 1984 Banff Conference on Graphs and Order," *Canadian Mathematical Bulletin* 54 (2011), 277-282.

11. Jonathan David Farley and Ryan Klippenstine, "Distributive lattices of small width, II: a problem from Stanley's 1986 text *Enumerative Combinatorics*," *Journal of Combinatorial Theory (A)* 116 (2009), 1097-1119.

12. Jonathan David Farley and Héctor Rosario, "A Critique of Monetary Educational Incentives for Elementary and Middle School Students in New York City Public Schools," *Teachers College Record* (May 15, 2008).

13. Jonathan David Farley and Stefan E. Schmidt, "Comparability graphs of lattices," *Journal of Pure and Applied Algebra* 212(2008), 832-839.

14. Jonathan David Farley, "A structure theorem for posets admitting a 'strong' chain partition: a generalization of a conjecture of Daykin and Daykin (with connections to probability correlation inequalities)," *Discrete Mathematics* 307 (2007), 191-198.

15. Jonathan David Farley, "Evolutionary Dynamics of the Insurgency in Iraq: A Mathematical Model of the Battle for Hearts and Minds," *Studies in Conflict and Terrorism* 30 (2007), 947-962.

16. Vladimir A. Lefebvre and Jonathan David Farley, "The Torturer's Dilemma: A Theoretical Analysis of the Societal Consequences of Torturing Terrorist Suspects," *Studies in Conflict and Terrorism* 30 (2007), 635-646.

17. J. D. Farley, "Coproducts of bounded distributive lattices: infinite distributivity," *Acta Mathematica Hungarica* 112 (2006), 269-273.

18. Jonathan David Farley, "Linear extensions of ranked posets, enumerated by descents. A problem of Stanley from the 1981 Banff Conference on Ordered Sets," *Advances in Applied Mathematics* 34 (2005), no. 2, 295-312.

19. Jonathan David Farley and Sungsoon Kim, "The automorphism group of the Fibonacci poset: a 'not too difficult' problem of Stanley from 1988," *Journal of Algebraic Combinatorics* 19 (2004), no. 2, 197-204.

20. Jonathan David Farley, "Quasi-differential posets and cover functions of distributive lattices II: a problem in Stanley's *Enumerative Combinatorics*," *Graphs and Combinatorics* 19 (2003), no. 4, 475-491.

21. Jonathan David Farley, "Breaking Al Qaeda Cells: A Mathematical Analysis of Counterterrorism Operations (A Guide for Risk Assessment and Decision Making)," *Studies in Conflict and Terrorism* 26 (2003), 399-411.

22. Jonathan David Farley and Bernd S. W. Schröder, "Strictly order-preserving maps into Z, II. A 1979 problem of Erné," *Order*18 (2001), 381-385.

23. Jonathan Farley, "Coproducts of bounded distributive lattices: cancellation—a problem from the 1981 Banff Conference on Ordered Sets," *Algebra Universalis* 45 (2001), no. 4, 375-381.

24. Jonathan David Farley and Stefan E. Schmidt, "Posets that locally resemble distributive lattices: an extension of Stanley's theorem (with connections to buildings and diagram geometries)," *Journal of Combinatorial Theory (A)* 92 (2000), 119-137.

25. Jonathan David Farley, "Quasi-differential posets and cover functions of distributive lattices I. A conjecture of Stanley," *Journal of Combinatorial Theory (A)* 90 (2000), no. 1, 123-147.

26. Jonathan David Farley, "Functions on distributive lattices with the congruence substitution property: some problems of Grätzer from 1964," *Advances in Mathematics* 149 (2000), no. 2, 193-213.

27. J. D. Farley, "Ideals of Priestley powers of semilattices," *Algebra Universalis* 41 (1999), 239-254.

28.J. D. Farley, "Cardinalities of infinite antichains in products of chains," *Algebra Universalis* 42 (1999), 235-238.

29. Jonathan David Farley, "The fixed point property for posets of small width," *Order* 14 (1997-1998), 125-143.

30. Jonathan Farley, "Chain decomposition theorems for ordered sets (and other musings)," in: *African Americans in Mathematics*(Nathaniel Dean, ed.), *DIMACS Series in Discrete Mathematics and Theoretical Computer Science* 34 (American Mathematical Society, Providence, Rhode Island, 1997), 3-13.

31. Jonathan David Farley, "Perfect sequences of chain-complete posets," *Discrete Mathematics* 167/168 (1997), 271-296.

32. Jonathan David Farley, "Priestley powers of lattices and their congruences. A problem of E. T. Schmidt," *Acta Scientiarum Mathematicarum (Szeged)* 62 (1996), no. 1-2, 3-45.

33. Jonathan David Farley, "Priestley duality for order-preserving maps into distributive lattices," *Order* 13 (1996), 65-98.

34. J.D. Farley, "The automorphism group of a function lattice: a problem of Jónsson and McKenzie," *Algebra Universalis* 36(1996), no. 1, 8-45.

35. Jonathan David Farley, "The number of order-preserving maps between fences and crowns," *Order* 12 (1995), 5-44.

36. Jonathan David Farley, "The uniqueness of the core," *Order: A Journal on the Theory of Ordered Sets and Its Applications* 10(1993), 129-131.

BOOKS AND MONOGRAPHS PUBLISHED

Nasrullah Memon, Jonathan D. Farley, David L. Hicks, and Torben Rosenørn (editors), *Mathematical Methods in Counterterrorism* (Springer Verlag, Vienna, 2009).

Jonathan Farley,*Toward a Mathematical Theory of Counterterrorism: Building the Perfect Terrorist Cell* (U.S. Army War College, Carlisle Barracks, Pennsylvania, 2007).

SELECTED PUBLISHED ESSAYS AND MAGAZINE ARTICLES

1. "Moment of Proof", *Notices of the American Mathematical Society* (March 2006).
2. "The N.S.A.'s Math Problem," *The New York Times* (May 16, 2006).
3. "The NSA Is Tap, Tap, Tapping: Spy Agency Misses the Big Picture As It Targets All the Dots," *San Francisco Chronicle* (July 9, 2006).
4. "What's So Wasteful about Funding Discovery?", *Sacramento Bee* newspaper (September 26, 2008).
5. "DLIs: A Minute to Learn," *A.N.A.L.O.G. Computing* Magazine (October 1986).

SELECTED PRESENTATIONS

· Invited speaker at Baltimore Combinatorics and Number Theory Seminar (May 8, 2020).

· Invited speaker at New York Combinatorics Seminar (April 3, 2020).

· Invited facilitator at Central Virginia Math Teachers' Circle, Virginia State University, Petersburg, Virginia (May 17, 2018).

· Invited speaker at Computer Science Seminar, Missouri University of Science and Technology, Rolla, Missouri (April 23, 2018).

· Invited speaker at Mathematics Seminar, Hofstra University, Hempstead, New York (March 7, 2018).

· Invited speaker at Hofstra Cultural Center, Hofstra University, Hempstead, New York (March 6, 2018).

· Invited speaker at Mathematics Colloquium, Towson University, Towson, Maryland (October 13, 2016).

· Invited featured speaker at Eastern Regional Meeting, National Council of Teachers of Mathematics, Atlantic City, New Jersey (October 22, 2015).

· Invited keynote speaker at Adjunct Summit Conference, Prince George's Community College, Largo, Maryland (March 7, 2015).

· Invited speaker at Mathematics Colloquium, Swarthmore College, Swarthmore, Pennsylvania (October 7, 2014).

· Invited speaker at Mathematics Colloquium, Teachers College, Columbia University, New York City, New York (November 11, 2013).
· Invited speaker at Department of Mathematical Sciences, Mathematics Division Colloquium, Stellenbosch University, Stellenbosch, South Africa (July 10, 2013).
· Invited panelist at Next Einstein Initiative, African Institute for Mathematical Sciences, Cape Town, South Africa (June 27, 2013).
· Invited speaker at Institut für Algebra, Technische Universität Dresden, Dresden, Germany (May 29, 2013).
· Invited speaker at Department of Computer Science Research Seminar, Palacký University, Olomouc, Czech Republic (April 25, 2013).
· Invited speaker at Department of Mathematical Sciences Colloquium, University of Puerto Rico at Mayagüez, Mayagüez, Puerto Rico (March 15, 2013).
· Invited speaker at MITACS Workshop on Social Networks, Vancouver, Canada (August 9-13, 2010).
· Invited speaker at MITACS/CORS 2010 Annual Conference, Edmonton, Canada (May 25-28, 2010).
· Keynote speaker at iMATHination 2010 Teacher Professional Development Conference held at the Chicago Teachers' Center of Northeastern Illinois University (January 22-23, 2010).
· Invited speaker at inaugural conference (and invited to participate in opening ceremony) of the Counterterrorism Research Lab, The Mærsk Mc-Kinney Møller Institute, University of Southern Denmark, Odense, Denmark (October 26 and 27-28, 2009).
· Invited speaker at Algebra Seminar, Technische Universität Wien, Vienna, Austria (January 23, 2009).
· Invited speaker at Center for Applied Mathematics Colloquium, Cornell University, Ithaca, New York (April 4, 2008).
· Invited panelist for workshop on Disrupting IED Terror Campaigns: Predicting IED Activities, The National Academies, Washington, D.C. (March 17-18, 2008).
· Invited panelist for workshop on Radicalisation: Foresight and Warning, Nanyang Technological University, Singapore (February 3-5, 2008).
· Invited speaker at Discrete Mathematics and Optimization Seminar, McGill University, Montreal, Canada (April 3, 2007).
· Speaker for the 2007 Myhill Lecture Series, University at Buffalo, State University of New York, Buffalo, New York (March 5-7, 2007).
· Invited speaker at session on Missions and Means Framework: Mathematical Perspectives at Annual Meeting of Institute for Operations Research and the Management Sciences, Pittsburgh, Pennsylvania (November 5, 2006).
· Invited facilitator for Bayesian Statistics and Social Network Analysis workshop, Virginia Modeling, Analysis and Simulation Center, Old Dominion University, Suffolk, Virginia (November 2-3, 2006).
· Invited panelist at U.S. Air Force Symposium on Countering Global Insurgency, Joint Special Operations University, Hurlburt Field, Fort Walton Beach, Florida (May 4, 2006).
· Invited speaker at launch of Raytheon math education initiative with Senator Edward Kennedy, Washington, D.C. (April 26, 2006).
· Invited keynote at conference of the Alliance for the Production of African-American Ph.D.'s in the Mathematical Sciences, Florida A&M University, Tallahassee, Florida (April 8, 2006).

· Invited speaker at the Eighteenth Midwest Conference on Combinatorics, Cryptography and Computing, Rochester Institute of Technology, Rochester, New York (October 29-30, 2004).
· Invited speaker at Analytic Topology Seminar, University of Oxford, Oxford, England (June 14, 2004).
· Invited speaker at Special Combinatorics Seminar, University of Minnesota, Minneapolis, Minnesota (February 17, 2004).
· Invited speaker at Seminar on Discrete and Applicable Mathematics, London School of Economics, London, United Kingdom (January 30, 2004).
· Invited speaker at Combinatorics Seminar, Massachusetts Institute of Technology, Cambridge, Massachusetts (September 24, 2003).
· Invited speaker at Centre d'Analyse de Mathématique Sociales, L'Ecole des Hautes Etudes en Sciences Sociales, Paris, France (June 27, 2002).
· Invited speaker at Algebra Seminar, University of Oxford, Oxford, England (October 9, 2001).
· Invited speaker at Free University of Berlin, Department of Computer Science, Berlin, Germany (July 6, 2000).
· Invited speaker for Invited Minisymposium on Ordered Sets at Tenth Society of Industrial and Applied Mathematics Conference on Discrete Mathematics, Minneapolis, Minnesota (June 12–15, 2000).
· Guest lecturer at Summer Program for Women in Mathematics, George Washington University, Washington, D.C. (July 6, 1999).
· …Many more invited talks before and after 1999…

SELECTED CONFERENCE AND SESSION ORGANIZING

Ø DIMACS Workshop on Applications of Order Theory to Homeland Defense and Computer Security, Rutgers University, Piscataway, New Jersey, September 28-29, 2004.
Ø Joint Meetings of the MAA/AMS, Special Session on Lattice Theory, 2002 (San Diego) and 2003 (Baltimore).
Ø Fifth Conference on Mathematical Methods in Counterterrorism, American Association for the Advancement of Science, Washington, D.C., March 12-13, 2009.
Ø Fourth Conference on Mathematical Methods in Counterterrorism, Rochester Institute of Technology, Rochester, New York , September 20-22, 2007.
Ø Symposium on Women in Mathematics, Stanford University, 2006.
Ø Third Conference on Mathematical Methods in Counterterrorism, Institute of World Politics, Washington, D.C., September 28-30, 2006.
Ø Second Conference on Mathematical Methods in Counterterrorism, Benedict College, Columbia, South Carolina, November 1-3, 2005.
Ø Universal Algebra, Vanderbilt University, Nashville, Tennessee, 2002.

EDUCATIONAL CONSULTING

2012: Joint leader of math enrichment program for students of the Rochester STEM High School, Rochester, New York

2012: The first math lecturer for Udacity, an on-line "university" started by Stanford University computer science professor Sebastian Thrun

2012: Mathematics Consultant, Greenburgh Central 7 School District, Hartsdale, New York

2011: Instructor, Harlem Scholars Program, New York City

VOLUNTEER TUTOR FOR MINORITY AND AT-RISK SCHOOLCHILDREN
2005–2006 : School in East Palo Alto, California (6th grade)
2003 : Cambridge Rindge and Latin School in Cambridge, MA (9th-12th grades)
ca. 2003 : Algebra Project, Cambridge, MA
1997 : Sankore Academy in Nashville, TN (after-school program)
1996 : Berkeley High School in Berkeley, CA (9th-12th grades)
1994 : Saturday School, Oxford, UK (10 year-olds)

BOARDS AND PANEL

Past Member, Advisory Board, Baxter Academy for Technology and Science.

Member, Scientific Planning Group on Mathematics Education, International Council for Science (Regional Office for Latin America and the Caribbean), 2007.

