CS550: Software Engineering

Ph.D. Qualifying Exam

**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.



**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 % statement coverage for the module.