SFWE 513: Research Methods
COURSE SYLLABUS

Course Description

This course provides a basic introduction to the principles, methods, and techniques of engineering research. Topics include the fundamentals of the scientific method and scientific inquiry, ethical considerations in research, basic methods of quantitative and qualitative data collection, and strengths and weaknesses of various data collection methods. The course is designed to make you a more informed consumer of scientific research through discussion, analysis, and hands-on practice.

Course Prerequisites

None

Instructor and Contact Information

Instructor Name: Tomas Cerny
Email: tcerny@gmail.com
Office: Old Engineering Blg 122
Office Hours: TBD

Appointments can be made outside of normal office hours by contacting the instructor(s) to schedule a time that is mutually convenient.

Course Objectives

By the completion of this course, you will be able to:
- Use Scrum Methodology
- Apply ethical guidelines to research proposals to identify potential risks such as harm to participants, lack of informed consent, and voluntary participation concerns
- Perform systematic literature reviews
- Draft a research paper and develop a research plan
- Prepare Threats to Validity Sections
- Prepare a specific survey measure
- Use empirical research methods, i.e. controlled experiment
  - Empirical Research Methods in Software Engineering
    - https://link.springer.com/chapter/10.1007/978-3-540-45143-3_2
  - Selecting Empirical Methods for Software Engineering Research

- http://www.robertfeldt.net/advice/easterbrook_2007_selecting_empirical_research_method_for_se.pdf
- Use statistical methods
- Prepare research presentation

Expected Learning Outcomes

Upon completion of this course, you should be able to:
1) Prepare a competitive research paper
2) Properly present your research
3) Properly analyze state of the art for a selected problem area
4) Draft limitations and threats to validity

https://www.uttyler.edu/socialsciences/files/_s20-syllabi/crij4322-s20.pdf

Textbooks & Software

Required Textbooks (2)

Research Design Qualitative, Quantitative, and Mixed Methods Approaches 6th Edition John W. Creswell, J. David Creswell, ISBN: 9781071817940

Research Methods for Engineers 1st Edition, by David V. Thiel, ISBN-13 978-1107610194

Modules

Module 1 – Team organization

This module introduces Scrum Methodology to apply in team research.

Module 2 – Systematic literature review
We will follow best practices developed for Software Engineering by Kitchenham. We will also perform such a study and intend to submit it for review.

Module 4 – Ethical Research Conduct

This module walks through Responsible Conduct of Research (RCR) and Social & Behavioral Research typically required by the institutional review board (IRB), we will earn a certificate to participate in human subject studies IRB.

Module 4 – Research methods
We will talk about research methods. These may include surveys and Questionnaires, Case Studies, Controlled experiments, Cross-Validation and Replication, Simulation and Modeling, Action Research, and Content Analysis. Apart from this, we look at Statistical analysis that aims to prove our observations and conclusions are 'beyond reasonable doubt.'

Module 5 – Publication essentials
This module will outline drafting a publication and its important parts, along with a research presentation.

Required Software

You will either need to install or create an account for the following software – links and instructions are available in the ***Start Here*** module of the D2L course site.
- **Overleaf –** Latex online.
- **Excel** – Microsoft Suite

Assignments and Examinations

Homework
There will be regular homework assignments on the topics covered in class, to be completed individually (or on a team basis when instructed). There will also be module-based discussion board prompts that each student is required to participate in and will be graded for.

Knowledge Checks
There might be online quizzes, and knowledge check questions with the completion of each module.   Knowledge checks are an individual assessment of your understanding of the concepts and knowledge covered in a given module.

Midterms/Exam

There will be two midterms/exams. All will be comprehensive and timed, administered by a proctor in the classroom or online (for online students), and will be available during the class or regularly scheduled exam time. Online students will be provided with information on how to access the exam on the specified date in the course calendar. ***Note: The instructor will give students ample notice of the format, time, and any resulting stipulations about where and how the exam will be administered.***

Semester Project

Team Component - The semester project is a team-based project. Teams will be formed consisting of 4-5 students. Each team will be given a high-level software engineering topic to perform a systematic literature review and prepare a publication and presentation on the topic. Each team member will be on Trello.

Individual Components - In addition to the team portions of the project, you will be required to write a 2-page individual reflection of your experience working on the team, developing particular sections of researched questions and reviewing parts added by others.

