Curriculum Vita

Hussein El Hajj

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Education

Virginia Tech - Blacksburg, VA, United States *August 2017 - May 2021*
Ph.D. in Industrial and Systems Engineering
Focus Area: Operations Research

Dissertation: *Robust and Equitable Public Health Screening Strategies, with Application to Genetic and Infectious Diseases*
Advisors: Prof. Ebru Bish (co-chair) and Prof. Douglas Bish (co-chair)
Cumulative GPA: 4.0/4.0

American University of Beirut - Beirut, Lebanon *January 2016 - August 2017*
M.E. in Engineering Management
Track: Financial Engineering

Dissertation: *Optimal Time and Cost Balance in Project Risk Management*
Advisor: Prof. Bacel Maddah
Cumulative GPA: 4.0/4.0

American University of Beirut - Beirut, Lebanon *September 2010 - July 2015*
B.E. in Civil and Environmental Engineering
Focus Areas: Transportation Engineering and Geotechnical Engineering
Minor in Mathematics

All graduate education has been supported by scholarships and assistantships.

Research Interests

My research interests are in the area of service operations management, with a focus on healthcare systems and public policy. I use methodologies from operations research and data analytics to solve complex problems that arise in these systems. Specifically, my PhD research explores the design and analysis of public health screening strategies. The objective is to design innovative strategies that maximize detection accuracy under uncertainty, while being cost-efficient and ensuring equitable outcomes. Solving these difficult problems requires analysis of large data sets, derivation of structural properties of optimal strategies, and design of effective and efficient solution algorithms. Specific applications include newborn screening for genetic disorders, and screening for infectious diseases, including COVID-19. My postdoc research focuses on developing a strategic disaster preparedness plan in a sharing economy setting, and on proposing a framework, in which the government engages the private sector. My research also studies the optimal response to the COVID-19 pandemic, in terms of disease screening, and personal protective equipment and vaccine allocation.

Research Methodologies

Stochastic, Robust, and Nonlinear Optimization
Combinatorial Optimization
Probability Theory
Simulation
Data Analytics

Publications

Published:

1. **H. El Hajj**, D. R. Bish, E. K. Bish, and D. Kay. Novel pooling strategies for genetic testing, with application to newborn screening. **Management Science**, 2022
   INFORMS Pierskalla Best Paper Award, Runner-up (2021)

2. **H. El Hajj**, D. R. Bish, and E. K. Bish. Optimal genetic screening for cystic fibrosis. **Operations Research**, 70(1): 265-287, 2022
   INFORMS Health Applications Society (HAS) Student Paper Competition, Runner-up (2019)

3. **H. El Hajj**, D. R. Bish, E. K. Bish, and H. Aprahamian. Screening multi-dimensional heterogeneous populations for infectious diseases under scarce testing resources, with application to COVID-19. **Naval Research Logistics**, 69(1): 3–20, 2022.

4. **H. El Hajj**, D. R. Bish, and E. K. Bish. Equity in genetic newborn screening.
   Naval Research Logistics, 68(1): 44–64, 2021.

5. D. R. Bish, E. K. Bish, **H. El Hajj**, and H. Aprahamian. An approach to pooled testing to expand COVID-19 screening capacity. **PLoS One**, 16(2): e0246285, 2021.

Under Review:

1. D. R. Bish, E. K. Bish, and **H. El Hajj**. Optimal multi-disease testing design for public health screening via multiplex assays and pooling. **Manufacturing and Service Operations Management**, *second round of review.*

2. **H. El Hajj**, F. Gzara, and S. Elhedhli. Sharing economy for efficient and equitable strategic diaraster preparedness. **Operations Research**, *first round of review.*

Conference Proceedings:

1. **H. El Hajj** and B. Maddah. Optimal time and cost balance in project risk management, in *The Sixteenth FEA Student and Alumni Conference Proceedings, American University of Beirut*, 375-382, 2017

Work in Process:

1. **H. El Hajj**, D. R. Bish, E. K. Bish, and D. Kay. Novel newborn screening processes for cystic fibrosis.

2. **H. El Hajj**, S. S. Sadeghzadeh, D. R. Bish, and E. K. Bish. Equitable biomarker screening schemes.

3. **H. El Hajj**, F. Gzara, and S. Elhedhli. A survey of analytical models and methods for the COVID-19 pandemic.

