

Comprehensive Exam Fall 2012

Software Engineering

Friday 28 September 2012

Instructions

Your answers must be specific to the questions! A generic listing of ideas or criteria without application to the problem/question posed is insufficient to a Master's comprehensive and will not receive a passing mark.

When a question asks you to “describe”, “discuss”, or “explain” something, it means you must provide a convincing, clear, and reasonable answer; simply stating a fact without any supporting argument is insufficient.

Write the last four digits of your student identification number in the space below and at the top of each page.

Do 4 of the following 6 questions, including question 1 or 2. You may do both of 1 and 2. Each question has equal value.

No study aids (notes, books, etc.) are permitted during the exam

Good luck!

ID Number: _____

ID Number: _____

1. Construction/Maintenance:

Use any *high-level programming language* that you wish. Pseudo-code is acceptable, but will not receive full marks.

A “saddle point” is a value in a matrix which is greater than or equal to any in its row, and less than or equal to any in its column.

- a. Write a program to search for a saddle point in a 5 by 5 array of integers and print out its coordinates. Print out “No saddle points” if there are none.
- b. There may be more than one saddle point in the array. *Outline* the changes you would make to the program of part (a) in order to print out the coordinates of **all** saddle points in an **n** by **n** array of integers.

ID Number: _____

2. Testing/Maintenance:

A “saddle point” is a value in a matrix which is greater than or equal to any in its row, and less than or equal to any in its column.

a. A program claims to search for a saddle point in a 5 by 5 array of integers and print out its coordinates. The output is “No saddle points” if there are none.

You do not have access to the source code. Outline a comprehensive strategy for this program and justify your thinking. THAT IS: describe how you would test this program. Give specific examples of the tests you would use and explain why. Explain how you would decide that your set of tests was sufficient for this program.

b. There may be more than one saddle point in the array. The output is the coordinates of all saddle points in an n by n array of integers.

What changes must be made to the test strategy of part (a)?

The next four questions of are organized around the following requirement specification:

Researchers have developed *Range-finder* software that uses a smartphone's global positioning system (GPS) and imaging abilities to determine the exact location of distant objects as well as monitor the speed and direction of moving objects. The software could have a wide range of applications, including being used by soldiers on the battlefield to target the location of their enemies, golfers to judge the distance to the green, and biologists to document the location of a rare animal without disturbing it. The researchers developed *Range-finder* to locate and track targets of known size, targets of unknown size, and moving targets. For example, on the battlefield, a soldier needs a distance-finder, compass, GPS, and other tools to do reconnaissance before calling in an air strike. With *Range-finder*, the soldier can have all those instruments in one device that can be purchased off the shelf. Although *Range-finder* is currently limited by the smartphone's hardware, improvements in GPS accuracy, battery life, and camera resolution will enable it to make even more accurate observations.

ID Number: _____

3. Design. Consider the 4 following security areas:

- **Application security** encompasses measures taken throughout the application's life-cycle to prevent breaches.
- **Computer security** includes protection of information and property from theft, corruption, or natural disaster, while allowing the information and property to remain accessible and productive to its intended users.
- **Information / Data security** means protecting information and information systems from unauthorized access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction.
- **Network security** consists of the provisions and policies used to prevent and monitor unauthorized access, misuse, modification, or denial of the computer network and network-accessible resources.

From a **systems engineering perspective**, rank these criteria in order of importance to the *Range-finder* project. *Justify your ranking.* NOTE: a listing of the areas is insufficient; you must explain *why* each criteria is in the position you determine.

ID Number: _____

4. Management: Project Management includes the following areas:

1. Planning
2. Executing
3. Monitoring
4. Controlling

Using the *Range-finder* as an illustrative example, discuss 2 scenarios:

- a. The planning of phase 1 above contributes to the *success* phases 2 - 4.
- b. The planning of phase 1 above contributes to the *failure* phases 2 - 4.

ID Number: _____

5. Process: Select a process model for an implementation of the *Range-finder* system. Justify your choice in two ways: reasons for selecting the process model and reasons for not selecting one other process model.

ID Number: _____

6. Requirements. The specification of *Range-finder* confuses functional and non-functional requirements.

- a. Identify the functional and non-functional requirements.
- b. For one of the functional requirements and one of the non-functional requirements that you extract, write a specification using structured natural language or a design description language.