NANYANG TECHNOLOGICAL UNIVERSITY

SEMESTER 1 EXAMINATION 2018-2019

EE4001/IM2001 – SOFTWARE ENGINEERING

November / December 2018 Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 5 pages.
2. Answer ALL questions.
3. All questions carry equal marks.
4. This is a closed book examination.

---

1. (a) Name the modeling technique used for each of the following activities in Unified Software Development Process (USDP):

   (i) Specifying requirements.
   (ii) Specifying a conceptual implementation of a use-case.
   (iii) Specifying a physical implementation of a use-case.
   (iv) Specifying the structure and behavior of types of things.
   (v) Specifying the changes of behaviors of a type of things upon occurrences of events.

   (5 Marks)

   (b) In a human resource system, the particulars of new employees and subsequent changes are recorded and updated respectively by a personnel staff. Any transfer of employee between departments is also updated by a personnel staff. Information on salary of new employee, salary increment and staff promotion is updated by a payroll staff. Draw a use-case diagram to give an overview for the requirements of this system.

   (8 Marks)

Note: Question No. 1 continues on page 2.

(c) Premier Global Education Institute offers academic bachelor degree programmes through partnerships with some of the overseas universities across the globe. Each programme is offered by an overseas university and chaired by a programme head from the university. The programme head may chair one or many programmes from the university. He or she is assisted by a local administrative team led by an administrative manager. Each administrative team assists one programme head. Each administrative manager leads one team. A programme offers at least seven courses per term. A course is offered by at least one programme. Some courses could be jointly offered by different programmes. Each course is enrolled with at least ten students. Each student must take at least two courses per term. Students can enrol into a programme either on part time or full time basis which has different requirement on the minimum number of courses to be enrolled per term. Each course under the programme is taught by a lecturer team which comprises of at most two lecturers. These lecturers are teaching either on part time or full time basis. Draw a class diagram to model the structural properties for the academic activities in the Premier Global Education Institute.

(12 Marks)

2. (a) Name three methods for measuring the quality of a test suite and briefly explain how they measure the quality of the test suite.

(6 Marks)

(b) A program is written to compute its output variable K according to the following formula:

$$K = \begin{cases} A + B, & \text{if } A \geq 100 \text{ and } B \geq 100; \\ A - B, & \text{otherwise.} \end{cases}$$

The input variables of this program are A and B which must be positive values.

(i) Design a test suite using the boundary value testing technique to test this program.

(ii) Calculate the total number of test cases in a test suite designed using the equivalence class testing technique. You are not required to design the test suite.

(12 Marks)

Note: Question No. 2 continues on page 3.

(c) Figure 1 shows the control flow graph of a program. Without considering path feasibility, identify a minimal set of paths for designing a test suite to test the program using each of the following techniques:

(i) The branch coverage testing technique.
(ii) The basis path coverage testing technique.

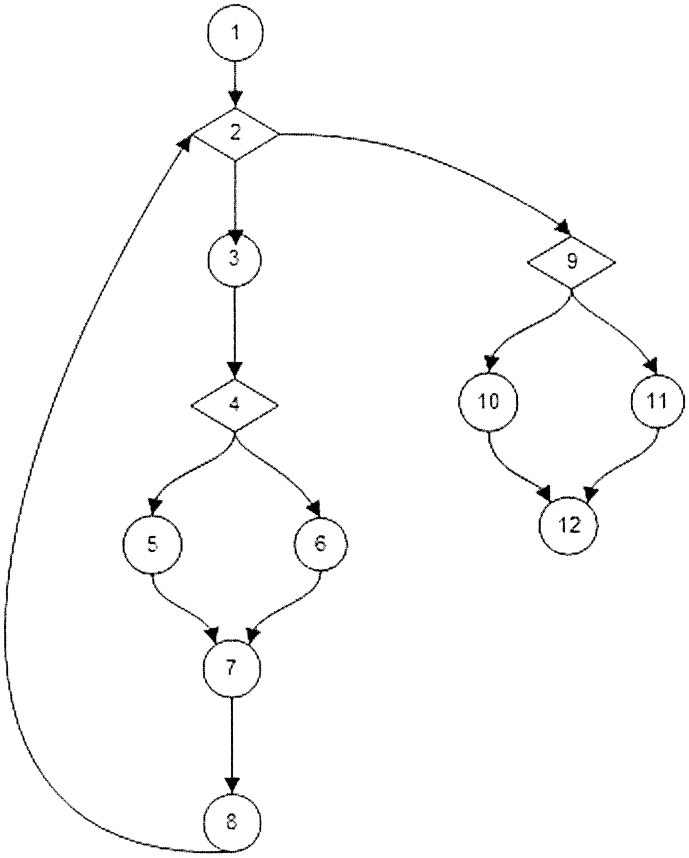

Figure 1. A control flow graph

(7 Marks)

3. (a) In the context of software project management, answer the following two parts.
(i) Briefly explain the usage of *Risk Exposure*.