Selected Honors and Awards

IISE Pritsker Doctoral Dissertation Award, First Place *2022*
Awarded based on quality and contribution to industrial engineering

INFORMS Pierskalla Best Paper Award, Runner-up *2021*
Awarded based on quality, originality, and contribution to
operations research and management science in health care

Outstanding PhD Student *2021*
Virginia Tech, Department of Industrial and Systems Engineering
Awarded based on teaching, research, and outreach achievements

INFORMS Bonder Scholarship *2020*
for Applied Operations Research in Health Services, Finalist
Awarded based on excellence, innovation, and preparation

INFORMS Health Application Society (HAS) *2019*
Student Paper Competition, Runner-up
Awarded based on quality, novelty, and importance of methodology,
contribution to healthcare research, and potential for impact on practice

Outstanding Teaching Assistant *2018*
Virginia Tech, Department of Industrial and Systems Engineering
Awarded based on voting by all undergraduate students in the department

Harold Schneikert Graduate Fellowship *2017*
Awarded based on superior academic achievements and credentials
Virginia Tech, Department of Industrial and Systems Engineering

Ingersoll Rand Graduate Fellowship *2017*
Awarded based on superior academic achievements and credentials
Virginia Tech, Department of Industrial and Systems Engineering

Jack and Judy Sweers Graduate Fellowship *2017*
Virginia Tech, Department of Industrial and Systems Engineering
Awarded based on superior academic achievements and credentials

Awards (as a Member of the Virginia Tech INFORMS Student Chapter):

INFORMS Cum Laude Award *2020*
Awarded based on the achievements of student chapters

INFORMS "OR What?" Student Video Competition, First Place *2018*
The winning video, produced by the Virginia Tech INFORMS Student Chapter
(including myself), aims to promote OR/MS and Analytics to undergraduate
students, and can be found at: *http://info.informs.org/or-what*

Presentations

1. **H. El Hajj**, E. K. Bish, and D. R. Bish. Optimal genetic screening for cystic fibrosis. *INFORMS Annual Meeting*, virtual, 2021.

2. **H. El Hajj**, E. K. Bish, and D. R. Bish. Novel pooling strategies for genetic testing, with application to newborn screening. *INFORMS Annual Meeting*, virtual, 2021.

3. **H. El Hajj**, E. K. Bish, and D. R. Bish. Mass testing of infectious diseases with pooling, with application to COVID-19 testing. *INFORMS Annual Meeting*, virtual, 2020.

4. **H. El Hajj**, E. K. Bish, and D. R. Bish. Optimal genetic screening for cystic fibrosis. *INFORMS Annual Meeting*, virtual, 2020.

5. **H. El Hajj**, E. K. Bish, and D. R. Bish. Robust and equitable public health screening strategies, with application to genetic and infectious diseases. *INFORMS Annual Meeting*, virtual, 2020.

6. **H. El Hajj**, E. K. Bish, and D. R. Bish. Optimal genetic screening for cystic fibrosis. *INFORMS Annual Meeting*, Seattle, WA, 2019.

7. **H. El Hajj**, D. R. Bish, and E. K. Bish. Optimal genetic screening for cystic fibrosis. *INFORMS Healthcare Conference*, Boston, MA, 2019.

8. **H. El Hajj**, D. R. Bish, and E. K. Bish. Optimal newborn screening algorithm for cystic fibrosis. *INFORMS Annual Meeting*, Phoenix, AZ, 2018.

9. **H. El Hajj**, D. R. Bish, and E. K. Bish. Optimal genetic testing schemes for cystic fibrosis. *INFORMS Annual Meeting*, Phoenix, AZ, 2018.

10. **H. El Hajj**, and B. Maddah. Optimal time and cost balance in project risk management. *The Sixteenth FEA Student and Alumni Conference*, American University of Beirut, Beirut, Lebanon, 2017.

Research & Teaching Experience

Postdoctoral Fellow *August 2021-July 2022*

University of Waterloo, Department of Management Sciences
Advisors: Prof. Fatma Gzara and Prof. Samir Elhedhli

Course Instructor

- University of Waterloo, Department of Management Sciences *Fall 2021*

  Co-instructor for Warehousing and Distribution Analytics, a two-week professional development course, required for the Logistics and Supply Chain Management Certificate

  - Course focuses on descriptive, predictive, and prescriptive models to study the designs of optimal supply chain, storage, and distribution plans. Topics include warehousing and its function, order fulfillment, inventory management, shipment planning, and strategic warehousing

- Virginia Tech, Department of Industrial and Systems Engineering *Summer 2019*

  Instructor for ISE 3414 - Probabilistic Operations Research, a required junior-level undergraduate course

  - Course focuses on probabilistic models to study the behavior and performance of manufacturing and service systems under conditions of uncertainty. Topics include conditional expectation and probability, discrete- and continuous-time Markov chains, stochastic processes, including the Poisson process

– Received an **excellent score** from students in teaching evaluations (a score of 92/100 on "overall teaching effectiveness")

Research Assistant
Virginia Tech, Department of Industrial and Systems Engineering *2018 - 2021*
Supported by the National Science Foundation, Grant #1761842

Teaching Assistant *2016 - 2021*
Virginia Tech, Department of Industrial and Systems Engineering

ISE 2214 - Manufacturing Processes Lab
ISE 2404 - Deterministic Operations Research I
ISE 3414 - Probabilistic Operations Research

American University of Beirut, Engineering Management Program

INDE 301 - Engineering Economy

Taught review sessions, assisted students, held office hours, and graded student work.