Past Member, Advisory Board, Benjamin Banneker Institute for Science and Technology.

Member, Proposal Review Panel for ADVANCE Program, National Science Foundation, 2012.

LANGUAGES

English (native speaker), German (4 courses), FORTRAN, PL/I, PASCAL, LISP, C++.

HOBBIES

Essay writing, Travel, Movies.

Candice Marshall
Biographical Information

Morgan State University
School of Computer, Mathematical & Natural Sciences
1700 E Cold Spring Lane
Baltimore, MD 21251

Tel: (443)885-4298
Fax: (443)885-8216
Email: candice.marshall@morgan.edu

(a) Professional Preparation

Morgan State University, Baltimore, MD	Mathematics	B. S.	2005
Morgan State University, Baltimore, MD	Mathematics	M. A.	2011
Morgan State University, Baltimore, MD	Industrial and Computational Math	Ph. D.	2017

(b) Appointments

2018 – Present	Program Director, Actuarial Science, Department of Mathematics, Morgan State University
2017 - 2018	Mathematics Professor, Stratford University
2016 - 2017	Mathematics Teacher, Archbishop Curley High School

(c) Products

1. Some Algebraic Structure of the Riordan Group, Linear Algebra and its Applications, March 2013, Vol. 438(5): 2018-2035.
2. Another Method of Constructing Pseudo-Involutions in the Riordan Group, Congressus Numeratum, March 2017.

(d) Synergistic Activities

- Initiated an International Association of Black Actuaries (IABA) Student Ambassador Program with Melissa Strother, actuary at Travelers Insurance.
- Organized an Actuarial Science Day for High School students to expose them to the f field.
- Served as a mentor and partner to the Ingenuity Project https://www.ingenuityproject.org/.
- Currently working with the Actuarial Foundation to become a Math Motivators site. https://www.actuarialfoundation.org/math-motivators-tutoring-program/#:~:text=The%20mission%20of%20the%20Math,students%20with%20strong%20math%20backgrounds.

ZEINAB BANDPEY

Topologist and Combinatorialist

443-600-0361
zeinab.bandpey@morgan.edu

6200 Rolling Rd, #523414
Springfield, VA 22152

Research interest:

Combinatorics, Lattice Theory, Topology

Technical Qualifications:

Programs/ Languages: MatLab, Python, Lingo

Education:

- 2020 PhD. In Computational and industrial mathematics, Morgan State University, Baltimore, Maryland. Thesis: TOPOLOGICAL PROPERTIES USING α-SETS, SOME COMBINATORIAL PROBLEMS OF STANLEY, ALONG WITH APPLICATIONS TO COUNTERTERRORISM AND SNOW REMOVAL. Dissertation joint-advisors: Dr. Jonathan David Farley, Dr. Bhamini P.M. Nayar.

- 2010 M.S. in Mathematics, University of Mazandaran, Babolsar, Mazandaran, Iran. Thesis: Fuzzy lattices. Dissertation advisor: Dr. Reza Ameri.

- 2008 B.S. In Mathematics, Mazandaran University, Babolsar, Mazandaran, Iran. Pure mathematics.

Publications:

1. R. Ameri, H. Hedayati, and Z. Bandpey, "Rough sets applied in sublattices and ideals of lattices," RATIO MATHEMATICA 29 (2015) 3-14.

2. Z. Bandpey, "Jonathan Farley's mathematical terror theory: the structure of perfect terrorist cells with a single leader," Congressus Numerantium 228 (2017), 345-352.

3. Z. Bandpey and B. M. P. Nayar, "A Study of Generalized Continuous Functions," *International Journal of Advances in Mathematics* 6 (2018), 16-26.

4. Bandpey, Z., & Nayar, B. M. P. (2019). Compact and extremally disconnected spaces via generalized continuous functions. *Journal of Advanced Studies in Topology*, *10*(1), 28-34. https://doi.org/10.20454/jast.2019.1507

5. Z.Bandpey and B. Nayar, A generalization of uniform boundedness principle in topological spaces, *International Journal of Advances in Mathematics, 1(2020), 24-32.*

Honors:

1. Winner of vCalc's First Level Prize ($1,000), Coding for the Community (2016). The company vCalc was co-founded by Kurt Heckman, a former math major who is (far right) giving me the prize:
   https://www.vcalc.com/wiki/Blog/Zeinab-Bandpey-Wins-vCalc-Award-for-Excellence

2. Winner of vCalc's Fourth Level Prize ($100), Coding for the Community (2016)

3. Winner of Third Prize (one member of a team) for HBCU Battle of the Brains 2017.
   http://news.morgan.edu/morgans-team-of-scholars-takes-third-place-in-hbcu-battle-of-the-brains/

Employment:

- August 2020-present: Lecturer at Morgan State University.

- 2016-May 2020: Research assistant ,Morgan State University, Baltimore, MD, USA.

- August 2020-present: Lecturer at Morgan State University.

- January 2017-December 2017: Instructor in Pre-algebra and algebra and statistics for the University of Baltimore, Baltimore, Maryland, USA. Besides the above, as part of UB faculties I taught a class with 28 students, all current prison inmates, inside Jessup Correctional Institution. It was a special program offered by the University of Baltimore called the "Second Chance Pell Grant" Program".

- 2015-present**:** Teaching Assistant for Calculus, Algebra, and Pre-algebra, Morgan State University, Baltimore, Maryland, MD, USA.

- January 2017-December 2017: Adjunct instructor for Statistics and Algebra at Towson University, Towson, Maryland, USA.

- January 2018-May 2018: Adjunct instructor for Graph Theory, Towson University, Towson, Maryland, USA.

Research and Related Senior/Key Person Profile

The PI Dr. Jonathan Farley's work applying mathematics to counterterrorism has been profiled in *The Chronicle of Higher Education*, in *Science News*, in *The Economist* Magazine, in *USA Today*, in MIT's *Technology Review*, on the MSNBC website, on Fox News Television, and on Air America Radio. He has been a guest twice on BBC World News Television, once at Ground Zero on the first anniversary of 9/11 and once after the death of Osama bin Laden. (Two of the other guests for his second appearance on BBC World News Television were U.S. Congressman Silvestre Reyes and British Member of Parliament Khalid Mahmood.) The PI Dr. Farley wrote two op-eds for the *New York Times*, one on the National Security Agency. He co-founded Phoenix Mathematics, Inc., a company that developed mathematical solutions to homeland security-related problems; one of their clients was Los Alamos National Laboratory, the lab that built the first atomic bomb.

The PI Dr. Farley has had a face-to-face meeting discussing math-for-counterterrorism with the Jamaican Minister of National Security. He had one-on-one coffee with Admiral Bobby Ray Inman, former Director of the US National Security Agency and a former Deputy Director of the CIA. He also had a meeting with Admiral Dennis Blair before the latter became Director of National Intelligence.

Seed Magazine named the PI Dr. Farley one of "15 people who have shaped the global conversation about science in 2005" because of Dr. Farley's work on counterterrorism. The British publication *Express* called Dr. Farley a "maths genius" in October 2016 in an article subtitled, "Maths genius develops EQUATION for wiping out ISIS." Dr. Kevin Blake, a policeman and the Director until 2014 of Jamaica's National Intelligence Bureau, part of Jamaica's Ministry of National Security, has written, "The ground-breaking achievements that have been made by the application of mathematical theory in the effort to dismantle gangs have been utilized in the Crime and Intelligence Management System," a computer program he developed. He added that "[t]he pioneering foundational path that has been laid by Dr Farley has made the afore-mentioned achievements possible...."

A U.S. Air Force officer (now a colonel) said that the PI Dr. Farley's "thinking has influenced real world decisions of highest operational importance to the Department of Defense."

MIT News published an article about the PI Dr. Farley entitled, "Math Whiz Fights Terror with Smarts". The Los Angeles County Sheriff Department's Emergency Operations Bureau, Terrorism Early Warning Group invited the PI to speak to their officers.

He has co-organized five Conferences on Mathematical Methods in Counterterrorism and co-edited the book, *Mathematical Methods in Counterterrorism*, chapters of which have been downloaded 24,000 times. One of the PI Dr. Farley's conferences featured Dr. Jennifer O'Connor of the Human Factors Division of the Division of Behavioral Sciences for the Department of Homeland Security, who had herself invited the PI Dr. Farley to give a talk to some members of her group.

The PI received $20,000 to write a monograph published by the U.S. Army War College, *Toward a Mathematical Theory of Counterterrorism: Building the Perfect Terrorist Cell*.

Bridges: The Office of Science and Technology's Publication on Science and Technology Policy for the Austrian Embassy in the United States of America published the PI Dr. Farley's

essay, "Terror and Beauty: The European Institute for Mathematical Methods in Counterterrorism.

The PI Dr. Farley's main fields in mathematics are lattice theory and the theory of ordered sets. He resolved a conjecture posed by MIT Professor of Applied Mathematics Richard Stanley in 1975; he solved a problem posed by Richard Stanley that had remained unsolved since 1981; he solved some problems from Richard Stanley's classic 1986 text, *Enumerative Combinatorics: Volume I*; he solved a problem in "transversal theory" attributed to combinatorialist Richard Rado that had remained unsolved since 1971 (Rado was a Fellow of the Royal Society whom the German Mathematical Society described as "einer der bedeutendsten diskreten Mathematiker unseres Jahrhunderts": "one of the most important discrete mathematicians of our century"); the PI Dr. Farley solved several problems from the 1981 Banff Conference on Ordered Sets and the 1984 Banff Conference on Graphs and Order; he solved some problems of lattice theory pioneer George Grätzer from 1964; he solved some problems of lattice theory pioneer E. T. Schmidt from 1974 and 1979; and he solved two problems published in 1982 by universal algebra pioneer Bjarni Jónsson and UC Berkeley professor (now emeritus) Ralph McKenzie.

The PI Dr. Farley has been a Science Fellow at Stanford University's Center for International Security and Cooperation, a Visiting Professor of Mathematics at Caltech, a Visiting Scholar in the Department of Mathematics at Harvard University, and a Visiting Associate Professor of Applied Mathematics at MIT. He was a tenured associate professor of mathematics at Vanderbilt University, which has had at least two Fields Medalists in its Math Department.

He obtained his doctorate in mathematics from Oxford University in 1995, after winning Oxford's highest mathematics awards for graduate students, the Senior Mathematical Prize and Johnson University Prize, in 1994. He graduated *summa cum laude* from Harvard University in 1991 with an academic record superior to all other students but one in his graduating class. (He earned 29 A's and 3 A-'s.)

He was the 2004 recipient of the Harvard Foundation's Distinguished Scientist of the Year Award, a medal presented on behalf of the president of Harvard University in recognition of "outstanding achievements and contributions in the field of mathematics." The City of Cambridge, Massachusetts (home, of course, to Harvard and to MIT) officially declared March 19, 2004 to be "Dr. Jonathan David Farley Day."

Harvard professor S. Allen Counter said, "Jonathan Farley is one of the world's most impressive young mathematicians.... He is a model of excellence for young people of all backgrounds..... Harvard is proud to honor his achievements and acknowledge his fine example."

Project/Performance Site Location(s)

Project/Performance Site Primary Location

☐ I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name: Morgan State University

DUNS Number: 8799413180000

* Street1: 1700 E. Cold Spring Lane

Street2:

* City: Baltimore

County: Maryland

* State: MD: Maryland

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code: 21251-0001

* Project/ Performance Site Congressional District: MD-007

Project/Performance Site Location 1

☐ I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

* Street1:

Street2:

* City:

County:

* State:

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code:

* Project/ Performance Site Congressional District:

Additional Location(s)

Add Attachment | Delete Attachment | View Attachment

RESEARCH & RELATED Other Project Information

OMB Number: 4040-0001
Expiration Date: 12/31/2022

1. Are Human Subjects Involved? ☐ Yes ☒ No

1.a. If YES to Human Subjects

Is the Project Exempt from Federal regulations? ☐ Yes ☐ No

If yes, check appropriate exemption number. ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8

If no, is the IRB review Pending? ☐ Yes ☐ No

IRB Approval Date:

Human Subject Assurance Number:

2. Are Vertebrate Animals Used? ☐ Yes ☒ No

2.a. If YES to Vertebrate Animals

Is the IACUC review Pending? ☐ Yes ☐ No

IACUC Approval Date:

Animal Welfare Assurance Number:

3. Is proprietary/privileged information included in the application? ☐ Yes ☒ No

4.a. Does this Project Have an Actual or Potential Impact - positive or negative - on the environment? ☐ Yes ☒ No

4.b. If yes, please explain:

4.c. If this project has an actual or potential impact on the environment, has an exemption been authorized or an environmental assessment (EA) or environmental impact statement (EIS) been performed? ☐ Yes ☐ No

4.d. If yes, please explain:

5. Is the research performance site designated, or eligible to be designated, as a historic place? ☐ Yes ☒ No

5.a. If yes, please explain:

6. Does this project involve activities outside of the United States or partnerships with international collaborators? ☐ Yes ☒ No

6.a. If yes, identify countries:

6.b. Optional Explanation:

7. Project Summary/Abstract Research plan.docx-3.pdf [Add Attachment] [Delete Attachment] [View Attachment]

8. Project Narrative DHS Grant Narrative-4.pdf [Add Attachment] [Delete Attachment] [View Attachment]

9. Bibliography & References Cited [Add Attachment] [Delete Attachment] [View Attachment]

10. Facilities & Other Resources [Add Attachment] [Delete Attachment] [View Attachment]

11. Equipment [Add Attachment] [Delete Attachment] [View Attachment]

12. Other Attachments [Add Attachments] [Delete Attachments] [View Attachments] ☒

Methods of reducing the risk of a terrorist attack, designing strategies to minimize the time and cost of cleaning up after an attack, designing strategies to prevent future attacks by analyzing past data and identifying potential vulnerabilities

Dr. Jonathan David Farley, PI
Dr. Candice Marshall, Co-PI
Dr. Zeinab Bandpey, Co-PI

Abstract.
In this study we will model terrorist cells using mathematical concepts. To be precise, using the lattice theory and graph theory (which tools have already been applied by others, namely, formal concept analysis and social network analysis). We believe that by modeling terrorist cells and analyzing their behavior, we may be able to help curtail future terrorist actions. Then we will use operations research strategies to see how we can minimize the risk of terrorist attacks by considering different objectives and constraints. Also, applying our mathematical knowledge in transportation problems, we will come up with a method to minimize the cost of cleaning up after an attack. Last but not least, by analyzing existing data and using machine learning algorithms, we will identify potential vulnerabilities and we will suggest some solutions. We will cover the following areas as well:

1. Strategies for disrupting terrorist cells
2. Data analysis of terrorist activity
3. Border penetration and security
4. Terrorist cell formation
5. Information security

A significant goal is to train students to be able to research in these areas. The PI has worked with at least one school district and one high-school student; the latter went on to write two peer-reviewed papers in this area.

