Elective-2: Software Testing and Analysis

Course Logistics

(subject to change with notice)

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Administrative Information

- Instructor: Dr. Sobeih
  - **E-mail:** dr_sobeih@yahoo.com
  - Office: 3716 Computer Engineering Department
    Architecture Bldg., 7th Floor
  - Office hours: *by appointment only*; please let me know in advance to set up a date and time

- TA-1: will be announced in class
- TA-2: will be announced in class
  - Office: The TAs office, Computer Engineering Department

- Newsgroup: swtest@yahoogroups.com
- **URL:** https://groups.yahoo.com/group/swtest
  - If your membership request was not approved in 72 hours, send an e-mail to the TAs, and they will send you an invitation to join.

Course Prerequisites

- I assume that you already know:
  - Java and C/C++
    - <u>Note:</u> The examples and the exercises in the textbook are all in Java. Make sure you're comfortable with them!
    - Based on previous instances of this course, the programming language has (almost) never been the problem
  - Data structures and algorithms
  - Object-oriented programming
  - Software engineering
  - Basic discrete math and graph theory

- I also assume that you can follow simple instructions ...

Course Intended Learning Objectives (ILOs)

a) Knowledge and Understanding

a1) State essential facts, concepts and principles related to software testing and its limitations.

a2) Explain quality assurance methodologies used in applying software testing techniques at different levels: unit, module, integration and system testing.

a3) Identify concepts and theories of the different modeling techniques for the software under test (SUT).

b) Intellectual Skills

b1) Select and apply appropriate methods for modeling and analyzing the software under test (SUT).

b2) Design, execute and evaluate test sets satisfying certain coverage criteria on a given SUT.

b3) Measure the coverage levels achieved and analyze the different limitations for coverage criteria.

Course Intended Learning Objectives (ILOs)

c) Professional and Practical Skills

   c1) Use appropriate software testing and analysis tools (e.g. JUnit/NUnit, GUI testing or Web testing) that are used to solve software engineering problems in industry and academia.
   c2) Develop software with higher quality faster for the future employer.
   c3) Prepare and present technical materials in a way that demonstrates project management and problem solving skills.

d) General and Transferable Skills

   d1) Work in a stressful environment and within constraints.
   d2) Communicate effectively as a member of a team.
   d3) Manage tasks and resources efficiently.

Required Textbook

- "Introduction to Software Testing" by Paul Ammann and Jeff Offutt, Cambridge University Press, 2008,
    - ISBN-13: 978-0521880381
    - URL: http://cs.gmu.edu/~offutt/softwaretest/
    - on reserve in the CUFE library; its code is **MIC38**
    - Student solution manual and support software are also available on the textbook website
    - Authors' slides are available online at:
    http://cs.gmu.edu/~offutt/softwaretest/powerpoint/
    - Errata list is also important
    - Resources keep being updated; so make sure you check out the latest update (especially before taking an exam)

- Note: My slides will not be available. You do not need them!

Self-Learning Policy

- My courses usually contain a (small?) part of self-learning

- I will give you some reading assignments from the textbook …
    - You must have access to the textbook
    - **We may ask you to bring your textbook to class**

- I may also give you reading assignments to look them up on the Internet …

- All reading assignments are included in the course
    - i.e. may be on the exams!

Tentative Schedule (subject to change)

Week	Topic
1 – 2	Introduction
3 – 4	Graph Coverage: Control Flow
5	Graph Coverage: Data Flow
6	Graph Coverage for Design Elements
	Graph Coverage for Use Cases
7	Regression testing and test oracles
TBD	Mid-Term Exam (exact date will be fixed later)
9 – 10	Input Space Partitioning
11	Course Wrap-up and JUnit Demo
TBD	Project Demo and Discussion (Final Report Due)
13 – 14	Make-up; Revision; Discussion Sessions

- We will cover most of Ch. 1, 2, 4 and Section 6.5 of the textbook
- The exact dates of the mid-term exam and the project demo and discussion will be determined soon …

Discussion Sections

• Before each discussion section, we will let you know what you will do in the section ("Problem Set 0" and "Problem Set 1" are already on the newsgroup in the "Files" area.)

• Students should come to the discussion section after having already thought about the solutions to the problems; otherwise you will not gain much from the section.