Development Activities

IISE Doctoral Colloquium *October 2020*
Virtual

INFORMS Doctoral Student Colloquium *October 2019*
Seattle, WA

Online Course Certificates
Fundamentals of Quantitative Modeling *March 2016*
Wharton School of the University of Pennsylvania, Coursera

The Data Scientist's Toolbox *July 2014*
Johns Hopkins Bloomberg School of Public Health, Coursera

Computing for Data Analysis *February 2014*
Johns Hopkins Bloomberg School of Public Health, Coursera

Professional Organizations

Institute for Operations Research and Management Science (INFORMS), Member
Computing Society
Health Applications Society
Manufacturing & Service Operations Management Society
Optimization Society

Leadership and Service

Virginia Tech INFORMS Student Chapter
Vice President (Operations) *August 2019 - July 2020*

- Managed the weekly seminar series and communicated with invited speakers

- Maintained documentation for operational activities

United States Agency for International Development (USAID) in Beirut, Lebanon *February 2017 - April 2017*

Recruitment Officer

- Assisted the USAID Recruitment Office in public high school visits in Lebanon
- Conducted information sessions for high school seniors about USAID scholarship programs and the American University of Beirut
- Met with high school principals to promote USAID scholarship programs

American University of Beirut, Faculty of Engineering and Architecture, Student Representative Committee (SRC) *September 2016 - August 2017*

Treasurer

- Presented student perspectives and concerns to the Dean's Office
- Monitored budget and financial transactions for all student activities organized by the Faculty of Engineering and Architecture

Seminars and Workshops

- Presented a research seminar as part of the ENMG 700-Engineering Management Seminar, American University of Beirut (Fall 2021)
- Conducted a workshop on optimization solvers (Gurobi and Excel) as part of the Virginia Tech INFORMS Student Chapter seminar series (February 2020)
- Presented research seminars as part of the Virginia Tech INFORMS Student Chapter seminar series (October 2018, October 2019, February 2020)
- Guest lecturer in ISE 4434-Supply Chain and Operations Engineering, Virginia Tech (Spring 2020)
- Guest lecturer in OM 610-Nonlinear Programming, University of Alabama (Fall 2020)

Served as a referee for various operations research, healthcare, and biostatistics journals.

Industry Experience

Inventory Control Coordinator *April 2017 - July 2017*

Basic Outlet Stores, Beirut, Lebanon

- Assisted in implementation of the RFID inventory system
- Worked with the IT department to develop and implement Microsoft Dynamics NAV
- Conducted worker training to increase the accuracy of the inventory system

Financial Consultant *April 2016 - January 2017*

Metlife, Ghazir, Lebanon

- Completed Metlife training program
- Advised clients on their investment portfolio, managed client meetings, and followed up with clients to ensure client satisfaction
- Prepared financial reports according to client needs

Structural Engineer *September 2015 - March 2016*

Secure Design Office, Beirut, Lebanon

- Set out project works in accordance with drawings & specification
- Analyzed and designed simple structures (SAFE and ETABS)
- Drafted/designed structural members (AutoCAD)
- Ensured that all assigned work is completed on time and within agreed budgets
- Prepared multiple "Bill of Quantities" for different projects
- Produced and processed financial measurements

Transportation Engineering Intern *June 2014 - August 2014*

Dar Al-Handasah (Shair and Partners), Beirut, Lebanon

- Designed highway, airport and internal roads
- Analyzed traffic data and set the traffic lights system

Computer Skills

Programming Languages
C++, VBA, Matlab, Python, R, Labview

Optimization and Simulation
CPLEX, Gurobi, LINGO, Excel Solver, Arena, Simio

MS Applications
Word, Excel, PowerPoint, Visio, Access, Outlook, Project

Other Technical and Mathematical Applications
MathCAD, Mathematica, Expert Fit, Minitab, LaTeX, PathPlanner Airside +, Synchro, AutoCAD, AutoCAD Civil 3D, SAFE, ETABS

Language Skills

Arabic: Native language.

English: Bilingual proficiency. Certified by *IELTS*. Score 7/10.

French: Bilingual proficiency. Certified by Diplome d'Etude en Langue Francaise (DELF) - Level: B2.