(ii) Suppose 50 reusable software components are planned for a new software project. Assume that on the average each component has 100 lines of code (LOC) and software engineering cost for each LOC is $18.00. We know 60% of the software components scheduled for reuse will be integrated into a new application without extra efforts. The remaining functionality will have to be custom developed. The Risk Probability of the whole plan is 85%. What is the risk exposure of this project?

(10 Marks)

Note: Question No. 3 continues on page 4.

(b) A web application project ***eProduct*** comprises 11 activities, *A* through *K*. Figure 2 shows the estimated duration and precedence requirements of each of the activities in a precedence activity network (PAN) in BS4335.

(i) Suppose the project is given **60** days to complete, complete the PAN in BS4335 using the given information.

(ii) Show the specific formula and solution of **total float**, **free float** and **interfering float** of activity *B*. Briefly explain the meaning of each float.

(iii) Suppose activity *F* is delayed by **3** days, draw the updated partial PAN to fully reflect the affected nodes in the PAN accordingly.

(iv) Explain and briefly justify if it is possible that there are several critical paths in a PAN. How should we do about them in the context of the project management?

(15 Marks)

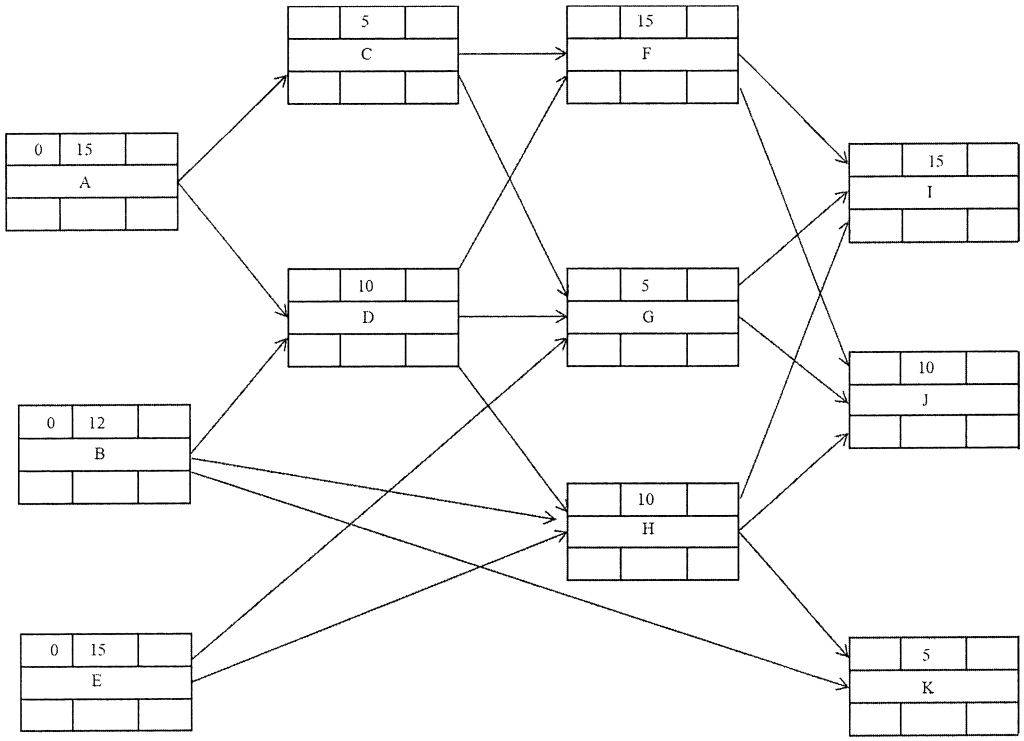

Figure 2. The partial completed PAN

4. (a) The following information shows the status of a 15-months project at the end of the 5th month: The actual cost to date is S$65,000; so far 20% of the project has been completed. Suppose the budget at completion is S$180,000.

(i) Are you able to tell whether the project is on schedule based on Earned Value Analysis? Briefly justify your answer.

(ii) Assume that the Planned Value, the Cost Performance Index and Schedule Performance Index remain the same after the evaluation. Briefly justify how much additional budget needs to be requested for the project completion based on the current status.

(iii) In your opinion, what should the project manager do after getting the evaluation at the end of 5th month?

(12 Marks)

(b) Briefly explain with an example what is function-oriented metrics in software engineering. Identify the reasons of why function-oriented-metrics can be used effectively and early than the lines-of-code-oriented metrics in software process.

(8 Marks)

(c) Briefly explain why Security/Reliability need to be considered in the design modelling of a WebApp?

(5 Marks)

END OF PAPER

EE4001 SOFTWARE ENGINEERING
IM2001 SOFTWARE ENGINEERING

Please read the following instructions carefully:

1. **Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**

2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.

3. Please write your Matriculation Number on the front of the answer book.

4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.