   • **Always bring your problem sets to the section**

• Each section is 90 minutes long. If you finish early, the TAs will stay in class (or in office) during the remaining time to see if any students have any questions about the course

• Make use of any available time to discuss the course material and/or your projects with the TAs

Assessment

- **15% Mid-term exam** Date: TBD
- **15% Project**
- **70% Final exam** Date: TBD

Note: All exams are cumulative (i.e. cover all of the material until the moment of the exam), closed-book, closed-notes, and open-mind

Bonus: I may give you a merit-based bonus (depending on your performance). The TAs <u>cannot</u> give a bonus!

However, I may ask the TAs about which student(s) they want to give a bonus, and why. I reserve the right to decline.

Grading

- College grading policy for undergraduate students
    - Excellent (85%)
    - Very good (75%)
    - Good (65%)
    - Pass (50%)
    - Fail (< 50%)

- I cannot change the cutoff points …

Grading Policy

- Grading the mid-term and final exams is "absolute"
    - if you get the right answer, you get the score
- Grading the project and its deliverables is "relative"
    - you are evaluated compared to your peers
    - the highest possible grade is "A"
    - the lowest possible grade is "Z" (i.e. zero), if you did not submit or in the case of violating the academic integrity
- Members of the same group may get different grades, depending on the quantity and quality of the work each member did. (we do not like doing that, but sometimes we have to.)
- If a team member is not participating adequately in the group work, he/she may be asked to leave the team and either work alone or join a team specifically made out of the non-participating members in all other teams

Project

- Goal and Scope:
    - (Tools) Choose a software testing and/or analysis tool that is used in industry and/or academia
    - The major goal is to learn how to use this tool to **solve problems** related to software testing and/or analysis
    - You will have to write a report and make a presentation and demo on your project

- You are allowed to choose <u>any</u> *legally-obtained* tools from the Internet, but you are <u>not</u> allowed to choose JUnit
    - TA-2 will double-check that, but it is your responsibility to choose another tool

- Every other week, the TAs will answer any questions you may have about your projects

Project Schedule and Deliverables

Due Dates	Deliverables
3rd Week at 8:30 PM	**Group formation:** submit by e-mail; no hardcopy needed
5th Week at 8:30 AM	**Project proposal:** softcopy and hardcopy
December [TBD] at 8:30 PM	**Final Submissions:** Report (softcopy); presentation and demo (softcopy)
December [TBD] at 8:30 AM	**Final Submissions:** Report (hardcopy) and CD

1) The report must teach how to use the tool, using examples and following a **problem-solving** approach. Please do not include too many screenshots!
2) The presentation and demo must include examples and case studies
3) The CD must contain <u>EVERYTHING</u>: report, presentation, demo, examples, case studies, code, test scripts, etc.

"Group Formation" Checklist

Submit the same e-mail to the TAs and to me:
a plain <u>text</u> e-mail, no attachments, indicating the following information for each group member:
a) Full name (in both English and Arabic, as it appears on the class list), section number and bench number
b) E-mail address

TA-2 will:
- check that each team is 3 – 5 students. **(We recommend 4)**
- assign each group a unique name (in English) from the month or day names; e.g. January, February, March, …, Sunday, Monday, Tuesday, …
  (No two groups will have the same name)

<u>**Within one week:**</u> **TA-2 will upload a file indicating the group name of each student.**

"Project Proposal" Checklist

Includes the following (≤ 4 pages excluding appendices):
1) Which tool you have chosen. Did you make sure that the tool runs?
2) A brief description of the tool, its usage, etc.
3) A work plan for the rest of the semester
4) References (and appendices if any) **We may or may not read the appendices, so do NOT print them!**

Submit the same e-mail to the TAs and to me: SOFTCOPY ATTACHMENT as ONE <u>PDF</u> ONLY
i.e. only one e-mail having only one PDF attachment submitted to all of the class personnel: Dr. and TAs

Submit the HARDCOPY of the proposal to TA-2.

