

# Mini-Exam for Senior Project

Spring 2009

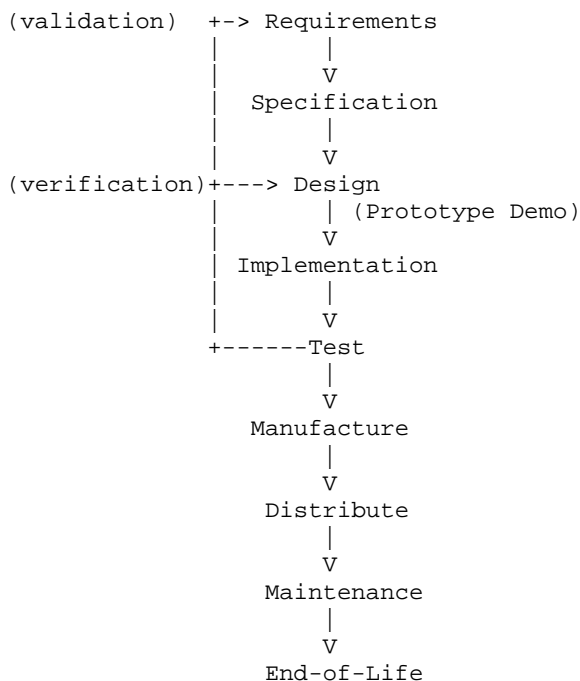
## >>> SOLUTIONS <<<

Welcome to the Mini Exam for *Senior Project*. Read each problem carefully. There are six required problems (each worth 16 points – you get 4 points for following these instructions correctly). There is also an additional extra credit question worth 10 points. You may have with you for reference a legally acquired copy of Brooks' *Mythical Man Month* (that is, our course textbook) and one 8.5 x 11 inch "formula sheet". On this formula sheet you may have anything you want (definitions, formulas, homework answers, old exam answers, etc.) as **handwritten by you** on both sides of the sheet. Photocopies, scans, or computer generated/printed text are not allowed on this sheet. You may not share material or give help during the exam. You have 75 minutes for the exam. Please use a separate sheet of paper for each question. Good luck and be sure to show your work!

**Use of a laptop for completing the exam:** These problems require a lot of writing. If you are like me, you can type better than you can write by hand. So, I will allow you to use your laptop to type the answers to this exam. At the end of 75 minutes I will ask you to hand-in to me your thumb drive with your exam file (name the file with your last name). We will then go up to my office and print-out your exam (and return the thumb drive to you). It is your responsibility to make sure your file is properly saved and not "eaten by the computer". During the exam you may only have your word processor open to your exam answers file, and nothing else. You will be asked to turn-off the wireless (WiFi) in your laptop. The exam will be proctored from the back of the room. Anyone opening-up a Web browser or otherwise displaying a file that is not the exam solution text will receive a zero for the exam.

### Problem #1

Sketch the product development process as we have discussed and followed it in this class.



1 point for each item and transition

## **Problem #2**

Answer the following two questions regarding project documents:

- a) Describe the key attributes of a requirements document, specification document, and test plan as discussed in class. That is, explain the purpose of each document and what it must contain. For the test plan describe the key components or parts of a test case.

2 points each for requirements and specification, 4 pts for test plan (including parts of a test case).

The purpose of the requirements document is to address "what is the problem". The requirements document should pay attention to who the user is, cost, reliability, performance, and time to market. Each item in a requirements document must be measurable and numbered (and listed in priority order).

The purpose of the specification document is to address "how to solve the problem". The specification should contain precise descriptions of inputs, outputs, and transformations - in short, everything measurable in a product should be covered in the specifications document. A specification document must contain a traceability matrix that traces specification items to requirement items.

The purpose of the test plan is to address "is the problem solved". The test plan should contain a description of how test cases were selected and descriptions of test cases. The key components of a test case are 1) traceability to requirements and/or specification item, 2) system configuration, 3) exact input, 4) exact expected output.

- b) What is the purpose of a traceability matrix? Where should a traceability matrix be included?

6 points for purpose and 2 points for where it should be.

The purpose of a traceability matrix in a specification is to ensure that all requirements have been met by the design and, equally, to ensure that nothing is being designed/built that is not called for in the requirements. In a test plan the traceability matrix ensures that all requirement and specification items are being validated (requirements) and verified (specification). A traceability matrix belongs in a specification and test plan.

## **Problem #3**

Answer the following two questions regarding design:

- a) What is Engineering Design?

8 points – roughly 1 point for each underlined item.