1.0 Study Objectives

The objective of the proposed study is to model terrorist cells mathematically, to lessen the risk of attack and to minimize the cost of cleaning up after attack, to analyze existing data, determine vulnerabilities and design strategies to prevent future attacks. It is also to train students in the mathematics needed to do the above modeling.

2.0 Project Description

2.1. Modeling terrorist cells

A common way to represent visually a group of people and the relationships between them is by means of a graph or network. The individuals are represented by dots or nodes, and, if two individuals are related in some fashion (for instance, if they are friends), then a line is drawn between the corresponding nodes. In the case of a terrorist cell, one might draw a line if the two individuals can communicate directly with one another. The leaders are represented by the

topmost nodes in the diagram of the ordered set and the foot soldiers are represented by the bottommost nodes. (In order theory, these are called "maximal" and "minimal" nodes, respectively.) A chain of command linking a leader with a foot soldier is a *maximal chain* in the ordered set.

One of the co-PI Dr. Zeinab Bandpey's accomplishments was to find the structure of the "perfect" terrorist cell with one leader, according to certain specific criteria. Precisely, she proved a conjecture about minimizing the number of cutsets in finite partially ordered sets P with a top element such that no element has more than b lower covers.

In this study we will continue working to model terrorist cells with less specific criteria; we will determine for each case, what would be the structure of a terrorist cell which is the hardest to destroy.

We will train students in the above ideas and methodology.

How Do You Stop a Terrorist? Let Us Count the Ways

During World War II and the Cold War, game theory and cryptography played an important role. Today, we need a new kind of mathematics for a new kind of war.

Which parts of a terrorist network do you sever in order to disable it? Current mathematical analysis of terrorist nodes does not address *hierarchy*.

Terrorist cells are often modeled as graphs, yet they are composed of leaders and of followers. Hence, neglecting the fact that they have a hierarchy leaves out an important aspect of their structure. The proper framework is therefore that of lattice theory or order theory.

Lattice theory will help intelligence agencies determine whether they have disrupted a terrorist cell. In short, it will help them ascertain whether they have won an individual battle in the war on terror.

This is not abstract theory. The Ministry of National Security in Jamaica has applied the PI Dr. Farley's work to gun-marijuana smuggling rings operating between Jamaica and Haiti.

Los Alamos National Laboratory, which hired the PI Dr. Farley's company, used lattice theory to mine data drawn from hundreds of reports of terrorist-related activity.[1]

Using the PI Dr. Farley's work, researchers from McGill and Concordia University in Montreal found the tree-structure representing a terrorist organization that is least likely to be disrupted when a fixed number of agents are captured at random. The co-PI Dr. Bandpey extended these results to find the "perfect" structure for a terrorist cell that has one leader (a "poset with a greatest element").

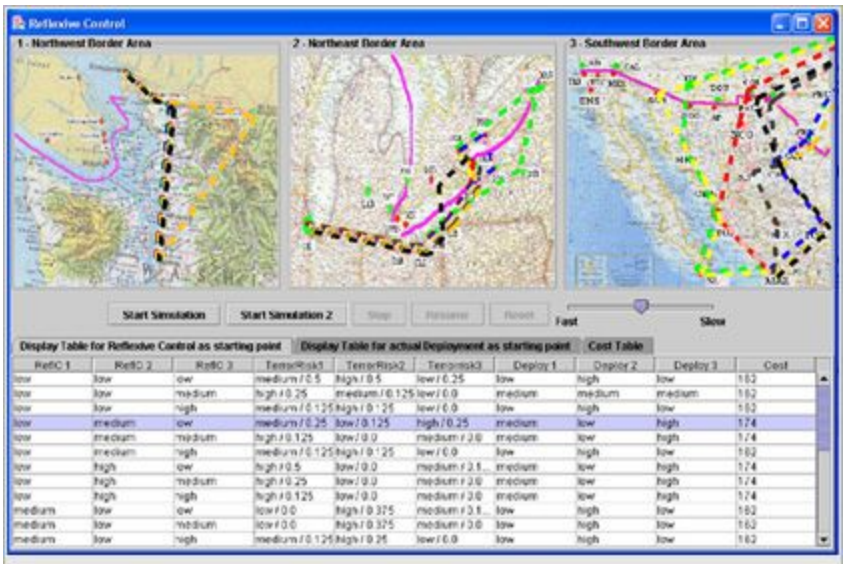
2.2. Methods of reducing the risk of terrorist attacks and minimizing the cost of cleaning up after an attack

We will study different cases, we will determine constraints for different cases, we will analyze the situations and define the objectives. Then, by using linear and non-linear optimization

algorithms, with help of computer languages such as Python and MATLAB, we will offer an algorithm that could reduce the risk of a terrorist attack before the attack and would minimize the cost of the cleaning up after the attack.

2.3. Analyzing past data and identifying potential vulnerabilities

Data science features and machine learning algorithms are useful to organize big data, to extract information from the structured data and to represent the information graphically and numerically so that it can be more easily analyzed. We will use these methods to clearly identify potential vulnerabilities. The following picture is a work done by Prof. Dr. Stefan Schmidt and the company of the PI, Phoenix Mathematics, Inc., to protect against the penetration of US borders by terrorists and it shows mathematics in action.
https://web.archive.org/web/20051219125645/http://ostina.org/html/bridges/article.htm?article=1298



Mathematics in action I: Software developed by Stefan Schmidt and Phoenix Mathematical Systems Modeling, Inc. to model – and protect against – the penetration of US borders by terrorists. © Phoenix

2.4. Creating a high school, community college and university curriculum for Mathematics and Homeland Security

We can develop a high school curriculum linking math and homeland security.
https://www.berkeleydailyplanet.com/issue/2012-06-29/article/39925?headline=The-True-Turing-Test-to-Save-Education-in-America--By-Ronald-O.-Ross-and-Jonathan-David-Farley-D.Phil.-with-Gregory-Labonte
"When we tried to initiate students to the war-winning mathematics of the likes of Alan Turing, the Board of Regents stepped in to abort the program at conception, saying that its $95,000 price tag was more than the state could afford..."

3. Program management approach:

We will have 2 graduate research assistants and 3 undergraduate students working with us under this grant. We will provide the necessary education to the students to prepare them for the research work. By studying the background we will summarize all that has been done in this area. Then we will use mathematical concepts drawn from graph theory and lattice theory to model the terrorist cells. We will distinguish different cell structures, their strengths and weaknesses. This is one of the directions we consider for the research. In the second round, we should educate students with the basics of machine learning and data science. Then we study the existing data and discuss the similarities and differences and compatibilities of our mathematical models to the real data. Lastly, we will use operations research to suggest an algorithmic solution to minimize the impact of a terror attack on our country and to minimize the cost of cleaning up after the attack. Students will be assisting us in all steps of this process. They will learn the necessary mathematical concepts as well as computer programming, machine learning and data science concepts. They will be well-educated STEM majors who could work on DHS-related problems and topics.

4. Program Performance targets and methods for measurement

High-school student Lauren McGough, who later went on to MIT and Princeton, asked if the theoretical models matched up with reality. We borrow her sentiments and ideas in this section. How well do mathematical models of terrorist cells apply to the real-life struggle against terrorism? Certainly, mathematical models have been useful in the past for military planning and predicting the behavior of U.S. adversaries, we saw PI Dr. Farley's monograph has been published by the US Army War College after he was given a $20,000 grant; but how well do mathematical projections of terrorist behavior actually hold up when tested on living people and real situations?
In this study, first we will present several mathematical models, and we discuss their functionality. Then, by studying real data, we conduct an experiment to test the model's theoretical results by comparing them with the results of the experiment based on the real data.

The results of these comparisons will be shown in charts, graphs and figures so they could be easily analyzed.

5. Examples of potential results and how those results may benefit HSE

Policeman Kevin Blake, the former director of Jamaica's National Intelligence Bureau, has written, "The ground-breaking achievements that have been made by the application of mathematical theory in the effort to dismantle gangs have been utilized in the Crime and Intelligence Management System," a computer program he developed. He added that "[t]he pioneering foundational path that has been laid by Dr Farley has made the afore-mentioned achievements possible...."

6. Technology transfer and transition pathways

Technology development and transfer plans on intellectual property to move research products from the institution to being leveraged by DHS and other stakeholders: In 2006, Lockheed Martin offered PI Dr. Farley's company $20,000 to develop novel ideas to model the penetration

of our borders by bad actors. (At the time, the software we used was open-source, so we declined this offer.)

7. Research outcome

We will begin to develop a cadre of students with the specialized skills to do the mathematical modeling for counterterrorism and homeland security that the nation requires. Dr. Lauren McGough, who worked with PI Dr. Farley as a high-school student, is an example of the kind of student we can produce.

8. Partnership with CAOE

We are pleased to announce our partnership with the Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State University. This partnership will enhance education in homeland security-related STEM and will create a diverse environment of students who are skilled to work on homeland security related problems. We will invite people from CAOE to Morgan State University for research collaborations; our students will be encouraged to participate in CAOE-driven research. Dr. Farley, Dr. Bandpey and Dr. Marshall will participate in CAOE's organized seminars and conferences.

References:

[1] Jonathan David Farley, "Breaking Al Qaeda Cells: A Mathematical Analysis of Counterterrorism Operations (A Guide for Risk Assessment and Decision Making)," *Studies in Conflict and Terrorism* **26** (2003), 399-411.

---

[1] See Los Alamos National Laboratory Technical Report LAUR 02-7867, "Advanced Knowledge Integration in Assessing Terrorist Threats."

Cover Sheet

Table of Contents

1. **Objectives**
2. **Program Plans**
3. **Education and Training**
4. **Academic Research Opportunities**
5. **Organization, Management, and Institutional Commitment**
6. **Performance Assessment and Program Evaluation**
7. **Integration with relevant Centers of Excellence (COEs) or other HSE Research Collaborators**
8. **References**

Appendix I – Resumes

1) **Objectives**

Program Objectives/Executive Summary

The U.S. is witnessing its leadership position in science and technology, which we once took for granted, erode at a rapid pace, and that has had an adverse impact on our economy and national security. To address this concern,we propose a research initiative with guidance provided by the mathematics faculty at Morgan State University to provide an effective means to build and sustain a continuous workforce pipeline that consists of a cutting edge, research-intensive educational program combined with real-world experiences. The proposed program will include the understanding of industry demands and the knowledge to advance the Department of Homeland Security's (DHS) mission and prepare students with the skills to seek and create innovative solutions to DHS's current problems. The proposed program will seek to leverage Morgan State University's successful mathematics and actuarial science curricula to explore several themes pertaining to the management of risk associated with the security of the nation. Student researchers will explore methods of reducing the risk of terrorist attacks, designing strategies to minimize time and cost of cleaning up after an attack, and the attempt to prevent certain types of future terrorist attacks by identifying vulnerabilities. Ensuring the highest level of commitment and leadership for an inclusive environment, this effort will be managed by Dr. Jonathan Farley (PI), Dr. Candice Marshall and Dr. Zeinab Bandpey (Co-PIs).

Institution Overview:

Morgan State University (MSU):

Founded in 1867, MSU is designated as Maryland's preeminent public urban research university by the Maryland Legislature and is one of the eleven HBCUs classified by the Carnegie Foundation as a Doctoral Research University with High Research Activities (R2).

MSU offers a comprehensive range of academic programs in engineering and natural sciences, and currently enrolls more than 7,800 undergraduate and graduate students. According to *U.S. News & World Report*, Morgan State University is tied for 15th on the list of historically black colleges and universities (HBCU) and is the only university in the state of Maryland to offer industrial and systems engineering undergraduate and graduate degrees and a cloud computing undergraduate degree. In addition, Morgan State University produces the most African-American engineers in the state of Maryland, and historically ranks among the top public campuses nationally in the number of black graduates receiving doctorates. Morgan State University is the only HBCU in the nation to award its students with a Bachelor's of Science in Actuarial Science. The School of Computer, Mathematical and Natural Sciences (SCMNS) and School of Engineering (SoE) at MSU enroll over 2,000 students and confer approximately 250 degrees per year.

2) Program Plans

Title of Program:

Methods of reducing the risk of terrorist attacks, designing strategies to minimize the time and cost of cleaning up after an attack, designing strategies to prevent future attacks by analyzing past data and identifying potential vulnerabilities

Program Abstract:

We will bring three undergraduate students and two graduate students to Morgan State University to work on HS-related research problems. In this study we will model terrorist cells using mathematical ideas from the theory of ordered sets and graph theory. We believe that by modeling terrorist cells and analyzing their behavior, we can help forestall future terrorist actions. Then we will use operations research strategies to see how we can reduce the risk of terrorist attacks by considering different objectives and constraints. Also, applying our mathematical knowledge regarding transportation problems, we will develop a method to minimize the cost of cleaning up after an attack. Last but not least, by analyzing existing data and using machine learning algorithms, we will identify potential vulnerabilities and we will suggest some solutions.

We will train students in the mathematical methodologies behind the above so they can solve DHS problems in the future.

Other key technical and program personnel: Associate Professor Dr. Jonathan Farley of MSU will be the Principal Investigator (PI) of this project and will provide the overall direction and oversight of the project, including the drafting and dissemination of results. Director of Actuarial Science, Dr. Candice Marshall, of MSU will be the Co-Principal Investigator (Co-PI) of this project. Mathematics Lecturer at Morgan State University, Dr. Zeinab Bandpey, will be the Co-Principal Investigator (Co-PI) of this project. We will also have 2 more faculty members to supervise research activities.