TA-2 will check that no two groups have the same project:
- Proposals will be approved in a FCFS basis

<u>**Within one week:**</u> **TA-2 will provide you with feedback**

The "Final Submissions" Checklist

Submit the same e-mail to the TAs and to me: 3 attachments

- Report **(≤ 10 pages excluding appendices)**: SOFTCOPY ATTACHMENT
  as ONE <u>PDF</u> ONLY
  - **We may or may not read the appendices, so do NOT print them!**
  - In your report, please describe the contents of the CD very clearly; e.g.:
    - test scripts are in a folder called "Scripts\Test"
- Presentation and Demo: SOFTCOPY ATTACHMENT as ONE
  <u>POWERPOINT</u> and ONE <u>PDF</u>

We will let you know to whom you should submit:
- Report HARDCOPY.
- CD (remember: CD must include EVERYTHING). Write the semester, the course code and title, and your group name on the CD itself.

TA-2 (and/or TA-1) will grade your projects, and will post the term work score of each student <u>one week</u> before the final exam

Important Note

The very last page of your report must indicate what each team member did:

- Be very clear and specific
- Put in a table

Team Member	Activities
Name and e-mail address	An **itemized** list of activities 1. …… 2. …… 3. ……

- Provide hyperlinks to previous sections
- Do **NOT** include "writing the report" or "documentation" in the list of activities!

Project Demo and Discussion

- TA-2 will send you the schedule …
    - Each group will make a project demo and discussions (10-15 minutes) with TA-2 (and/or TA-1)
    - Each group member will have to present his/her own work
    - You need to tell us what's so strong about your project work. Essentially, why do you think we should give you an "A"?
    - Bring a laptop because we will ask you to make a demo
    - If you don't have a laptop, borrow one from your colleagues or we can meet at the computer lab (subject to availability)

- **<u>Meanwhile</u>**, other groups will be presenting their project work in class or in the computer lab (again, subject to availability) to other students

- Checklist for each student during that day:
    - 1) participate in his/her group demo and discussions
    - 2) present his/her work to other students (think of it as an opportunity for you to learn from each other)

General Formatting Requirements

1) All hard-copy submissions should be double-sided (if possible)
2) Either staple your papers firmly or use a firm paper-size (spiral) binder. No removable paper clips or binder clips.
3) No need for a cover page; just include the semester, the course code and title, and your group name in the header
4) Must have project title, group members' names and e-mail addresses at the top center of the first page (as in research papers)
5) Page numbers in the footer please (just in case the staples fall out)
6) Make use of bookmarks, hyperlinks and cross-references. Yes, they should survive the Word to PDF conversion

<u>Note:</u> Never send us compressed, Word, Excel, or EXE files!

Submissions Policy

- Hardcopy (double-sided if possible)

- In any submission (or just any correspondence with us) via e-mail, your e-mail subject line must be:
    - [Elective-2] [Your group name] …..

- The file name of any softcopy must have your group name;
e.g. Elective-2-GroupXYZ-Report.pdf,
    Elective-2-GroupXYZ-Presentation.pdf

- Late submissions (after due date; e-mail softcopy and leave hardcopy at the mailbox ASAP):
    - Points will be taken off for late or incomplete submissions (e.g. softcopy, but no hardcopy)

- Your submission should be your own team work
    - Copying from other teams or from the Internet will simply get zero

Academic Integrity

• Simply stated, <u>any</u> work that has your name on it must be your individual and original work

    • Yes, this applies to <u>any</u> work, even a 1% assignment!

• Violations of academic integrity (e.g. cheating, plagiarism, etc.) are **not** tolerated, and will be penalized to the maximum extent possible as determined by the college/department policy

• If you violate the academic integrity, you will (at least):

    1) Get zero on whatever you violated the academic integrity!

    2) Not get any bonus in this course!

    I have the right, and the duty, to notify the administration

• Check the college/department policy for more details ...

Exams Policy

- Anything said/done in class is included in exams
- Bring your original, valid university card (or photo ID)
- Bring everything you may need; you will <u>not</u> borrow anything from your colleagues (imagine you're taking the exam alone!)
- No mobile phones, laptops or programmable calculators are allowed in exams
    - Only standard non-programmable calculators are allowed
- Follow any other rules announced in the exam room
- Continuing to talk during an exam, despite being warned, will be considered cheating

- If you cheat or make a disruptive behavior during an exam:
    - this behavior will be penalized to the maximum extent possible according to the college/department policy
    - I have the right, and the duty, to notify the administration

Make-up Exams Policy

• Make-up mid-term exams are offered only under truly exceptional circumstances that are <u>documented</u> and <u>verifiable</u>
  • Check the college/department policy for acceptable "excuses"
  • You have to bring an official document from the students affairs office. **<u>RESPECT ALL DEADLINES.</u>**
  • To ensure fairness: The make-up exam is also cumulative; i.e. may, and most likely will, cover more material than the original exam!