Team Participation (part of the Individual Components) - Over the course of working on the semester team project, you will be required to individually submit 3 team evaluations for all deliverables for the semester project. Every team member is expected to contribute equally to the project (measured by version control or assigned sections). If there are team dynamics that are preventing a collaborative working environment, it is best to inform the instructor ahead of time so that adjustments can be made to facilitate effective teaming and communication amongst the team.

Your individual final team project grade will be factored by the average score of all team members' inputs from these evaluations and the measurable individual contributions to the project. Failure to submit a team/individual evaluation will result in the loss of 10 points from your personal team semester project score.

Grade Distribution, Scale & Policies

The grading distribution for course assignments is as follows:

Assignments:	20%
Knowledge Checks/Quizzes:	5%
Midterm I:	20%
Exam:	25%
Semester Project (see total grade distribution below):	30%

1. Systematic literature review.
2. Publication draft
3. Ready publication

Total	**100%**

Late Work Policy

Homework/ Knowledge Checks/ Projects: All homework, knowledge checks, and elements of the semester project are due at the time that is specified in the course schedule and/or D2L content pages. *Late homework and projects <u>will not</u> be accepted without prior approval by the instructor and will receive 0 points.*

Exams: If a student misses a midterm/exam, the score will be calculated as an average from the other two midterms/exam. Students cannot miss more than one midterm to earn a passing grade. Please note that students must contact the instructor well in advance and provide *written* documentation for the reason that he/she will not be able to attend the regularly scheduled exam. It is up to the discretion of the instructor to accept the justification provided by the student.

Code of Academic Integrity and Honor Code

Any violation of academic integrity will result in an F in the course; students are advised to self-assess them at https://deanofstudents.arizona.edu/policies/code-academic-integrity
Plagiarism or any form of cheating involves a breach of student-teacher trust. This means that any work submitted under your name is expected to be your own, neither composed by anyone else as a whole or in part nor handed over to another person for complete or partial revision. Be sure to document all ideas that are not your own. Instances of plagiarism or any other act of academic dishonesty will be reported to the Honor Council and may result in failure of the course. Not understanding plagiarism is not an excuse. I expect you, as a Baylor student, to be intimately familiar with the Honor Code at
https://law.arizona.edu/sites/default/files/Honor_Code_2015.pdf
Few examples (read well):
- Using a source fragment other than the course textbook, the course website, or your professor to obtain credit for an assignment, project, or exam.
- Copying another student's work. Simply looking over someone else's source code is copying.
- Providing your work for another student to copy.
- Collaboration on any assignment, unless the work is explicitly given as collaborative work. Any discussion of an assignment or project is considered collaboration.
- Using notes or books during an exam.
- Giving another student answers during an exam.
- Reviewing a stolen copy of an exam.
- Plagiarism.
- Studying tests or using assignments from previous semesters, except when provided by the professor.

- Providing someone with tests or assignments from previous semesters.
- Taking an exam for someone else.
- Turning in someone else's work as your own work.
- Studying a copy of an exam prior to taking a make-up exam.
- Providing a copy of an exam to someone who is going to take a make-up exam.
- Giving test questions to students in another class.
- Reviewing previous copies of the instructor's tests without permission from the instructor.

Instructor Grading & Student Appeals Policy

The instructor will make every attempt to provide timely feedback on all assignments, knowledge checks, exams, and projects.

You can dispute any grade that you receive within three days days from the time the grade was awarded.

If you feel that you have received an unfair assessment of your performance on any given homework assignment, knowledge check, exam, or final project, please reach out to the course instructor either in person, via email, or over Zoom as soon as possible. Be prepared to provide substantiated claims for your dispute, including any evidence that would support a re-evaluation of your grade.

Grading Scale
The following scale will be used to award final grades for undergraduate students.

A	90-100%
B	80-89%
C	70-79%
D	60-69%
E	less than 60%

The following scale will be used to award final grades for graduate students.

A	92-100%
B	84-91%
C	76-83%
D	68-75%
E	less than 68%

Incomplete (I) or Withdrawal (W):
Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-

system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Course Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

University Policies

Links to the following UA policies are available at, https://academicaffairs.arizona.edu/syllabus-policies:
- Absence and Class Participation Policies
- Threatening Behavior Policy
- Accessibility and Accommodations Policy
- Code of Academic Integrity
- Nondiscrimination and Anti-Harassment Policy
- Subject to Change Statement