Education Program Highlights:

We will provide full tuition and mandatory fees to support three undergraduate students and a stipend to two graduate students for the duration of three years. In this period, students will work on the research projects related to DHS problems of interests. They will be educated about the mathematical concepts they need to solve those problems. They will learn how to code in Python and MATLAB. They also will learn about the basics of machine learning and data science. With all of the above knowledge they will be able to publish a couple of research papers to address HS problems.

Workforce Need/Gap:
Our proposal reflects the variety and breadth of capabilities that the proposed program can bring in addressing the various workforce needs/gaps for the DHS. Our significant presence as a highly focused research center, as well as talented faculty in our departments, allow for the flexibility to pivot and address emerging needs. MSU has many facets that will aid in understanding the workforce needs/gaps. Working groups consisting of technical experts and program coordinators from MSU will identify and prioritize overarching gaps/needs.

3) Education and Training

Curricula Development:
The proposed program's team will work closely in collaboration with experts in the field to create appropriate and timely curricula. The long history of our Actuarial Science and Mathematics programs clearly show that MSU is preparing the next generation of mathematicians and actuaries, as is evident by the size of the cohort of current undergraduate students.

Total number of students supported by the program:
We will have three undergraduate students and two graduate students.

Recruitment Strategy:
As a minority-serving institution, Morgan State University is committed to recruiting, mentoring, and retaining diverse student researchers. We recognize that candidates will come from a variety of science/math disciplines and experiences. Our goal is to broadly recruit highly-motivated and talented students from high school up to 4+-year institutions around the country, who are interested in pursuing STEM topics that are strongly aligned to the Department of Homeland Security's mission. Our target cohort is not one composed of a particular under-represented group, but rather a diverse, inclusive cohort. Student researchers will be recruited from Morgan State University's own STEM majors, as well as local community colleges and beyond. Morgan State University is a leader in drawing large

numbers of highly-qualified students with diverse backgrounds with a significantly higher percentage of underrepresented minorities and female students.

Broadening Participation:

We will continue to broaden the participation of the scholars by participating in diversity STEM conferences and professional societies, such as the International Association for Black Actuaries, the Society of Actuaries, and the American Statistical Association. In addition, we will expand our search by utilizing career websites, such as Simplicity One Stop and Handshake, which allows access to over nine million students at nearly 1,000 and 500 universities, respectively. Another hallmark of increasing the diversity pipeline is the participation of a diverse faculty/teaching pool, which includes both junior and more established faculty/teachers provides students with unique perspectives when working with faculty mentors in different stages of their careers.

Website and Social Media:

MSU will provide a dedicated website to the proposed research initiative. This website will provide a landing page for potential scholars to find more information about the program, how to apply, on-line application forms, as well as other useful information to current and former scholars. Dissemination of program information and other opportunities will occur through a variety of media including Facebook and Twitter. We will create a Facebook group where incoming scholars can connect, socialize, and keep in touch with each other and with previous scholars as part of mentoring. Also, ongoing contact with scholars will be made through email and regular mail.

Scholar Enrollment and Selection Process:

Enrollment of potential scholars will occur, depending on the program element, on either a schedule or rolling basis as potential candidates are sought through open announcements and faculty recommendations. Prospective scholars will apply online. For undergraduates and beyond, submission will include a resume, a statement of relevant experience, student transcript, letters of recommendation, and a personal statement that addresses his/her reasons for applying, and a future plan. Prospective scholars will be provided with information about activities, mentors, research topics offered, and will be asked for their top choices. In particular, where a scholar is placed under the mentorship of a faculty researcher, it is critically important that both scholar and mentor are aligned in both interest and expectations. After admitting top-ranked applicants, we make preliminary matches to projects using the applicant's preferences, skills, and the host lab project requirements. After confirming student interest, we then ask the student and the assigned mentor to meet via a video teleconference to discuss project ideas and again confirm their interest in working together.

Coordination Plan:

Mentees connected to several individuals (mentors and other mentees) in a mentoring network can have a profound effect in promoting a 'growth-focused' engagement strategy. Faculty members have many years of experience in working with students from diverse backgrounds and training.

4) Academic Research Opportunities

Methods of reducing the risk of a terrorist attack, designing strategies to minimize the time and cost of cleaning up after an attack, designing strategies to prevent future attacks by analyzing past data and identifying potential vulnerabilities

Dr. Jonathan David Farley, PI
Dr. Candice Marshall, Co-PI
Dr. Zeinab Bandpey, Co-PI

Abstract.

In this study we will model terrorist cells using mathematical concepts. To be precise, using the lattice theory and graph theory (which tools have already been applied by others, namely, formal concept analysis and social network analysis). We believe that by modeling terrorist cells and analyzing their behavior, we may be able to help curtail future terrorist actions. Then we will use operations research strategies to see how we can minimize the risk of terrorist attacks by considering different objectives and constraints. Also, applying our mathematical knowledge in transportation problems, we will come up with a method to minimize the cost of cleaning up after an attack. Last but not least, by analyzing existing data and using machine learning algorithms, we will identify potential vulnerabilities and we will suggest some solutions.
We will cover the following areas as well:

1. Strategies for disrupting terrorist cells
2. Data analysis of terrorist activity
3. Border penetration and security
4. Terrorist cell formation
5. Information security

A significant goal is to train students to be able to do research in these areas. The PI has worked with at least one school district and one high-school student; the latter went on to write two peer-reviewed papers in this area.

1.0 Study Objectives

The objective of the proposed study is to model terrorist cells mathematically, to lessen the risk of attack and to minimize the cost of cleaning up after attack, to analyze existing data, determine vulnerabilities and design strategies to prevent future attacks. It is also to train students in the mathematics needed to do the above modeling.

2.0 Project Description

2.1. Modeling terrorist cells

A common way to represent visually a group of people and the relationships between them is by means of a graph or network. The individuals are represented by dots or nodes, and, if two individuals are related in some fashion (for instance, if they are friends), then a line is drawn between the corresponding nodes. In the case of a terrorist cell, one might draw a line if the two individuals can communicate directly with one another. The leaders are represented by the topmost nodes in the diagram of the ordered set and the foot soldiers are represented by the bottommost nodes. (In order theory, these are called "maximal" and "minimal" nodes, respectively.) A chain of command linking a leader with a foot soldier is a *maximal chain* in the ordered set.

One of the co-PI Dr. Zeinab Bandpey's accomplishments was to find the structure of the "perfect" terrorist cell with one leader, according to certain specific criteria. Precisely, she proved a conjecture about minimizing the number of cutsets in finite partially ordered sets P with a top element such that no element has more than b lower covers.

In this study we will continue working to model terrorist cells with less specific criteria; we will determine for each case what would be the structure of a terrorist cell which is the hardest to destroy. We will train students in the above ideas and methodology.

How Do You Stop a Terrorist? Let Us Count the Ways

During World War II and the Cold War, game theory and cryptography played an important role. Following 9/11, we needed a new kind of mathematics for a new kind of war.

Which parts of a terrorist network do you sever in order to disable it? The old mathematical analysis of terrorist nodes did not address *hierarchy*.

Terrorist cells are often modeled as graphs, yet they are composed of leaders and of followers. Hence, neglecting the fact that they have a hierarchy leaves out an important aspect of their structure. The proper framework is therefore that of lattice theory or order theory.

Lattice theory will help intelligence agencies determine whether they have disrupted a terrorist cell. In short, it will help them ascertain whether they have won an individual battle in the war on terror.

This is not abstract theory. The Ministry of National Security in Jamaica has applied the PI Dr. Farley's work to gun-marijuana smuggling rings operating between Jamaica and Haiti.

Los Alamos National Laboratory, which hired the PI Dr. Farley's company, used lattice theory to mine data drawn from hundreds of reports of terrorist-related activity.[1]

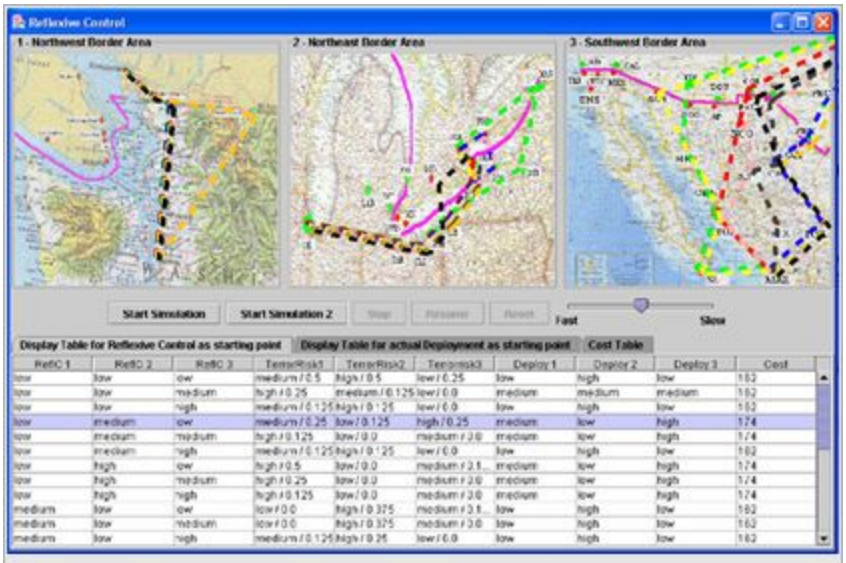
Using the PI Dr. Farley's work, researchers from McGill and Concordia University in Montreal found the tree-structure representing a terrorist organization that is least likely to be disrupted when a fixed number of agents are captured at random. The co-PI Dr. Bandpey extended these results to find the "perfect" structure for a terrorist cell that has one leader (a "poset with a greatest element").

2.2. Methods of reducing the risk of terrorist attacks and minimizing the cost of cleaning up after an attack

We will study different cases, we will determine constraints for different cases, we will analyze the situations and define the objectives. Then, by using linear and non-linear optimization algorithms, with the help of computer languages such as Python and MATLAB, we will offer an algorithm that could reduce the risk of a terrorist attack before the attack and would minimize the cost of the cleaning up after the attack.

2.3. Analyzing past data and identifying potential vulnerabilities

Data science features and machine learning algorithms are useful to organize big data, to extract information from the structured data and to represent the information graphically and numerically so that it can be more easily analyzed. We will use these methods to clearly identify potential vulnerabilities. The following picture is a work done by Dr. Stefan Schmidt and the company of the PI, Phoenix Mathematics, Inc., to protect against the penetration of US borders by terrorists and it shows mathematics in action.
https://web.archive.org/web/20051219125645/http://ostina.org/html/bridges/article.htm?article=1298



Mathematics in action I: Software developed by Stefan Schmidt and Phoenix Mathematical Systems Modeling, Inc. to model – and protect against – the penetration of US borders by terrorists. © Phoenix

2.4. Creating a high school, community college and university curriculum for Mathematics and Homeland Security

We can develop a high school curriculum linking math and homeland security.
https://www.berkeleydailyplanet.com/issue/2012-06-29/article/39925?headline=The-True-Turing-Test-to-Save-Education-in-America--By-Ronald-O.-Ross-and-Jonathan-David-Farley-D.Phil.-with-Gregory-Labonte

"When we tried to initiate students to the war-winning mathematics of the likes of Alan Turing, the Board of Regents stepped in to abort the program at conception, saying that its $95,000 price tag was more than the state could afford…"

3. Program management approach:

We will have 2 graduate research assistants and 3 undergraduate students working with us under this grant. We will provide the necessary education to the students to prepare them for the research work. By studying the background we will summarize all that has been done in this area. Then we will use mathematical concepts drawn from graph theory and lattice theory to model the terrorist cells. We will distinguish different cell structures, their strengths and weaknesses. This is one of the directions we consider for the research. In the second round, we should educate students with the basics of machine learning and data science. Then we study the existing data and discuss the similarities and differences and compatibilities of our mathematical models to the real data. Lastly, we will use operations research to suggest an algorithmic solution to minimize the impact of a terror attack on our country and to minimize the cost of cleaning up after the attack. Students will be assisting us in various steps of this process. They will learn the necessary mathematical concepts as well as computer programming, machine learning and data science concepts. They will be well-educated STEM majors who could work on DHS-related problems and topics.

4. Program Performance targets and methods for measurement

High-school student Lauren McGough, who later went on to MIT and Princeton, asked if the theoretical models matched up with reality. We borrow her sentiments and ideas in this section. How well do mathematical models of terrorist cells apply to the real-life struggle against terrorism? Certainly, mathematical models have been useful in the past for military planning and predicting the behavior of U.S. adversaries; we saw PI Dr. Farley's monograph has been published by the US Army War College after he was given a $20,000 grant; but how well do mathematical projections of terrorist behavior actually hold up when tested on living people and real situations?

In this study, first we will present several mathematical models, and we discuss their functionality. Then, by studying real data, we conduct an experiment to test the model's theoretical results by comparing them with the results of the experiment based on the real data. The results of these comparisons will be shown in charts, graphs and figures so they could be easily analyzed.

5. Examples of potential results and how those results may benefit HSE

Policeman Kevin Blake, the former director of Jamaica's National Intelligence Bureau, has written, "The ground-breaking achievements that have been made by the application of mathematical theory in the effort to dismantle gangs have been utilized in the Crime and Intelligence Management System," a computer program he developed. He added that "[t]he pioneering foundational path that has been laid by Dr Farley has made the afore-mentioned achievements possible...."

6. Technology transfer and transition pathways

Technology development and transfer plans on intellectual property to move research products from the institution to being leveraged by DHS and other stakeholders: In 2006, Lockheed Martin offered PI Dr. Farley's company $20,000 to develop novel ideas to model the penetration of our borders by bad actors. (At the time, the software PI Dr. Farley's company used was open-source, so his company declined this offer.) We will use the Python programming language to run the machine learning algorithms we will define to reduce the risk of attack and to minimize the cost of cleaning up after the attack.

