IT 700: Doctoral Seminar I: Intro to Research

Proposed Draft (Ver. 0.9)

When: TBD
Where: In-Person
Instructor: Dr. Myeong Lee (mlee89@gmu.edu)
Instructor Office hours: By appointment
TA: TBD
TA Office hours: TBD
Prerequisites: None

Course Description: Provides orientations on doctoral research to early-stage PhD IT students. The course discusses research methodologies used in the broader field of IT, academic life, and key research topics in IT through lectures, class activates, and seminars. Through the course, students will orient themselves in the IT field by learning research processes, diverse approaches, and computational thinking.

Goal: This course aims to provide orientations for early-stage doctoral students who start their research in the PhD in Information Technology program. Specifically, this course provides discussions about (1) being academics and research processes, (2) general research methodologies, and (3) major research areas in the program. Students are expected to actively participate in the discussions, seminars, and projects while exploring different topics, research methods, and goals of research conducted in the program. Ultimately, the goal of the course is to prepare early-stage doctoral students with a good understanding of academic processes, methodological approaches, and research streams, so to start thinking about their dissertation research plans.

Course Structure: This course is a combination of lectures, student discussions, and participatory activities. Students are expected to participate in class discussions and activities proactively.

Midterm: Written exams about course materials
Final exam: Group project and presentation
Course requirements and evaluations:

- Class attendance and participation (10%)
- Homework assignments (40%)
- Midterm (20%)
- Final Project (30%)

Assignments

1. Data collection and descriptive analysis
2. Performance evaluation of algorithms
3. Article review (peer review)

Recommended course books and resources:

- O'Meara, K., Terosky, A. L., and Neumann, A. (2008). Faculty Careers and Work Lives: A Professional Growth Perspective. *ASHE Higher Education Report, Special Issue*.
- Glass, R. L., Ramesh, V., & Vessey, I. (2004). An analysis of research in computing disciplines. *Communications of the ACM, 47*(6), 89-94.
- Oates, B. J., Griffiths, M., & McLean, R. (2022). *Researching information systems and computing*. Sage.
- Course materials include research papers and web resources in each session.

Final Project

Final project will be to develop a research proposal that consists of (1) a written proposal and (2) oral presentation of the proposal. They need to include:

a. **Introduction**: student needs to motivate the research well by articulating the scientific, methodological, or practical gaps/challenges.
b. **Literature Review**: student needs to synthesize the prior research in the way that surface the research gaps in the literature. It should not be a simple summary of papers. If the proposed research is empirical, developing hypotheses through the literature review will be encouraged.
c. **Methodology**: student needs to provide thorough methodological plans on how to collect, clean, and analyze the data to answer their research questions. Also, they need to provide justifications on why the proposed data and methods will be effective in answering the questions.
d. **Expected Outcomes**: If everything goes well as expected, what are the expected outcomes, and what are the implications of them? Provide any scientific, theoretical, or empirical implications that could be derived from the expected outcomes.
e. **Research Plan**: Provide logistical plans about how to conduct the study. This includes the presentation of timelines and milestones.

Students will use this proposal as a basis to find a faculty mentor for IT 701 (Doctoral Seminar II: Research Experience) and conduct the actual research throughout the semester.

Weekly Schedule (Course Structure)

Session	Course Materials and Resources

Week 1: How does the IT field looks?	**Main Topics:**
	• Student introduction
	• Program introduction
	  ○ "The PhD degree is research degree."
	  ○ General Requirements for Doctoral Dissertations
	  ○ Working with dissertation advisor
	• Reviewing course logistics
	• Project team formation
	• Introduction to the fields of Information Technology, Information Systems, and Computing (research climate in PhD in IT)
	• Tech: Git Tutorial: https://github.com/myeong/git-practice
	Reading List:

	• Glass, R. L., Ramesh, V., & Vessey, I. (2004). An analysis of research in computing disciplines. *Communications of the ACM, 47*(6), 89-94. • Oates et al., Ch. 1 **Class Activity:** • Mapping IT research using sticky notes (group activities) • Discussing the clusters of IT research • Tech: Github setup
Week 2: Foundations of Research in IT and Computing	**Main Topics:** • What is research? • Research process • Research ethics • Epistemology • Types of research (computing, empirical, theoretical, engineering) • What makes strong research questions and how to identify research problems? • Literature review: how to read a research paper? **Reading List:** • Oates et al., Ch. 2, 3, 6 • Crotty Ch. 1: Introduction: The research process (PDF to be provided) • Background/Literature review: Cronin, P., Ryan, F., & Coughlan, M. (2008). Undertaking a literature review: a step-by-step approach. British journal of nursing (Mark Allen Publishing) (17), 38-43. Link **Class Activity:** • Discussion on "contribution to academia": what aspects of research makes contributions to disciplines? • Exercises to conduct literature review (library resources, Google Scholar, etc.)
Week 3: Research Design, Hypothesis Development, and Statistical methods.	**Main Topics:** • How to develop hypothesis from research questions? • How to design a research study? • Statistical methods: an overview. • How to test hypotheses using statistical methods? **Reading List:** • Oates, Ch. 17. • McCombes (2021). What Is a Research Design | Types, Guide & Examples. https://www.scribbr.com/methodology/research-design/ • Ch. 2.4 Developing a Hypothesis by Paul C. Price, Rajiv Jhangiani, I-Chant A. Chiang, Dana C. Leighton, & Carrie Cuttler https://opentext.wsu.edu/carriecuttler/chapter/developing-a-hypothesis/

	• Nusser, S. M. (2023). The Role of Statistics in Promoting Data Reusability and Research Transparency. *Annual Review of Statistics and Its Application*, 10. Supplimental Reading: • Erceg-Hurn, D. M., & Mirosevich, V. M. (2008). Modern robust statistical methods: an easy way to maximize the accuracy and power of your research. *American Psychologist*, *63*(7), 591. **Class Activity:** • Hypothesis testing using simple datasets and theories using R. • Sticky-note exercises to connect between hypothesis and research designs.
Week 4: Performance Evaluation and Experiments	**Main Topics:** • Experimental design in computational research • Why we use experimental design in IT and computing research? • Scaling up experiments in computing. • Performance evaluation of computational models and algorithms. • System experiments (analytical modeling, simulation, etc.) **Reading List:** • Oates et al., Ch 9, • Bail, C. A., et al. (2018). Exposure to opposing views on social media can increase political polarization. *PNAS*, *115*(37), 9216-9221. (available from the course contents) • Czekster, R.M. and Webber, T., 2019. Introduction to Performance Evaluation of Systems. • Flach, P. (2019, July). Performance evaluation in machine learning: the good, the bad, the ugly, and the way forward. In *Proceedings of the AAAI conference on artificial intelligence* (Vol. 33, No. 01, pp. 9808-9814). **Supplemental Resources:** • Experimental Research & Usability evaluation methods: Different methods for evaluating Usability **Class Activity:** • Experimental data analysis using ANOVA. • Performance evaluation in Python. • Sticky-note exercises to brainstorm experimental methods to answer students' research questions.
Week 5: Data Collection, Cleaning, and Computational Thinking	**Main Topics:** • The history of data curation practices. • Survey-based data collection. • Sampling • Meta-data and secondary data collection. • Social media data collection. • Computational thinking

	Reading List: • Oates et al., Ch. 7, Ch. 15 • Wing, J. M. (2006). Computational thinking. *Communications of the ACM, 49*(3), 33-35. • Lomborg, S., & Bechmann, A. (2014). Using APIs for data collection on social media. *The Information Society, 30*(4), 256-265. • Lazer, D., Pentland, A., Adamic, L., Aral, S., Barabási, A. L., Brewer, D., ... & Van Alstyne, M. (2009). *Computational social science. Science, 323*(5915), 721-723. **Supplemental Resources:** • IT Library Research guide: https://infoguides.gmu.edu/IST • Google Forms Full Tutorial From Start To Finish - How To Use Google Forms • TED Talk: The voices of Twitter users - Evan Williams • Likert scale options for surveys **Class Activity:** • Survey protocol design exercise: measurement. • Social media data collection using APIs. • Basic descriptive analysis of the collected data using Python. • Sticky notes exercise to apply computational thinking in students' research areas.
Week 6 Qualitative Methods	**Main Topics:** • Qualitative research methods: interviews, focus group, observations. • Qualitative approaches in computing research and HCI • Qualitative content analysis **Reading List:** • Oates, Ch. 12.,13,14 • Cranshaw, J., Schwarsz, R., Hong, J., & Sadeh, N. (2012, May). The Livehoods project: Utilizing social media to understand the dynamics of a city. In *Sixth International AAAI Conference on Weblogs and Social Media*. Link • Mayring (2000). Qualitative Content Analysis. *Forum: Qualitative Social Research* (available from the course contents) **Class Activity:** • Qualitative content analysis exercise + discussion. Sticky notes exercise to brainstorm how qualitative approach could be used in students' research areas.
Week 7 Mid-term Exam	Quiz-based exam that asks basic knowledge about what we covered from Week 1 through Week 6.
Week 8: Research Presentation and Visualization	**Main Topics:** • How to structure a dissertation by combining multiple research studies?