• If you miss the final exam, you have to check the college/department policy on what you can/have to do …

Regrade Policy

• Regrade requests and appeals must be computer-typed hardcopy (no oral, no handwritten, no softcopy, no e-mails), signed and dated
• Submit your regrade request to the TA within 1 week from the date you got your exam paper. No extensions!
• Suggested structure of the request: Please be very specific
   1) Course code and title, your name and e-mail address
   2) Question number: e.g., Mid-term exam, Question 1-a
   3) Specific request: e.g., Get two more points
   4) Rationale: why you think you deserve these two more points …
   5) Attach your exam paper
• Wait for the TA's response. If the TA's response does not satisfy you, you have the right to appeal to me within 10 days. Again, no extensions!
• You must give your appeal to me by hand; do not put it in my mailbox
• Suggested structure of the appeal: Please be very specific
   1-5) Five items above
   6) TA's response
   7) Your rebuttal to the TA's response
• I will respond to you as soon as I can. No promises.
• I trust the TA's judgment; you'd better have a very strong appeal
• I will actually "regrade" your exam paper; i.e. **yes, you may lose points!**

Your today's to-do list

1) Join the newsgroup; you are responsible for any announcements made, files uploaded, etc.

2) Go to the newsgroup website:
- Download **"Problem Set 0" and "Problem Set 1"**
- Download the "Course Logistics" slides from the "Files" area. Read them very carefully and prepare any questions you may have for next time …

3) Go the CUFE library for the textbook [MIC38]
- We will cover most of Chapters 1, 2, 4 and Section 6.5

4) Start working on your project: group formation, tool choice, …

5) Relax! I hope you'll enjoy the course ☺

How to join a Yahoo! group? (in case you don't already know!)

• Login to your Yahoo! account. (Create an account at www.yahoo.com if you don't have one already)
• Go to the newsgroup website (see the Administrative Information slide above)
• Click on the "Join This Group!" button
• Step 1) Fill in your contact information. *Write your full name (as it appears on the college roster) in the "Comment from user:"*
• Step 2) Message Delivery. Choose "Individual Email"
• Step 3) Message Preference. Choose "Fully Featured"
• After filling out everything, click on "Join"
• Wait for our confirmation.
• ***Check your spam/junk folder. Messages may go there!!***

Note: The TAs and I will only use this newsgroup for the e-mails and files sent to all students.

Notes to the TAs

- Include yourself in proctoring the mid-term exam.
    - Right after the mid-term exam, let me know the names of students who were absent on the exam, if any.
- Finish the sections promptly on time. Never go over time!

- Use the newsgroup to send announcements to students. Do not send them announcements on any other newsgroup or social networking website.
- Do not send files as attachments. Instead, upload them to the Files area of the newsgroup. Make sure that you notify all group members right after a file has been uploaded / updated.
- Never upload compressed, Word, PowerPoint or EXE files

Notes to the TAs

• For students' scores: <u>each</u> TA must maintain **_two identical_** files (Excel and PDF) on the newsgroup under "Files > Grades"

  • Use the official sheet with the students' full names **in Arabic**. You can get it from the secretary.
  • Project scores must be available on the newsgroup within 3 days
  • The scores of the mid-term exam must be available on the newsgroup within 7 days.
  • Do not leave the cell of any score empty. If the student were absent, put the number 0 instead.
  • In the header of each column, specify:
      • the type (e.g. "mid-term", "project")
      • the date. This helps us in dealing with students who were absent with excuses.
  • In the row of each student, indicate his/her project group name

Notes to the TAs

• Acknowledge the receipt of every e-mail that I send you.

• Send me your phone number. I will only call you for urgent issues.

• For the course file: Please include the following:
  • all files on the newsgroup
  • two hardcopy samples of students' work for each: mid-term exam, project deliverable (report and CD), etc.
  • Start working on the course file early. I will keep checking it regularly.
  • Course files are now made online. I will send you the URL.

Final Note

- Anything mentioned in these slides is subject to change with notice …