7. Research outcome
We will begin to develop a cadre of students with the specialized skills to do the mathematical modeling for counterterrorism and homeland security that the nation requires. Dr. Lauren McGough, who worked with PI Dr. Farley when she was a high-school student, is an example of the kind of student we can produce.

8. Partnership with CAOE
We are pleased to announce our partnership with the Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State University. This partnership will enhance education in homeland security-related STEM and will create a diverse environment of students who are skilled to work on homeland security-related problems. We will invite people from CAOE to Morgan State University for research collaborations; our students will be encouraged to participate in CAOE-driven research. Dr. Farley, Dr. Bandpey and Dr. Marshall will participate in CAOE's organized seminars and conferences.

References:
[1] Jonathan David Farley, "Breaking Al Qaeda Cells: A Mathematical Analysis of Counterterrorism Operations (A Guide for Risk Assessment and Decision Making)," *Studies in Conflict and Terrorism* **26** (2003), 399-411.

---

[1] See Los Alamos National Laboratory Technical Report LAUR 02-7867, "Advanced Knowledge Integration in Assessing Terrorist Threats."

Risk Management:
MSU has a proven track record in STEM training from high school to the post-graduate level. MSU currently runs successful STEM programming over multiple years and is well-equipped and eager to enhance and expand our offerings. We have experience and streamlined operations.

5) Organization, Management, and Institutional Commitment
Successful implementation of the proposed program will rely on both a well-coordinated oversight group and day-to-day logistical operations. We plan to support the needs and requirements of the participants, align activities with the needs and mission of the DHS, and monitor the performance and success of the program. The management of the proposed program has been designed primarily with the needs of the DHS and the program participants in mind. It supports the participants throughout the entire life-cycle of the program, from broadening awareness and interest, to application, selection, research at MSU, and eventual placement in their chosen research field.

6) Performance Assessment and Program Evaluation
The program will undergo several forms of regular internal evaluations to ensure that the overall objectives of all the modules are being met and for better understanding the impact our program is having, specifically regarding DHS workforce training. Equally important is

to provide an "evidence-based" means to enable our program to be adaptive and efficient as the incoming data is used to make improvements and corrections in managing this partnership. Specifically, we will assess three distinct topic areas using the key indicators below:

Topic Areas	Metrics (Key Indicators)
Scholars/ Participants	• Number of applicants and participants enrolled/completing in the program, participation rate (number and % population) of females and URMs • Number and % recruitment/retention rate, • The number of Scholars pursuing a higher degree in STEM field • The number of Scholars pursuing education/careers incorporating STEM, measured through surveys
Research Outcomes	• The number and quality of publications, presentations, patents, tools, or software developed, • Collaborative research projects developed/established during and after the program,
Logistics	• Effectiveness and efficiency in managing the program, • Effectiveness of outreach activities in improving the experience and research outcome, • Effectiveness of the training plan and activities

Merit Criteria Discussion

The program's team believes that this offering provides an engaging and effective program that addresses and exceeds each of the merit review criteria. For the convenience of the reviewer, summarized below are a few of the main points.

<u>Criterion 1: Technical Merit and Impact</u>

The vision and plan for the proposed program is closely aligned to support the Federal STEM Strategy and the DHS STEM Mission to effectively cultivate a diverse, agile, and world-class STEM workforce. The program spans a broad range of participants to feed and nurture this workforce, including multiple opportunities for students, instructors, peers, professors, researchers, statisticians, and mathematicians to work in collaboration, building both skills and relationships. This structure not only provides for a broad introduction to the STEM needs at an early age, but allows participants to engage meaningfully throughout their entire academic journey, providing programs that get participants excited, then providing follow-up guidance and opportunities to turn that excitement into a lifelong commitment.

The proposed program specifically addresses broad participation for underrepresented and underserved communities, leveraging strong ties to these communities at Morgan State University and their relationship with the underserved populations of Baltimore and beyond. The recruitment plan makes strong use of existing successful mechanisms at MSU, already adept at satisfying these needs.

Criterion 2: Program and Implementation Approach

The program and management structure for the proposed program are solidly founded on successful models at work at MSU, and the participant engagement and success metric concepts are guided by the experiences gained in managing existing programs, each of which has rigorous processes in place for program management to track and report the baseline, metrics, milestones, lessons learned or best practices. The program also offers many opportunities for personnel to interact with faculty and students at all levels of the program.

Criterion 3: Organizational Team and Resources

The MSU team is well poised to effectively execute and oversee the proposed STEM portfolio. Program management at MSU will facilitate communication between the team members and student researchers, to ensure that the various program elements act in harmony – engaging with periodic meetings, site visits, and web-based collaboration tools.

The structure presented offers an effective use of resources, highly leveraging existing programs (research centers, existing STEM programs and Research Experiences for Undergraduates) as the basis for new and emerging activities – allowing funds to be used primarily on delivering content to and hands-on experience for participants, as well as on infrastructure and content development. This model promotes lasting programs that can be built upon and continue long past the life of the grant, an opportunity that MSU is proud to offer to its students.

Review/Evaluation:

We have found that empowering individual program leaders to monitor their participants is effective in identifying an issue and resolving it before it becomes a bigger problem. Program leaders often have more "local" knowledge through frequent interactions with a participant and thus make better-informed decisions. As part of their regular reports, the PI and Co-PIs will inquire more frequently with program staff and faculty and will be able to assist and resolve matters quickly.

7) Integration with relevant Centers of Excellence (COEs) or other HSE Research Collaborators

We are pleased to announce our partnership with the Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State

University. This partnership will enhance education in homeland security-related STEM and will create a diverse environment with students who are skilled to work on homeland security-related problems. We will invite people from CAOE to Morgan State University for research collaborations; our students will be encouraged to participate in CAOE-driven research. Dr. Farley, Dr. Bandpey and Dr. Marshall will participate in CAOE's organized seminars and conferences.

Appendix I (Resumes)

Jonathan D. Farley, D.Phil. (Oxon.)

Department of Mathematics
Morgan State University
Phone: +1 (443) 885-3473 (work)
1700 E. Cold Spring Lane
Baltimore, MD 21251
Email: jonathan.farley@morgan.edu

"Jonathan Farley…is a model of excellence for young people of all backgrounds, but especially African-Americans who may see their intellectual potential in him. Harvard is proud to honor his achievements and acknowledge his fine example."

— *Professor S. Allen Counter, Harvard University (Jet Magazine, July 2004)*

EDUCATION

University of Oxford, D.Phil. (Mathematics), 1995.

Harvard University, A.B. in Mathematics (*summa cum laude*), 1991.

RESEARCH INTERESTS

- Combinatorics, Lattice Theory and the Theory of Ordered Sets
- Applications of combinatorics in homeland security and counterterrorism

HONORS AND AWARDS

§ Proteus Monograph Series Fellows Program, 2007 (for writing the monograph *Toward a Mathematical Theory of Counterterrorism: Building the Perfect Terrorist Cell*).

§ *Seed* Magazine Science "Icon", 2006 (for being one of "15 people who have shaped the global conversation about science in 2005").

§ Key to the City of Columbia, South Carolina (state capital), 2005.

§ Harvard Foundation Distinguished Scientist Award, 2004 (for "outstanding achievements and contributions in the field of mathematics"), medal presented on behalf of the President of Harvard University. City of Cambridge, Massachusetts proclaims March 19, 2004 to be "Dr. Jonathan David Farley Day."

§ U.S.-U.K. Fulbright Distinguished Scholar Award, one of only four Americans to win this award this year; used while at the University of Oxford, 2001-2002.

§ Senior Mathematical Prize and Johnson Prize, University of Oxford, 1994 (for "the dissertation of the greatest merit" by a mathematics graduate student under 25).

§ Harvard Class Rank: 2nd highest average in a class of about 1,600 students. Harvard Record: 29 A's, 3 A-'s.

ACADEMIC APPOINTMENTS

Morgan State University, Associate Professor, Department of Mathematics, 2013-.

Research Institute for Mathematics (Maine), Institute Researcher, 2012-2014.

University of Maine, Associate Professor, School of Computing and Information Science and Department of Mathematics and Statistics, 2011-2012.

University of Maine, Associate Professor, Department of Computer Science, 2010-2011.

Johannes Kepler Universität Linz (Austria), Research and Teaching Fellow, Institut für Algebra, 2008-2009, 2009-2010.

California Institute of Technology, Visiting Professor, Department of Mathematics, 2007-2008.

The University of the West Indies (Jamaica), Professor, Department of Mathematics and Computer Science, 2006-2007.

Stanford University, Science Fellow, Center for International Security and Cooperation, 2005-2006.

Indian Institute of Technology-Bombay (India), Visiting Professor, Department of Mathematics, 2005 (Summer).

Harvard University, Visiting Scholar, Department of Mathematics, 2005.

Massachusetts Institute of Technology, Visiting Associate Professor, Department of Applied Mathematics, 2003 and 2004.

Vanderbilt University, Assistant and Associate Professor with Tenure, Department of Mathematics, 1996-2005.

Mathematical Sciences Research Institute, Berkeley, California, Postdoctoral Fellow, 1995-1997.

RESEARCH GRANTS AND CONTRACTS

Proteus Monograph Series Fellows Program, 2007. $20,000

National Science Foundation grant (with Ralph McKenzie), 1999-2002. Est. $150,000

National Science Foundation Graduate Research Fellowship (for study at University of Oxford, 1991-1995).

COURSES TAUGHT

Calculus 1; Calculus 2; Multivariable Calculus; Discrete Math (for math students); Discrete Math (for computer science students); Linear Algebra; Abstract Algebra (undergraduate and graduate level); Special Topics in Combinatorics and Discrete Mathematics; Computers, Ethics, and Society

SELECTED JOURNAL PUBLICATIONS AND BOOK CHAPTERS

1. Jonathan David Farley, "Another Problem of Jónsson and McKenzie from 1982: Refinement Properties for Connected Powers of Posets," *Algebra Universalis* (to appear).

2. Jonathan David Farley, "Evolutionary Dynamics of Bee Colony Collapse Disorder: First Steps toward a Mathematical Model of the Contagion Hypothesis," *Journal of Advances in Agriculture* 7 (2017), 1050-1056.

3. Jonathan David Farley, "Quasi-completeness and localizations of polynomial domains: A conjecture from 'Open problems in commutative ring theory,'" *Bulletin of the Korean Mathematical Society* 53 (2016), 1613-1615.

4. Jonathan David Farley and Dominic van der Zypen, "A Problem of Hartmanis on Generalized Partitions," *Baltic Journal of Modern Computing* 3 (2015), 268-272.

5. Jonathan David Farley, "Strictly Order-Preserving Maps into Z, I: A Problem of Daykin from the 1984 Banff Conference on Graphs and Order," *Mathematica Pannonica* 25 (2014-2015), 17-39.

6. Jonathan David Farley, "Distributive Lattices of Small Width, I: A Question of Rosenberg from the 1981 Banff Conference on Ordered Sets," *Mathematica Pannonica* 24 (2013), 231-242.

7. Jonathan David Farley, "A Problem (Attributed to Rado) from Mirsky's 1971 Monograph *Transversal Theory* and a Conjecture from the 1982 *Proceedings of the American Mathematical Society*," *Mathematica Pannonica* 24 (2013), 3-14.

8. Jonathan David Farley (2012). "How Al Qaeda Can Use Order Theory to Evade or Defeat U.S. Forces: The Case of Binary Posets," in Evangelos Kranakis (Ed.), *Advances in Network Analysis and Its Applications* (pp. 299-306). Vienna, Austria: Springer Verlag.

9. Jonathan David Farley, "Solution to conjectures of Schmidt and Quackenbush from 1974 and 1985: tensor products of semilattices," *Mathematica Pannonica* 22 (2011), 135-147.

10. Jonathan David Farley, "Maximal sublattices of finite distributive lattices. III: a conjecture from the 1984 Banff Conference on Graphs and Order," *Canadian Mathematical Bulletin* 54 (2011), 277-282.

11. Jonathan David Farley and Ryan Klippenstine, "Distributive lattices of small width, II: a problem from Stanley's 1986 text *Enumerative Combinatorics*," *Journal of Combinatorial Theory (A)* 116 (2009), 1097-1119.

12. Jonathan David Farley and Héctor Rosario, "A Critique of Monetary Educational Incentives for Elementary and Middle School Students in New York City Public Schools," *Teachers College Record* (May 15, 2008).

13. Jonathan David Farley and Stefan E. Schmidt, "Comparability graphs of lattices," *Journal of Pure and Applied Algebra* 212(2008), 832-839.

14. Jonathan David Farley, "A structure theorem for posets admitting a 'strong' chain partition: a generalization of a conjecture of Daykin and Daykin (with connections to probability correlation inequalities)," *Discrete Mathematics* 307 (2007), 191-198.

15. Jonathan David Farley, "Evolutionary Dynamics of the Insurgency in Iraq: A Mathematical Model of the Battle for Hearts and Minds," *Studies in Conflict and Terrorism* 30 (2007), 947-962.

16. Vladimir A. Lefebvre and Jonathan David Farley, "The Torturer's Dilemma: A Theoretical Analysis of the Societal Consequences of Torturing Terrorist Suspects," *Studies in Conflict and Terrorism* 30 (2007), 635-646.

17. J. D. Farley, "Coproducts of bounded distributive lattices: infinite distributivity," *Acta Mathematica Hungarica* 112 (2006), 269-273.

18. Jonathan David Farley, "Linear extensions of ranked posets, enumerated by descents. A problem of Stanley from the 1981 Banff Conference on Ordered Sets," *Advances in Applied Mathematics* 34 (2005), no. 2, 295-312.

19. Jonathan David Farley and Sungsoon Kim, "The automorphism group of the Fibonacci poset: a 'not too difficult' problem of Stanley from 1988," *Journal of Algebraic Combinatorics* 19 (2004), no. 2, 197-204.

20. Jonathan David Farley, "Quasi-differential posets and cover functions of distributive lattices II: a problem in Stanley's *Enumerative Combinatorics*," *Graphs and Combinatorics* 19 (2003), no. 4, 475-491.