	• How to present the research results (writings, visualizations, storytelling, presentations) and how to write a paper? • Data Visualization as an effective way to present research work. **Reading List:** • Oates, Ch. 21 • Writing Research Papers: Read the subsections of this page. • Chen, C. H., Härdle, W., Unwin, A., & Friendly, M. (2008). A brief history of data visualization. *Handbook of data visualization*, 15-56. **Class Activity:** • Sticky note exercise to brainstorm effective visualization methods for different kinds of data analytics. • Abstract writing exercise that conveys a research idea effectively.
Week 9 Reviewing and Critical Reading of Academic Articles	**Main Topics:** • What does it mean by "reviewing article", and why is it important? • How to read critically? • The role of peer review in scientific processes. • Structure of a good review. • Different forms for peer reviews by disciplines. **Reading List:** • Lee, 1995. "Reviewing a manuscript for publication," *Journal of Operations Management*, 13 • Daft, R. "Why I recommend that your manuscript be rejected and what you can do about it," in Cummings and Frost (eds) *Publishing in the Organizational Sciences*, pp. 210-219. • Ragone, A., Mirylenka, K., Casati, F., & Marchese, M. (2013). On peer review in computer science: Analysis of its effectiveness and suggestions for improvement. *Scientometrics, 97*, 317-356. • Watling, C., Ginsburg, S., & Lingard, L. (2021). Don't be reviewer 2! Reflections on writing effective peer review comments. *Perspectives on Medical Education, 10*(5), 299-303. **Class Activity:** • Reviewing short article based on a reading. • Sharing of review points using sticky notes → group discussion.
Week 10 Major Focused Research Area Seminar I: Data Science, AI, and Machine Learning	**Main Topics:** • Focus area: Data Science, AI, and Machine Learning • 1-hour lecture by the invited speaker(s) about (1) the introduction of the focus research area and (2) an example study. • Student discussions about the research and applications + Q&A. • Moderated by the instructor with any discussion protocols and questions while having the speaker as the panel. **Reading List:** • TBD: To be recommended by the invited speaker.

Week 11 Major Focused Research Area Seminar II: Human-Centered Computing	**Main Topics:** • Focus area: Human-Centered Computing • 1-hour lecture by the invited speaker(s) about (1) the introduction of the focus research area and (2) an example study. • Student discussions about the research and applications + Q&A. • Moderated by the instructor with any discussion protocols and questions while having the speaker as the panel. **Reading List:** • TBD: To be recommended by the invited speaker.
Week 12 Major Focused Research Area Seminar III: Information and Cyber Security	**Main Topics:** • Focus area: Information and Cyber Security • 1-hour lecture by the invited speaker(s) about (1) the introduction of the focus research area and (2) an example study. • Student discussions about the research and applications + Q&A. • Moderated by the instructor with any discussion protocols and questions while having the speaker as the panel. **Reading List:** • TBD: To be recommended by the invited speaker.
Week 13 Major Focused Research Area Seminar IV: Software and Mechanical Engineering	**Main Topics:** • Focus area: Software and Mechanical Engineering • 1-hour lecture by the invited speaker(s) about (1) the introduction of the focus research area and (2) an example study. • Student discussions about the research and applications + Q&A. • Moderated by the instructor with any discussion protocols and questions while having the speaker as the panel. **Reading List:** • TBD: To be recommended by the invited speaker.
Week 13: Academic Life and Research Jobs	**Main Topics:** • What does it mean to be "tenured"? • How does faculty life look?: Composition of faculty work • Framework for Faculty Growth (what is "growth" in academia?) • Faculty appointment and promotions • Research positions in industry and research labs. • Research positions in governments and public-sector orgs. **Reading List:** • O'Meara et al., pp. 1-72: about faculty work. • Clawson, D. (2009). Tenure and the future of the university. *Science, Vol. 324*, 1147-1148. • Dorn, Mary Frances, O'Malley, Daniel, Nagarajan, Harsha, Ray, Navamita, & Sornborger, Andrew Tyler. *Early Career Paths at Los Alamos National Laboratory*. United States. https://doi.org/10.1090/noti2065

