

# **CS550: Software Engineering**

## **Ph.D. Qualifying Exam**

### **July 5, 2013**

**Q1. [10 pts.]** You have been asked to lead a five-person software development team that will implement a small but safety critical software package. Which software process model would you choose and justify why you select the model with the consideration of what factors.

**Q2. [5 pts.]** Describe the defect amplification briefly.

**Q3. [5 pts.]** What is the main difference between verification and validation?

**Q4. [20 pts.]** KAIST Employee Credit Union is trying to build software for their ATMs. Answer to the following questions:

**Q4.1. [10 pts.]** Draw a simple use case diagram that shows the following main functions of the ATM system.

- ◆ Open New Account
- ◆ Make Account Deposit
- ◆ Make Account Withdrawal
- ◆ Make Account Transfer
- ◆ Make Account Inquiry
- ◆ Close Account

**Q4.2. [10 pts.]** Draw a sequence diagram for Make Account Withdrawal.

**Q5. [10 pts.]** You are required to perform a risk analysis for real time nuclear reactor control software. List at least three risk items that could significantly affect the project and mitigation techniques.

**Q6. [10 pts.]** The *Capability Maturity Model Integration* (CMMI) rates software companies according to how well they identify and manage their software processes. The model has five levels in its staged representation: Initial, Repeatable, Defined, Managed, and Optimising. Briefly describe each of the five levels. What advantages are there for a company to move up to the top level?

**Q7. [20 pts.]** The table shown below enumerates the tasks with the dependencies among the tasks and durations to complete a project. Answer to the following questions

Task	Predecessors	Duration (days)
A	None	8
B	None	24
C	A	24
D	B,C	40
E	C	8
F	D	32
G	E,F	24
H	G	20
I	G	16
J	H,I	40
K	J	48

**Q7.1. [10 pts.]** Draw a PERT chart, highlight the critical path and identify the slack time for all the non-critical tasks.

**Q7.2. [10 pts.]** Choose any one critical plus one noncritical task other than J or K from above. Double the duration and determine the overall schedule impact. What choices would you have to get the project back on schedule?

**Q8. [20 pts.]** Given below is the following method *sort* which sorts a field of int variables with a bubble sort. Answer to the following questions.

```
public int[] sort(int[] list) {
    boolean change = true;
    if (list.length > 1) {
        while (change) {
            change = false;
            for (int i = list.length - 1;
                i > 0;
                i--) {
                int i1 = list[i];
                int i2 = list[i - 1];
                if (i1 < i2) {
                    list[i] = i2;
                    list[i - 1] = i1;
                    change = true;
                }
            }
        }
    }
    return list;
}
```

**Q8.1. [10 pts.]** Draw a control graph for the above method and what is the cyclomatic complexity for the module.

**Q8.2. [10 pts.]** Based on the number of test cases you identified for the above question, Develop the test cases for 100 %t statement coverage for the module.