21. Jonathan David Farley, "Breaking Al Qaeda Cells: A Mathematical Analysis of Counterterrorism Operations (A Guide for Risk Assessment and Decision Making)," *Studies in Conflict and Terrorism* 26 (2003), 399-411.

22. Jonathan David Farley and Bernd S. W. Schröder, "Strictly order-preserving maps into Z, II. A 1979 problem of Erné," *Order*18 (2001), 381-385.

23. Jonathan Farley, “Coproducts of bounded distributive lattices: cancellation—a problem from the 1981 Banff Conference on Ordered Sets,” *Algebra Universalis* 45 (2001), no. 4, 375-381.

24. Jonathan David Farley and Stefan E. Schmidt, “Posets that locally resemble distributive lattices: an extension of Stanley’s theorem (with connections to buildings and diagram geometries),” *Journal of Combinatorial Theory (A)* 92 (2000), 119-137.

25. Jonathan David Farley, “Quasi-differential posets and cover functions of distributive lattices I. A conjecture of Stanley,” *Journal of Combinatorial Theory (A)* 90 (2000), no. 1, 123-147.

26. Jonathan David Farley, “Functions on distributive lattices with the congruence substitution property: some problems of Grätzer from 1964,” *Advances in Mathematics* 149 (2000), no. 2, 193-213.

27. J. D. Farley, “Ideals of Priestley powers of semilattices,” *Algebra Universalis* 41 (1999), 239-254.

28.J. D. Farley, “Cardinalities of infinite antichains in products of chains,” *Algebra Universalis* 42 (1999), 235-238.

29. Jonathan David Farley, “The fixed point property for posets of small width,” *Order* 14 (1997-1998), 125-143.

30. Jonathan Farley, “Chain decomposition theorems for ordered sets (and other musings),” in: *African Americans in Mathematics*(Nathaniel Dean, ed.), *DIMACS Series in Discrete Mathematics and Theoretical Computer Science* 34 (American Mathematical Society, Providence, Rhode Island, 1997), 3-13.

31. Jonathan David Farley, “Perfect sequences of chain-complete posets,” *Discrete Mathematics* 167/168 (1997), 271-296.

32. Jonathan David Farley, “Priestley powers of lattices and their congruences. A problem of E. T. Schmidt,” *Acta Scientiarum Mathematicarum (Szeged)* 62 (1996), no. 1-2, 3-45.

33. Jonathan David Farley, “Priestley duality for order-preserving maps into distributive lattices,” *Order* 13 (1996), 65-98.

34. J.D. Farley, “The automorphism group of a function lattice: a problem of Jónsson and McKenzie,” *Algebra Universalis* 36(1996), no. 1, 8-45.

35. Jonathan David Farley, “The number of order-preserving maps between fences and crowns,” *Order* 12 (1995), 5-44.

36. Jonathan David Farley, “The uniqueness of the core,” *Order: A Journal on the Theory of Ordered Sets and Its Applications* 10(1993), 129-131.

BOOKS AND MONOGRAPHS PUBLISHED

Nasrullah Memon, Jonathan D. Farley, David L. Hicks, and Torben Rosenørn (editors), *Mathematical Methods in Counterterrorism* (Springer Verlag, Vienna, 2009).

Jonathan Farley,*Toward a Mathematical Theory of Counterterrorism: Building the Perfect Terrorist Cell* (U.S. Army War College, Carlisle Barracks, Pennsylvania, 2007).

SELECTED PUBLISHED ESSAYS AND MAGAZINE ARTICLES

1. "Moment of Proof", *Notices of the American Mathematical Society* (March 2006).
2. "The N.S.A.'s Math Problem," *The New York Times* (May 16, 2006).
3. "The NSA Is Tap, Tap, Tapping: Spy Agency Misses the Big Picture As It Targets All the Dots," *San Francisco Chronicle* (July 9, 2006).
4. "What's So Wasteful about Funding Discovery?", *Sacramento Bee* newspaper (September 26, 2008).
5. "DLIs: A Minute to Learn," *A.N.A.L.O.G. Computing* Magazine (October 1986).

SELECTED PRESENTATIONS

· Invited speaker at Baltimore Combinatorics and Number Theory Seminar (May 8, 2020).

· Invited speaker at New York Combinatorics Seminar (April 3, 2020).

· Invited facilitator at Central Virginia Math Teachers' Circle, Virginia State University, Petersburg, Virginia (May 17, 2018).

· Invited speaker at Computer Science Seminar, Missouri University of Science and Technology, Rolla, Missouri (April 23, 2018).

· Invited speaker at Mathematics Seminar, Hofstra University, Hempstead, New York (March 7, 2018).

· Invited speaker at Hofstra Cultural Center, Hofstra University, Hempstead, New York (March 6, 2018).

· Invited speaker at Mathematics Colloquium, Towson University, Towson, Maryland (October 13, 2016).

· Invited featured speaker at Eastern Regional Meeting, National Council of Teachers of Mathematics, Atlantic City, New Jersey (October 22, 2015).

· Invited keynote speaker at Adjunct Summit Conference, Prince George's Community College, Largo, Maryland (March 7, 2015).

· Invited speaker at Mathematics Colloquium, Swarthmore College, Swarthmore, Pennsylvania (October 7, 2014).

· Invited speaker at Mathematics Colloquium, Teachers College, Columbia University, New York City, New York (November 11, 2013).

· Invited speaker at Department of Mathematical Sciences, Mathematics Division Colloquium, Stellenbosch University, Stellenbosch, South Africa (July 10, 2013).

· Invited panelist at Next Einstein Initiative, African Institute for Mathematical Sciences, Cape Town, South Africa (June 27, 2013).
· Invited speaker at Institut für Algebra, Technische Universität Dresden, Dresden, Germany (May 29, 2013).
· Invited speaker at Department of Computer Science Research Seminar, Palacký University, Olomouc, Czech Republic (April 25, 2013).
· Invited speaker at Department of Mathematical Sciences Colloquium, University of Puerto Rico at Mayagüez, Mayagüez, Puerto Rico (March 15, 2013).
· Invited speaker at MITACS Workshop on Social Networks, Vancouver, Canada (August 9-13, 2010).
· Invited speaker at MITACS/CORS 2010 Annual Conference, Edmonton, Canada (May 25-28, 2010).
· Keynote speaker at iMATHination 2010 Teacher Professional Development Conference held at the Chicago Teachers' Center of Northeastern Illinois University (January 22-23, 2010).
· Invited speaker at inaugural conference (and invited to participate in opening ceremony) of the Counterterrorism Research Lab, The Mærsk Mc-Kinney Møller Institute, University of Southern Denmark, Odense, Denmark (October 26 and 27-28, 2009).
· Invited speaker at Algebra Seminar, Technische Universität Wien, Vienna, Austria (January 23, 2009).
· Invited speaker at Center for Applied Mathematics Colloquium, Cornell University, Ithaca, New York (April 4, 2008).
· Invited panelist for workshop on Disrupting IED Terror Campaigns: Predicting IED Activities, The National Academies, Washington, D.C. (March 17-18, 2008).
· Invited panelist for workshop on Radicalisation: Foresight and Warning, Nanyang Technological University, Singapore (February 3-5, 2008).
· Invited speaker at Discrete Mathematics and Optimization Seminar, McGill University, Montreal, Canada (April 3, 2007).
· Speaker for the 2007 Myhill Lecture Series, University at Buffalo, State University of New York, Buffalo, New York (March 5-7, 2007).
· Invited speaker at session on Missions and Means Framework: Mathematical Perspectives at Annual Meeting of Institute for Operations Research and the Management Sciences, Pittsburgh, Pennsylvania (November 5, 2006).
· Invited facilitator for Bayesian Statistics and Social Network Analysis workshop, Virginia Modeling, Analysis and Simulation Center, Old Dominion University, Suffolk, Virginia (November 2-3, 2006).
· Invited panelist at U.S. Air Force Symposium on Countering Global Insurgency, Joint Special Operations University, Hurlburt Field, Fort Walton Beach, Florida (May 4, 2006).
· Invited speaker at launch of Raytheon math education initiative with Senator Edward Kennedy, Washington, D.C. (April 26, 2006).

· Invited keynote at conference of the Alliance for the Production of African-American Ph.D.'s in the Mathematical Sciences, Florida A&M University, Tallahassee, Florida (April 8, 2006).

· Invited speaker at the Eighteenth Midwest Conference on Combinatorics, Cryptography and Computing, Rochester Institute of Technology, Rochester, New York (October 29-30, 2004).

· Invited speaker at Analytic Topology Seminar, University of Oxford, Oxford, England (June 14, 2004).

· Invited speaker at Special Combinatorics Seminar, University of Minnesota, Minneapolis, Minnesota (February 17, 2004).

· Invited speaker at Seminar on Discrete and Applicable Mathematics, London School of Economics, London, United Kingdom (January 30, 2004).

· Invited speaker at Combinatorics Seminar, Massachusetts Institute of Technology, Cambridge, Massachusetts (September 24, 2003).

· Invited speaker at Centre d'Analyse de Mathématique Sociales, L'Ecole des Hautes Etudes en Sciences Sociales, Paris, France (June 27, 2002).

· Invited speaker at Algebra Seminar, University of Oxford, Oxford, England (October 9, 2001).

· Invited speaker at Free University of Berlin, Department of Computer Science, Berlin, Germany (July 6, 2000).

· Invited speaker for Invited Minisymposium on Ordered Sets at Tenth Society of Industrial and Applied Mathematics Conference on Discrete Mathematics, Minneapolis, Minnesota (June 12–15, 2000).

· Guest lecturer at Summer Program for Women in Mathematics, George Washington University, Washington, D.C. (July 6, 1999).

· …Many more invited talks before and after 1999…

SELECTED CONFERENCE AND SESSION ORGANIZING

Ø DIMACS Workshop on Applications of Order Theory to Homeland Defense and Computer Security, Rutgers University, Piscataway, New Jersey, September 28-29, 2004.

Ø Joint Meetings of the MAA/AMS, Special Session on Lattice Theory, 2002 (San Diego) and 2003 (Baltimore).

Ø Fifth Conference on Mathematical Methods in Counterterrorism, American Association for the Advancement of Science, Washington, D.C., March 12-13, 2009.

Ø Fourth Conference on Mathematical Methods in Counterterrorism, Rochester Institute of Technology, Rochester, New York , September 20-22, 2007.

Ø Symposium on Women in Mathematics, Stanford University, 2006.

Ø Third Conference on Mathematical Methods in Counterterrorism, Institute of World Politics, Washington, D.C., September 28-30, 2006.

Ø Second Conference on Mathematical Methods in Counterterrorism, Benedict College, Columbia, South Carolina, November 1-3, 2005.

Ø Universal Algebra, Vanderbilt University, Nashville, Tennessee, 2002.

EDUCATIONAL CONSULTING

2012: Joint leader of math enrichment program for students of the Rochester STEM High School, Rochester, New York

2012: The first math lecturer for Udacity, an on-line "university" started by Stanford University computer science professor Sebastian Thrun

2012: Mathematics Consultant, Greenburgh Central 7 School District, Hartsdale, New York

2011: Instructor, Harlem Scholars Program, New York City

VOLUNTEER TUTOR FOR MINORITY AND AT-RISK SCHOOLCHILDREN

2005–2006 : School in East Palo Alto, California (6th grade)
2003 : Cambridge Rindge and Latin School in Cambridge, MA (9th-12th grades)
ca. 2003 : Algebra Project, Cambridge, MA
1997 : Sankore Academy in Nashville, TN (after-school program)
1996 : Berkeley High School in Berkeley, CA (9th-12th grades)
1994 : Saturday School, Oxford, UK (10 year-olds)

BOARDS AND PANEL

Past Member, Advisory Board, Baxter Academy for Technology and Science.

Member, Scientific Planning Group on Mathematics Education, International Council for Science (Regional Office for Latin America and the Caribbean), 2007.

Past Member, Advisory Board, Benjamin Banneker Institute for Science and Technology.

Member, Proposal Review Panel for ADVANCE Program, National Science Foundation, 2012.

LANGUAGES

English (native speaker), German (4 courses), FORTRAN, PL/I, PASCAL, LISP, C++.

HOBBIES

Essay writing, Travel, Movies.

ZEINAB BANDPEY

Topologist and Combinatorialist

Department of Mathematics
Email: zeinab.bandpey@morgan.edu
Morgan State University
Phone: +1 (443) 600-0361(cell phone)
1700 E. Cold Spring Lane
Baltimore, MD 21251

Research interest and projects:

Combinatorics: I am highly interested in solving open problems in combinatorics posed by Richard Stanley. For my dissertation I worked on the Sperner property of distributive lattices. We also solved one of Stanley's problems from 1986, for which we had to prove combinatorially that two formulas are correct.

Lattice Theory: I worked on application of lattice theory to counterterrorism, "Jonathan Farley's Mathematical Terror Theory: The Structure of Perfect Terrorist Cells with a Single Leader." Basically, in that study, terrorist cells were modeled as finite partially ordered sets. The study determined the structure of the terrorist cell most likely to remain intact if a subset of its members is captured at random, provided that the cell has a single leader and no member has more than *b* immediate subordinates.

Topology: I studied generalized continuous functions, by generalizing the concept of u-continuity using the notion of an α-set. Three classes of functions were introduced and studied, and several characterizations are established for each of them. As an application of it, we considered the effect of these functions on compact and extremally disconnected spaces and the uniform boundedness principle.

Computational Modeling: I worked on a computational problem called "Just In Time snow removal." We developed a mathematical model for a snow removal problem which is a combination of transportation and optimization problem sbased on the "just in time" algorithm. The main objective of our research is to design models for establishing efficient routes for snow removal by optimizing the time constraints and cost. We also generalize the network flow problem for snow removal to minimize the time and cost of cleaning the streets "just in time." We presented several simulations of general models and solutions that we ran using the MATLAB software.

Technical Qualifications:

Programs/ Languages: MatLab, Python.