The full legal definition of design (from the Florida Administrative Code) is (key words are underlined):

"Engineering Design" shall mean that the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing and evaluation. Central to the process are the essential and complementary roles of synthesis and analysis. This definition is intended to be interpreted in its broadest sense. In particular the words "system, component, or process" and "convert resources optimally" operate to indicate that sociological, economic, aesthetic, legal, ethical, etc., considerations can be included."

- b) What are the reasons to hold a design review?

2 points for each reason

Reasons for a design review are:

- 1) Feedback to improve the design
- 2) Education to others (employees and/or customer)
- 3) Evaluation of employees (the designers)
- 4) Contractual

## **Problem #4**

Answer the following general questions (from MMM):

8 points, key is communications overhead

- a) Where does the title “Mythical Man Month” (Brooks’ book) come from? That is, what is the mythical man month?

That man and months are interchangeable (in the essential sequential task of developing software) is the myth. Men and months can only be exchangeable when tasks can be partitioned among many workers with no communications between them. This is not the case in software development.

8 points, 1 point per item

- b) What are the key documents for a software project as described by Brooks in the Mythical Man Month?

In Chapter 10 of MMM Brooks describes the key documents for a software project as: Objectives, Product Specifications, Schedule, Budget, Space Allocation, and Organization Chart.

## **Problem #5**

Answer the following questions (from MMM):

4 points to identify day-by-day.

- a) Brooks says “Usually, however, the disaster is due to termites, not tornadoes...” What is he referring to?

In Chapter 14 of MMM Brooks discusses how schedules slip and how this slippage can be controlled. The point he is making with the termites statement is that most schedule slippage is due to day-by-day small issues and not major calamities. Such day-by-day issues are hard to control and demoralize the team.

- b) What is the main point of “No Silver Bullet”? Describe “accidental” and “essential”.

6 points to identify magnitude improvement and design is essential.

The main point of NSB is that there is no single foreseeable development in software development that promises an order-of-magnitude improvement in productivity. This is because the *essential* difficulty of software development lies in design (or concept), and not construction (or representation) of the design. Accidental difficulties are those related to software construction and are addressed with better tools.

- c) What does Brooks mean by “Don’t Build One to Throw Away – The Waterfall Model is Wrong!”? What is a possible remedy to the weaknesses of the waterfall model?

6 points to identify that design mistakes are “bad” in waterfall model and that incremental development is a fix.

The Waterfall model, according to Brooks, assumes that all mistakes will be in realization and not design, thus all mistakes can be corrected in testing. This means that design mistakes can be found only after a full investment in constructions and testing. Brooks says that there has to be an “upstream movement” to affect upstream activity beyond what the waterfall model allows for. A remedy to the weakness of the waterfall model is incremental development – which Brooks highly touts on page 268.

## **Problem #6**

Answer the following regarding our guest talks. **There are two possible questions answer only one.**

Jeremy Ramos was one of our guest speakers. Jeremy is an entrepreneur who owns a small company that develops, markets, and installs digital signs. During his guest talk Jeremy described in detail the technical aspects of digital signage. What is the name of Jeremy’s company? What are the eight key technical aspects, or components, of digital signage?

The company is Digital Impact Signs. The eight key technical aspects of digital signage are:

- Display system
- Interactive capabilities

2 points for name of company, 2 points for each item.

- Media player
- Metric system
- Content delivery
- Content development
- Content management

**OR...**

Steve Baigrie was one of our guest speakers. Steve is the Director of Engineering for a large Tampa Bay area company that develops flight simulators for pilot training. During his guest talk, Steve described the major pieces of a simulation system. What is the name of Steve's company? What are the nine major pieces of a simulation system?

The company is CAE. The nine major pieces of a simulation system are:

- Visual system
- Motion system
- Real-time simulation software for systems
- Computer network
- Sound and communications systems
- Sensor systems
- Environmental simulation
- Operational database
- Instructor station

1 point for name of company, 2 points for each item.

**Extra Credit**

What do you think are the key attributes to success in the workplace as a highly-paid Computer Engineer (or Computer Scientist)? In other words, what are attributes are YOU going to exhibit in your first job in order to be successful?

Many answers are possible. Good answers will include attributes such as:

- Have a good skill set and keep it sharp and up-to-date
- Be able to follow instructions and rules
- Keep your schedule - make your milestones
- Be able to productively work with others
- Be able to understand what is important to your boss
- Be reliable and accountable
- Not make excuses
- Not complain, whine, and otherwise be "toxic"
- Get the job done regardless of what happens
- Be popular

Need at least three reasonable attributes – so about 3 points per attribute. One attribute must be skills related (worth 2 pts)