28/11/18

Indian Institute of Engineering Science and Technology, Shibpur
B.Tech 7th Semester (CST) Examination 2018
Under 5-year Dual-Degree (B. Tech-M. Tech) Programme
Software Engineering CS-702

Full marks: 70 Time: 3 hours

**All parts of a question are to be answered together**
**Answer mandatory questions 1 and 2 and any 4 from rest of the questions**

1. **[Mandatory Question]** Answer any 5 questions out of 6 in brief.

   a) What is Decision Table technique to specify software requirements?
   b) What is the importance of Structure Chart in the context of module integration?
   c) What do you understand by the terms "Software Validation" and "Software Verification"?
   d) To determine the effectiveness of the testing strategy, before the start of any kind of testing, 60 different bugs of different varieties are seeded into the 10K lines of code. On completion of all testing phases, it is observed that a total of 157 bugs are detected. Out of that, 30 are those bugs which were artificially introduced. Predict the approximate number of residual bugs still present in the code.
   e) If functions `funA` and `funB` have cyclomatic complexities of N1 and N2 respectively, then what will be the cyclomatic complexity of function `funC` stated in Fig-1 and why?
   f) Draw the basic class diagram corresponding to the sequence diagram presented in Fig-2.

```
int funA(...);
int funB(...);
int funC(...) {
   int c = 3*funA(...)+ funB(...);
   return c;
}
```

*Fig-1 : C code snippet*

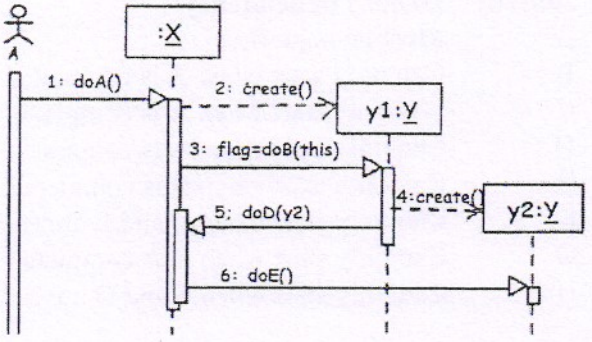


*Fig-2 : Sequence diagram*

[5 x 3] = 15

2. **[Mandatory question]** Suppose you have to design a linked list that can store the student database having information as names, their roll numbers, and their GPA. Design a suitable class structure to represent it. The operations to be supported are `addToEnd`, `search` and `delete`. The `addToEnd` adds a student by creating an appropriate node. The `delete` operation deletes a node in the linked list that matches the given roll number.
   a) Do the initial domain modelling and refined domain modelling for the above problem.
   b) Draw the sequence diagram for the "add student" and "delete student" usecases.

[5+ 10] = 15

3. Consider the following function in C programming language, which computes the sum of all even integers (*line no in following code should NOT be altered* )

```
   int SumOfEvenNums(int arrayElems[], unsigned char numOfElems)
 1 {
 2     unsigned char index = 0;
 3     int sum = 0;
 4     while(index < numOfElems) {
 5         int tempElem = arrayElems[index];
 6         if(0 == tempElem%2)
 7         {
 8             sum += tempElem;
 9         }
10         index++;
11     }
12     return sum;
13 }
```

a) Draw the Control Flow Graph (CFG) for the above function.
b) Compute the McCabe's Cyclomatic complexity of the above function and find all Linearly Independent Paths (LIPs) in the CFG.

[5 + 5] = 10

4. A certain project can be split into 8 distinct activities A, B, …, H. The time (in weeks) to complete each activity is as given below, along with the dependencies between the tasks.

| Activity | Order / dependency | Estimated time (in weeks) |
|---|---|---|
| A | Must be done first | 5 |
| B | Can only start when A is completed | 2 |
| C | Can only start when A is completed | 8 |
| D | Can only start when A is completed | 6 |
| E | Can only start when B is completed | 2 |
| F | Can only start when C and E are completed | 5 |
| G | Can only start when D is completed | 4 |
| H | Can only start when F and G are completed | 5 |

a) Draw the Activity Network for the project following AOA convention.
b) For each activity compute the following parameters so that the overall project can be completed as early as possible -
   i) Earliest time at which it can start, latest time at which the activity must start and slack time
   ii) Find the Critical Path and Minimum Time to complete the project.

[5 + 5] = 10

5. a) Specify which kind of programming errors can be uncovered by "Code Inspection" technique?
b) What are the objectives of Unit testing and what are the aspects it emphasises?

[5 + 5] = 10

6. a) In UML, why usecase diagram factoring is needed? What are the differences between <<include>> and <<extend>> relationship in UML usecase factoring? Explain using an example.
   b) How is composition class relationship different from aggregation in the context of software class relationship? Explain with example.

   [5 + 5] = 10

7. a) State the four values of the Agile Manifesto.
   b) Give an overview of Agile methodology.
   c) What are the advantages of "pair programming" in the context of Extreme Programming?

   [2+ 5 + 3] = 10

8. Write short notes on following -
   a) COCOMO
   b) SEI CMM Levels

   [5x2] = 10