	• What is life like for PhDs in computer science who go into industry? https://blog.vivekhaldar.com/post/29296581613/what-is-life-like-for-phds-in-computer-science-who **Class Activity:** • Sharing of student's future career and their motivation. • Sticky notes activities to group future career and ideal path. Sticky note activities to discuss students' values on work and life.
Week 15 Final Presentation	**Main Topics:** • Final-term presentation on completed research or a comprehensive research proposal (20 minutes per team + 10 minutes Q&A). • Final research report needs to be submitted separately. **Evaluation Criteria:** • Did the presentation provide a good justification for "what the research topic is and why it is important"? (20%) • Did the presentation provide a good synthesis of the literature, beyond a simple summary of them and derived a good/hard question out of it? (20%) • Did the study provide reasonable data analyses that are effective in answering the research questions? (20%) • Were the data analysis results well discussed in the way that provide implications for other researchers in the field as well as practitioners? (20%) • Was the presentation overall well organized and provide reasonable explanations on the limitations and future work? (20%)

Honor Code

All work performed in this course will be subject to GMU's Honor Code. Students are expected to do their own work in the course unless a group project is approved by the instructor. In papers and project reports, students are expected to write in their own words, rather than cutting-and-pasting from sources found on the Internet. The goal of assignments is to demonstrate what you have learned, not what you can google. When you do use text or graphical material from books, articles, and the Web, enclose the material in quotes and provide a complete and proper reference (in APA format). If a paragraph is used then it should be indented in the text (both left and right margins). In-text citation can use the [Author, Year] format or the Numerical [1] format which must refer to the source in the References section of your assignment. Use APA for guidance on citation style, usage, etc. (Don't buy the big CMS. See the smaller A Manual for Writers by Kate Turabian). Regardless of the citation method used, proper citations always include: Author(s), Title, Publication Date, Publisher, and URL (if from the Web, along with Last Accessed Date). BlackBoard's SafeAssign service will be used to review selected student assignments. The followings are additional honor code items:

- Wikipedia is **not** a primary reference. Use it for initial discovery, but use and cite primary references (which Wikipedia itself might use).

- If you need assistance with writing an assignment, you can get assistance here: http://writingcenter.gmu.edu
- Refer the Graduate Policies for general policies about courses and degrees: https://catalog.gmu.edu/policies/academic/graduate-policies/
- Any programming/coding assignments must adhere to the CS Honor Code.

Notes

- The course will be structured based on the assumption that you have read papers.
- Lecture slides from instructor's material will be posted on Blackboard.
- E-mail the instructor if you anticipate being unable to meet any course requirements in a timely manner.
- Personal Safety and Security: The Mason Alert system provides emergency information of various sorts. Students can sign up for it by visiting the website https://alert.gmu.edu. Students are also reminded that an emergency poster exists in each classroom explaining what to do in the event of crises and that further information about emergency procedures exists on https://ready.gmu.edu/be-prepared/
- Computer and IT Security: Visit GMU's IT http://itsecurity.gmu.edu/ web site regularly. Norton AntiVirus Software is free to download for all GMU students/faculty/staff.

Important Dates

Dates for adding, dropping the course, etc. are available via: https://registrar.gmu.edu

Religious Holidays

A list of religious holidays is available on the GMU's Religious Holiday Calendar. GMU respects any religious holidays. However, any student whose religious observance conflicts with a scheduled course activity must contact the Instructor at least 2 modules in advance of the conflict date in order to make alternative arrangements.

Attendance Policy

Scheduled course sessions will be spent on clarification, amplification, and review of material through the use of slides, examples, and exercises. Lecture slides are complements to the lecture session, not substitutes for it. Each course session is an excellent time for you to raise questions, request additional examples, and get explanations of any ideas that are still unclear to you. As members of the academic community, all students are expected to contribute regardless of their proficiency with the subject matter. Students are expected to make prior arrangements with Instructor if they know in advance that they will miss any class and to consult with the Instructor as soon as possible if they miss any class without prior notice. Any student who expects to miss more than one class session is advised to drop the course and take it in a later semester when he/she can attend every class.

Privacy

The Instructor will not discuss issues relating to an individual student with anyone lacking a need to know without prior written permission of the student. This includes a student's family members and other students. Under no circumstances will a student's graded work be returned to another student. Instructors, staff, and Teaching Assistants will take care to protect the privacy of each student's scores and grades.

Disability Accommodations

The Office of Disability Services (ODS) works with students with disabilities to arrange for appropriate accommodations to ensure equal access to university services. Any student with a disability of any kind is strongly encouraged to register with ODS as soon as possible and take advantage of the services offered. Phone: 703-993-2474, Web: http://es.gmu.eeu.

Writing Center

A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.eeu

Counseling and Psychological Services (CAPS)

(703) 993-2380 http://caps.gmu.eeu