Courses: Abstract Algebra 1 and 2, Real analysis 1 and 2, Advanced Algebra, finite groups, Theory of Fuzzy sets, commutative Algebra, point set topology 1 and 2, Complex analysis 1 and 2, Applications of combinatorics and graph theory, Intro to functional analysis, Combinatorial optimization and Integer programing, What is Data Science?, Programming for Everybody (Getting Started with Python), Python Data Structures, Python for Data Science and AI, Machine

Learning Foundations: A Case Study Approach, Introduction to Machine Learning, Regression, Data Analysis with Python, Data Science Methodology, Data Visualization with Python.

Education:

• 2020 PhD. In Computational and industrial mathematics, Morgan State University, Baltimore, Maryland. Thesis: TOPOLOGICAL PROPERTIES USING α-SETS, SOME COMBINATORIAL PROBLEMS OF STANLEY, ALONG WITH APPLICATIONS TO COUNTERTERRORISM AND SNOW REMOVAL. Dissertation joint-advisors: Dr. Jonathan David Farley, Dr. Bhamini P.M. Nayar.

• 2010 M.S. in Mathematics, University of Mazandaran, Babolsar, Mazandaran, Iran. Thesis: Fuzzy lattices. Dissertation advisor: Dr. Reza Ameri.

• 2008 B.S. In Mathematics, Mazandaran University, Babolsar, Mazandaran, Iran. Pure mathematics.

Publications and Conference Talks:

Scientific Journals:

1. R. Ameri, H. Hedayati, and Z. Bandpey, "Rough sets applied in sublattices and ideals of lattices," RATIO MATHEMATICA 29 (2015) 3-14.

2. Z. Bandpey, "Jonathan Farley's mathematical terror theory: the structure of perfect terrorist cells with a single leader," Congressus Numerantium 228 (2017), 345-352.

3. Z. Bandpey and B. M. P. Nayar, "A Study of Generalized Continuous Functions," *International Journal of Advances in Mathematics* 6 (2018), 16-26.

4. Bandpey, Z., & Nayar, B. M. P. (2019). Compact and extremally disconnected spaces via generalized continuous functions. *Journal of Advanced Studies in Topology*, *10*(1), 28-34. https://doi.org/10.20454/jast.2019.1507

5. Z.Bandpey and B. Nayar, A generalization of uniform boundedness principle in topological spaces, *International Journal of Advances in Mathematics, 1(2020), 24-32.*

Conferences:

1. R. Ameri, H. Hedayati, and Z. Bandpey, "Rough lattices," 41st Annual Iranian Mathematics Conference, Urima University, 12-15 September 2010.

2. R. Ameri, H. Hedayati, and Z. Bandpey, "Rough fuzzy and fuzzy rough lattices," 4th workshop on Algebraic Hyper structures and Fuzzy Mathematics, 16-17 June 2010.

3. H. Hedayati and Z. Bandpey, "Representation of T-Fuzzy filters of lattices," 5th workshop on Algebraic Hyper structures and Fuzzy Mathematics, 16-17 June 2011.

4. Zeinab Bandpey, "Rough Lattices," second QuantLA workshop, 6th to 10th of October 2014, Technische Universität Dresden, Dresden, Germany.

5. Zeinab Bandpey, "Jonathan Farley's Mathematical Terror Theory: The Structure of Perfect Ternary Terrorist Cells," Third Seminar on Algebra and its Applications, University of Mohaghegh Ardabili, August 12-14, 2014, Ardebil, Iran.

6. Zeinab Bandpey, "Jonathan Farley's Mathematical Terror Theory: The structure of the perfect terrorist cell with a single leader," Towson University, Mathematics Colloquium, September 22, 2016. http://www.towson.edu/fcsm/departments/mathematics/news/documents/colloquium_09_22_2016.pdf

7. Zeinab Bandpey, "Jonathan Farley's Mathematical Terror Theory: The structure of the perfect terrorist cell with a single leader," Morgan State University, Mathematics Colloquium, October 6, 2016.

8. Zeinab Bandpey, "Jonathan Farley's Mathematical terror theory: The structure of the perfect terrorist cell with a single leader," NAM Mathfest November 10-12, 2016.

9. Zeinab Bandpey, "Jonathan Farley's Mathematical terror theory: The structure of the perfect terrorist cell with a single leader," 48th Southeastern International Conference on Combinatorics, Graph Theory & Computing March 6-10, 2017.

10. Zeinab Bandpey, "Jonathan Farley's Mathematical terror theory: The structure of the perfect terrorist cell with a single leader," Graduate Research, Interdisciplinary Network and Development (GRIND) conference, March 17, 2017.

11. Zeinab Bandpey, "A Study of Generalized Continuous Functions," Graduate Research, Interdisciplinary Network and Development (GRIND) conference, March 17, 2017.

12. Zeinab Bandpey and Bhamini M.P. Nayar, "A Study of Generalized Continuous Functions," accepted to be presented at American Mathematical Society Joint Meetings 2018, January 10-13, 2018.

13. Zeinab Bandpey, Isabelle Kemajou Brown, Xiao-Xiong Gan, and Alham Tannouri, "Urban snow removal—just in time: the mathematical model and algorithm," presented at American Mathematical Society Joint Meetings 2018, January 10-13, 2018.

14. Zeinab Bandpey, "Jonathan Farley's mathematical terror theory: The structure of the perfect terrorist cell with a single leader," 24th Conference for African American Researchers in the Mathematical Sciences CAARMS24- Institute for Advanced Study / Princeton University, July 11-14, 2018.

15. Zeinab Bandpey and Bhamini M.P. Nayar, "A Study of Generalized Continuous Functions," 33rd Summer Conference on Topology and its Applications, Western Kentucky University, July 17-20, 2018.

16. Zeinab Bandpey and Bhamini M.P. Nayar, "A Study of Generalized Continuous Functions, AMS Joint Meetings, January 16-19, 2019.

17. Zeinab Bandpey, "Jonathan Farley's mathematical terror theory: The structure of the perfect terrorist cell with a single leader," , AMS Joint Meetings , January 16-19, 2019.

18. Zeinab Bandpey, Isabelle Kemajou Brown, and Alham Tannouri, "Urban snow removal—just in time: the mathematical model and algorithm," presented at ICTA2019 OCT 29-31 MSU USA.

Newspapers, Newsletters, and Radio:

1. Z. Bandpey, "Equations of Peace," The Berkeley Daily Planet (October 28th, 2013).

2. Z. Bandpey, "Equations of Peace," Association for Women in Mathematics newsletter, May-June 2017, page 19.

https://drive.google.com/file/d/0B2rXxbFqvn3ZM2NJcFJLWUJDNzA/view#page=19

3. Chicago radio program (December 5, 2017)

https://www.facebook.com/photo.php?fbid=168059533939061&set=a.128083394603342&type=3&theater

Work in progress:

1. Z.Bandpey, A. Tannouri, and I. K. Brown, Urban Snow Removal—Just In Time Mathematical Model and Algorithm. In progress

2. Z. Bandpey, J. D. Farley, "The number of graph homomorphisms between paths and cycles with loops, A problem from Stanley's Enumerative Combinatorics," in progress.

Invited talk:

"An Iranian woman studying in a historical black university teaches College Algebra in prison!" Special Session: Innovative Mathematical Outreach in Alternative Settings, AMS Joint Meetings 2018.

Honors:

1. Winner of vCalc's First Level Prize ($1,000), Coding for the Community (2016). The company vCalc was co-founded by Kurt Heckman, a former math major who is (far right) giving me the prize:

https://www.vcalc.com/wiki/Blog/Zeinab-Bandpey-Wins-vCalc-Award-for-Excellence

2. Winner of vCalc's Fourth Level Prize ($100), Coding for the Community (2016)

3. Recognized as the best student in the department of pure mathematics in my M.Sc. course.

4. Winner of Third Prize (one member of a team) for HBCU Battle of the Brains 2017.

http://news.morgan.edu/morgans-team-of-scholars-takes-third-place-in-hbcu-battle-of-the-brains/

Employment:

- August 2020-present: Lecturer at Morgan State University.

- 2016-May 2020: Research assistant doing research on Generalized Continuous Functions, Compact and Extremally Disconnected Spaces, A generalization of uniform boundedness principle Morgan State University, Baltimore, MD, USA.

- June 2016-May 2020: Research assistant doing research on Unimodality and Free Distributive Lattices, Morgan State University, Baltimore, MD, USA.

- Before 2015: Research assistant doing research on Fuzzy Lattices, Department of Mathematics, University of Mazandaran, Babolsar, Mazandaran, Iran.

Teaching:

- August 2020-present: Lecturer at Morgan State University.

- January 2017-December 2017: Instructor in Pre-algebra and algebra and statistics for the University of Baltimore, Baltimore, Maryland, USA. Besides the above, as part of UB faculties I taught a class with 28 students, all current prison inmates, inside Jessup Correctional Institution. It was a special program offered by the University of Baltimore called the "Second Chance Pell Grant Program".

- 2015-present**:** Teaching Assistant for Calculus, Algebra, and Pre-algebra, Morgan State University, Baltimore, Maryland, MD, USA. Average 30 students in each class, two classes per semester.

- January 2017-December 2017: Adjunct instructor for Statistics and Algebra at Towson University, Towson, Maryland, USA. Classes had an average 30 students. Lab sections were included; we used Minitab as the software.

- January 2018-May 2018: Adjunct instructor for Graph Theory, Towson University, Towson, Maryland, USA. Class had an average of 4 students. Graduate level.

CANDICE A MARSHALL

4362 Old Frederick Rd.

- Baltimore, MD 21229
- c_jn_louis@hotmail.com

• (443) 310-8912

Diligent, dedicated individual with many years of experience in the field of mathematics with knowledge of Complex Analysis, Combinatorics and Graph Theory, Advanced Calculus, Real Analysis, Statistics, Point Set Topology, Differential Equations and Abstract Algebra.

EDUCATION AND TRAINING

Ph. D IN INDUSTRIAL AND COMPUTATIONAL MATHEMATICS Dec 2017

MORGAN STATE UNIVERSITY

GPA 4.0 ● Summa cum Laude Baltimore, MD

MASTER OF ARTS IN MATHEMATICS 2011

MORGAN STATE UNIVERSITY

GPA 3.88 ● Summa cum Laude Baltimore, MD

BACHELOR OF SCIENCE IN MATHEMATICS 2004

MORGAN STATE UNIVERSITY Baltimore, MD

GPA 3.91 ● Summa cum Laude ● Dean's List

- Recipient, First Prize in Undergraduate Science Research Symposium, Morgan State University
- 2005 Recipient, William H. Proctor Prize in Mathematics, Department of Mathematics, Morgan State University

PROFESSIONAL EXPERIENCE

PROGRAM DIRECTOR FOR ACTUARIAL SCIENCE August 2018 – present
MORGAN STATE UNIVERSITY Baltimore, MD

•Teach Professional Development to Actuarial Science majors and any other Math/Actuarial courses assigned.

•Advise all Actuarial Science majors and help with the process of entering the profession.

MATHEMATICS PROFESSOR May 2018 – October 2018 STRATFORD UNIVERSITY Baltimore, MD

- Teach Modern Math with Algebra to culinary and hospitality students.
- Revise Math Curriculum to improve student engagement and performance.

MATHEMATICS TEACHER - SECONDARY August 2017 – June 2018 ARCHBISHOP CURLEY HIGH SCHOOL Baltimore, MD

•Teach Algebra 1 and Geometry to 9th and 10th grade students.

•Mentor students for full understanding of principles to increase engagement and satisfaction

•Develop curriculum and pacing guide for upper and mid level Algebra 1 students.

PART-TIME LECTURER/GRADUATE ASSISTANT August 2008 – Dec 2017 MORGAN STATE UNIVERSITY
Baltimore, MD

•Lecture freshmen students on theories, concepts, and mathematical methods and practices.

•Demonstrate adept interpersonal communication skills in all interactions with students.

•Successfully motivate and teach using personal examples of strong work ethic and integrity.

•Assist professors with their research into trending mathematical concepts and principles.

CALCULUS TEACHER -SAMS PROGRAM Summer 2016 and 2017

MORGAN STATE UNIVERSITY Baltimore, MD

•Teach Calculus 1 to high school students in the SAMS program.

MATHEMATICS TEACHER - SECONDARY August 2015 – July 2016 MERGENTHALER VOCATIONAL TECHNICAL HIGH SCHOOL Baltimore, MD

•Teach Algebra 2 and Probability and Statistics to 11th and 12th grade students.

•Lead the Algebra 2 intervention which was created to help students bridge the gap between Algebra 1 and 2.

•Use analytic, strategic, and pragmatic skills in presenting materials using various approaches to foster learning and understanding thereby assisting students to realize their individual goals.

HEAD OF MATHEMATICS DEPARTMENT February 2006 – July 2008

GROS ISLET SECONDARY SCHOOL Gros Islet, Saint Lucia

•Acted as head of the Mathematics Dep't of secondary school teachers for grades 7 through 11.

•Responsible for formulating student work plans and calendar of activities in the curriculum.

•Implemented parent-teacher program which fostered improved learning and performance.

SPECIALIZED TRAINING AND AWARDS, HONORS AND OTHER

•Recipient, bookkeeping diploma, Penn Foster Career School, Scranton, PA, November 2011.

•Passed Exam 1 of the Society of Actuaries, May 2005.

•Certificate of Achievement, 2004 ECSU NAM Institute in Computational Science – Scientific Visualization, Elizabeth City State University, Elizabeth City, NC, 2004.

PUBLICATIONS

•Some Algebraic Structure of the Riordan Group, Linear Algebra and its Applications, March 2013, Vol. 438(5): 2018-2035.

•Another Method of Constructing Pseudo-Involutions in the Riordan Group, Congressus Numeratum, March 2017.

RESEARCH INTERESTS

•The Riordan Group

•Biosurveillance using Entropy

HONORS AND OTHER

•Member, Pi Mu Epsilon, Maryland Beta Chapter, Baltimore, MD, 2004.

•Member, Alpha Kappa Mu, Pi Lambda Psi Chapter, Baltimore, MD 2004.

•Member, Golden Key International, Baltimore, MD, 2003.

•Member, Alpha Lambda Delta and Phi Eta Sigma Morgan State University Chapters, 2002.

•Member, Promethean Kappa Tau, Morgan State University Chapter, Baltimore, MD, 2002.

•Basic knowledge of French and Spanish.

The following attachment is not included in the view since it is not a read-only PDF file.

Upon submission, this file will be transmitted to the Grantor without any data loss.

Farket 2020 support letter.docx

Ira A. Fulton Schools of Engineering
ARIZONA STATE UNIVERSITY

SCHOOL OF COMPUTING, INFORMATICS, AND DECISION SYSTEMS ENGINEERING
engineering.asu.edu/cidse

PO Box 878809
Tempe, AZ 85287-8809
Ph: 480.965.3190
FAX: 480.965.2751

October 2, 2020

Greg Simmons
Program Manager
Office of University Programs; Science and Technology Directorate
Department of Homeland Security

Dear Greg Simmons,

I am the Director of the Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State University. I am writing this letter to support Morgan State University's (MSU) proposal to the Department of Homeland Security (DHS) Scientific Leadership Awards for Minority Serving Institutions. The basis of MSU's proposal is to enhance education in Homeland Security related Science, Technology, Engineering, and Mathematics (HS-STEM) in order to develop a diverse and inclusive workforce with skills to support the Homeland Security Enterprise.

The proposed MSU program objectives may benefit from a review of CAOE research, and the CAOE will establish a collaborative relationship with this MSU program if their proposal is funded. The CAOE will collaborate with the MSU program by presenting our research at MSU upon their invitation. Furthermore, under existing DHS programs, CAOE will include MSU as a candidate for their students to participate in CAOE driven research, including summer internships. CAOE will also invite MSU faculty to participate in CAOE's organized seminars or conferences.

Sincerely,

Ross Maciejewski
Associate Professor
Director, Center for Accelerating Operational Efficiency, A Department of Homeland Security Center of Excellence
School of Computing, Informatics & Decision Systems Engineering
Arizona State University
http://rmaciejewski.faculty.asu.edu

CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Statement for Loan Guarantees and Loan Insurance

The undersigned states, to the best of his or her knowledge and belief, that:

If any funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this commitment providing for the United States to insure or guarantee a loan, the undersigned shall complete and submit Standard Form-LLL, "Disclosure of Lobbying Activities," in accordance with its instructions. Submission of this statement is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required statement shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

* APPLICANT'S ORGANIZATION

Morgan State University

* PRINTED NAME AND TITLE OF AUTHORIZED REPRESENTATIVE

Prefix: Dr. * First Name: Farin Middle Name:

* Last Name: Kamangar Suffix:

* Title: Interim Assistant Vice President for Research

* SIGNATURE: Completed on submission to Grants.gov * DATE: Completed on submission to Grants.gov

ATTACHMENTS FORM

Instructions: On this form, you will attach the various files that make up your grant application. Please consult with the appropriate Agency Guidelines for more information about each needed file. Please remember that any files you attach must be in the document format and named as specified in the Guidelines.

Important: Please attach your files in the proper sequence. See the appropriate Agency Guidelines for details.

1) Please attach Attachment 1	Farket 2020 support letter.pd	Add Attachment	Delete Attachment	View Attachment
2) Please attach Attachment 2	DHHS Colleges & Universities	Add Attachment	Delete Attachment	View Attachment
3) Please attach Attachment 3	MorganState.pdf	Add Attachment	Delete Attachment	View Attachment
4) Please attach Attachment 4	Fringe Rate.pdf	Add Attachment	Delete Attachment	View Attachment
5) Please attach Attachment 5	Certificate regarding Lobbyin	Add Attachment	Delete Attachment	View Attachment
6) Please attach Attachment 6		Add Attachment	Delete Attachment	View Attachment
7) Please attach Attachment 7		Add Attachment	Delete Attachment	View Attachment
8) Please attach Attachment 8		Add Attachment	Delete Attachment	View Attachment
9) Please attach Attachment 9		Add Attachment	Delete Attachment	View Attachment
10) Please attach Attachment 10		Add Attachment	Delete Attachment	View Attachment
11) Please attach Attachment 11		Add Attachment	Delete Attachment	View Attachment
12) Please attach Attachment 12		Add Attachment	Delete Attachment	View Attachment
13) Please attach Attachment 13		Add Attachment	Delete Attachment	View Attachment
14) Please attach Attachment 14		Add Attachment	Delete Attachment	View Attachment
15) Please attach Attachment 15		Add Attachment	Delete Attachment	View Attachment

MORGAN STATE UNIVERSITY

GROWING THE FUTURE • LEADING THE WORLD

Department of Mathematics

September 8, 2020

On behalf of the Department of Mathematics at Morgan State University, I am pleased to support Dr. Candice Marshall, Dr. Zeinab Bandpey, and Dr. Jonathan Farley's application for the 2020 Department of Homeland Security Scientific Leadership Awards for Minority Serving Institutions. A Historically Black Institution (HBI), Morgan State University prides itself on educating and creating opportunities for underrepresented and minority individuals. The School of Computer, Mathematical, and Natural Sciences, which houses the Department of Mathematics, is fully committed to the providing Dr. Marshall, Dr. Bandpey, and Dr. Farley with the resources and support necessary to develop their own academic careers, as well as to provide an innovative, comprehensive, and supportive research and educational program for young scholars.

Dr. Marshall, Dr. Bandpey, and Dr. Farley have proposed a unique and rigorous program that aligns with the Department's, School's, and University's commitment to new research initiatives, enhancing student success, and engaging with the community. In addition, the proposed plan supports the Department of Homeland Security's mission and guiding principles by investigating methods of mitigating risks to our national security.

Dr. Candice Marshall defended her PhD dissertation in December 2017. She is currently the Director of the Actuarial Science Program at Morgan State University and will act as Co-PI in this project. Dr. Zeinab Bandpey got her PhD in 2020 in Industrial and Computational Mathematics and works as a Lecturer in the Department of Mathematics and will also serve as Co-PI for this project. The Department of Mathematics is pleased to support these early-career faculty, Dr. Marshall and Dr. Bandpey, while they initiate HS-STEM education programs and guide students through their research once the students are accepted.

An Associate Professor of Mathematics, Dr. Farley is an experienced researcher in pure mathematics and in mathematical terror theory and a K-12 math education consultant. The book he co-edited, *Mathematical Methods in Counterterrorism*, has had over 24,000 chapter downloads. Dr. Farley's co-primary investigators and early-career faculty members, Dr. Marshall, Director of the Actuarial Science Program; and Dr. Bandpey, Lecturer in the Department of Mathematics, have proven themselves to be dedicated to increasing the number of underrepresented minority students in STEM fields at the high school and baccalaureate level. Their dedication to diversifying STEM is evident in their leadership and involvement in mentoring activities, as well as their involvement in the Actuarial Science Program's summer bridge program for high school students, The Summer Academy of Actuarial and Mathematical Sciences. The proposed research and education plan will draw from the many successful initiatives the School has already developed and maintained to support the education and careers of minority and underserved students.

I certify that the proposed program is supported by and is aligned with the Department's, School's, and University's research and educational goals and I am personally committed to the success of the initiative and to the professional development of Drs. Marshall, Bandpey,and Farley.

Sincerely,

Asamoah Nkwanta, PhD
Chair of the Department of Mathematics at Morgan State University
asamoah.nkwanta@morgan.edu

1700 East Cold Spring Lane | 251 Carnegie Hall | Baltimore, Maryland 21251
Tel: 443-885-3964

COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN: 52-6002033

ORGANIZATION:

Morgan State University
1700 E. Cold Spring Lane
Truth Hall 307
Baltimore, MD 21251

DATE:05/08/2020

FILING REF.: The preceding agreement was dated 05/25/2017

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

SECTION I: Facilities And Administrative Cost Rates

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

	EFFECTIVE PERIOD				
TYPE	**FROM**	**TO**	**RATE(%)**	**LOCATION**	**APPLICABLE TO**
PRED.	07/01/2019	06/30/2023	51.00	On-Campus	Organized Research
PRED.	07/01/2019	06/30/2023	62.00	On-Campus	Instruction
PRED.	07/01/2019	06/30/2023	38.00	On-Campus	Other Sponsored Activities
PRED.	07/01/2019	06/30/2023	26.00	Off-Campus	All Programs
PROV.	07/01/2023	Until Amended			Use same rates and conditions as those cited for fiscal year ending June 30, 2023.

*BASE

PREVIEW Date: Oct 12, 2020 Workspace ID: WS00576433 Funding Opportunity Number: DHS-20-ST-062-001

Modified total direct costs, consisting of all salaries and wages, fringe benefits, materials, supplies, services, travel and subgrants and subcontracts up to the first $25,000 of each subgrant or subcontract (regardless of the period covered by the subgrant or subcontract). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, student tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are specifically identified to each employee and are charged individually as direct costs. The directly claimed fringe benefits are listed below.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences.

OFF-CAMPUS DEFINITION: For all activities performed in facilities not owned by the institution and to which rent is directly allowed to the project(s) the off-campus rate will apply. Grants or contracts will not be subject to more than one F&A cost rate. If more than 50% of a project is performed off-campus, the off-campus rate will apply to the entire project.

Fringe Benefits include: FICA/Medicare, Retirement, Tuition Remission, TIAA/CREF, Workers' Compensation, Unemployement Insurance, and Health Insurance.

Per 2 CFR 200.414(g) - A rate extension has been granted.

The next indirect cost proposal based on actual costs for the fiscal year ending 06/30/2022 is due in our office by 12/31/2022.

Equipment means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or $5,000.

PREVIEW Date: Oct 12, 2020 Workspace ID: WS00576433 Funding Opportunity Number: DHS-20-ST-062-001

SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Title 2 of the Code of Federal Regulations, Part 200 (2 CFR 200), and should be applied to grants, contracts and other agreements covered by 2 CFR 200, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:

Morgan State University
(INSTITUTION)

(SIGNATURE)

Sidney H. Evans, Sr.
(NAME)

Vice President for Finance/CFO
(TITLE)

5/19/20
(DATE)

for

ON BEHALF OF THE FEDERAL GOVERNMENT:

DEPARTMENT OF HEALTH AND HUMAN SERVICES
(AGENCY)

Darryl W. Mayes - S
Digitally signed by Darryl W. Mayes -S
DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, 0.9.2342.19200300.100.1.1=2000131669, cn=Darryl W. Mayes -S
Date: 2020.05.13 08:44:05 -04'00'
(SIGNATURE)

Arif Karim
(NAME)

Director, Cost Allocation Services
(TITLE)

5/8/2020
(DATE) 4626

HHS REPRESENTATIVE: Ernest Kinneer

Telephone: (214) 767-3261

PREVIEW Date: Oct 12, 2020 Workspace ID: WS00576433 Funding Opportunity Number: DHS-20-ST-062-001

Ira A. Fulton Schools of Engineering
ARIZONA STATE UNIVERSITY

SCHOOL OF COMPUTING, INFORMATICS, AND DECISION SYSTEMS ENGINEERING
engineering.asu.edu/cidse

PO Box 878809
Tempe, AZ 85287-8809
Ph: 480.965.3190
FAX: 480.965.2751

October 2, 2020

Greg Simmons
Program Manager
Office of University Programs; Science and Technology Directorate
Department of Homeland Security

Dear Greg Simmons,

I am the Director of the Center for Accelerating Operational Efficiency, a Department of Homeland Security Center of Excellence at Arizona State University. I am writing this letter to support Morgan State University's (MSU) proposal to the Department of Homeland Security (DHS) Scientific Leadership Awards for Minority Serving Institutions. The basis of MSU's proposal is to enhance education in Homeland Security related Science, Technology, Engineering, and Mathematics (HS-STEM) in order to develop a diverse and inclusive workforce with skills to support the Homeland Security Enterprise.

The proposed MSU program objectives may benefit from a review of CAOE research, and the CAOE will establish a collaborative relationship with this MSU program if their proposal is funded. The CAOE will collaborate with the MSU program by presenting our research at MSU upon their invitation. Furthermore, under existing DHS programs, CAOE will include MSU as a candidate for their students to participate in CAOE driven research, including summer internships. CAOE will also invite MSU faculty to participate in CAOE's organized seminars or conferences.

Sincerely,

Ross Maciejewski
Associate Professor
Director, Center for Accelerating Operational Efficiency, A Department of Homeland Security Center of Excellence
School of Computing, Informatics & Decision Systems Engineering
Arizona State University
http://rmaciejewski.faculty.asu.edu

MORGAN STATE UNIVERSITY

GROWING THE FUTURE • LEADING THE WORLD

March 30, 2018

Re: 2018 Aggregate Rate Applicable to Grant and Contract Proposals

The fringe benefit rate is expressed as a percentage of salary in preparation of a grant and/or contract cost proposal and ultimately billable at actual cost. For fiscal year 2018, the aggregate fringe benefit rate for grant and contract proposals is 42% as outlined below, and will be used on all proposals beginning January 1, 2018.

Although the rates for social security, retirement, unemployment, and workers' compensation are relatively stable, health insurance rates could change significantly. Should you choose to use a dollar figure for health insurance, $15,000 per employee would be appropriate.

Health Insurance	18.0%
Social Security	7.5%
Retirement	15.5%
Unemployment & Workers Compensation	1.0%
Total Fringe Benefit %	**42.0%**

The fringe rate for contractual employees will be 9%, to include social security, unemployment, and workers' compensation, plus an additional $12,000 for healthcare.

If you require additional clarification or information, please do not hesitate to contact me at (443) 885-3144.

Sincerely,

Mr. Sidney H. Evans, Jr.
Vice President for Finance and Management

SHE/MH

Office of the Vice President for Finance and Management
1700 E. Cold Spring Lane • 307 Truth Hall • Baltimore, Maryland 21251-0001
Tel: 443-885-3144 • Fax: 443-885-8294

PREVIEW Date: Oct 12, 2020 Workspace ID: WS00576433 Funding Opportunity Number: DHS-20-ST-062-001

The following attachment is not included in the view since it is not a read-only PDF file.

Upon submission, this file will be transmitted to the Grantor without any data loss.

Certificate regarding Lobbying.pdf