

ME Software Engg 1st Year 1st Semester Examination, 2024

Principles of Software Engineering

TIME: 3 Hours

FULL MARKS: 100

Answer ALL 10 Questions

- 1.a) List down any 5 of Boehm's Top 10 Industrial Software Metrics.
- b) List down the factors influencing Software Cost Estimating Task. (5+5)
- 2.a) With a proper diagram, explain the V-Model.
- b) List down the Manifesto for Agile Software Development. (5+5)
- 3.a) For the scenario mentioned below, pick out at least 6 different Data Objects. Draw pairwise ERD using these data objects. Show at least 5 pairs. Cardinality & Modality should be shown also with proper notation.

The department of public works for a large city has decided to develop a Web-based Pothole Tracking and Repair System (PTRS). Citizens can log onto a Website and report the location (street name, number and on which portion of the street the pothole lies, e.g., middle curbs etc.) and severity (in a scale of 1 to 10, depending upon the size of the pothole). Citizens also log their name, address and phone numbers. Every such report is stored with a Pothole Identifying Number (PIN). This list is consulted around the end of the week by the Higher Administrative Authority (HAA) and assigned a repair priority number (depending upon severity and street address) for every PIN. This list can be called Pothole Occurrence List (POL).

During the beginning of every week the repair department consults the POL and prepares PTL (Pothole Tracking List). In PTL, there will be Pothole Status Information (the values of status are 'work in progress' , '% of completion', 'repaired', 'not repaired' and 'temporary repair') and repair team number against every PIN.

At the end of the repair, the repair department also prepares a Pothole Expense List (PEL), where all the expenses are recorded against every PIN. The details of expense may include, repair team number, number of workers involved, total hours spent on pothole repair, total materials and labor expense, calendar time used etc.

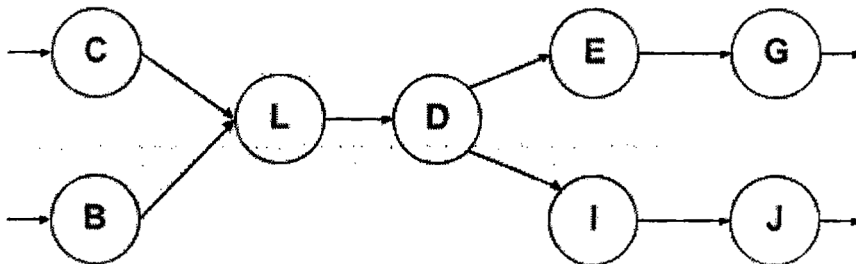
It is to be noted that POL and PTL can be viewed by the public but not PEL.

b) Draw the STD and write the CSPEC of the following system:-

A telephone answering system is about recording incoming messages and displaying the number of messages on the LCD. The system should allow the telephone customer to dial in from any location, type a sequence of numbers (PIN) and play the recorded messages. The customer has an option of storing any particular message or delete it. (5+5)

4.a) Using relevant code snippets, explain various types and degree of coupling.

b) Map the following DFD to a suitable Call and Return Architecture. Assume that the below diagram is exhibiting Transform Flow characteristics. (5+5)



5.a) With regard to the Interface Design Issues; explain your understanding about "Information Presentation" and "Color Usage".

b) For the SafeHome (Home Security Monitoring System) problem, assume that the system is connected to the internet via a modem. Write a decision table (with regard to the component level design) based on the following facts:-

The homeowner is supposed to get an EMail if and only if the noise level goes beyond a certain level. If the temperature of any of the rooms goes beyond a certain level (fire situation), not only the homeowner will be getting an EMail, but also the alarm has to be switched on along with a telephone call to a local police station. As far as pressure and vibration is concerned (window breakage detected), when it goes beyond a certain level, an alarm needs to be turned on along with a telephone call to a local police station. ((3+2)+5)

6.a) Explain the proper style of naming and declaring a variable (with respect to 'C' programming language).

b) List down at least 8 'Factors Affecting Maintenance Costs'.

c) List down at least 6 Lehman's Law of Software Change. (3+4+3)

7.a) Draw the flow graph for the following program :-

An array contains n number of integers. The program prints the maximum number from that array.

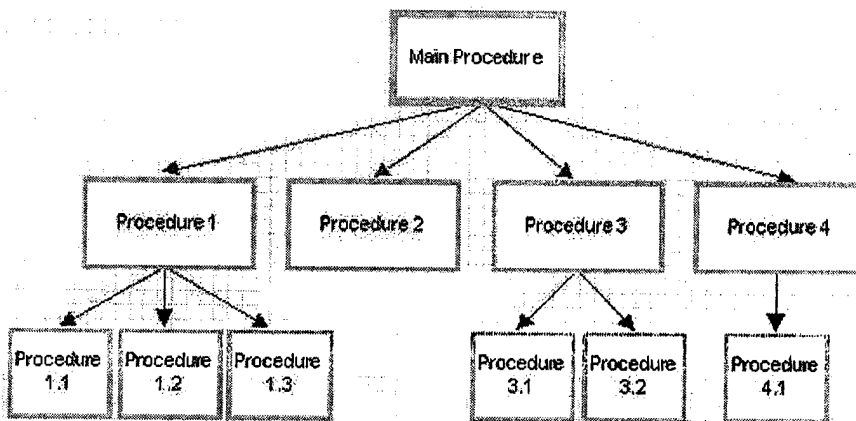
What is the Cyclomatic Complexity of this program?

b) Also, Design relevant number of test cases for White Box Testing for the same program mentioned above.

c) For the same problem mentioned above, Design relevant number of Black Box test cases. (3+3+4)

8.a) What are the four phases of testing for the newly developed software? What are the test techniques and Error Finding Rate during those four phases?

b) Study the following diagram. Considering the case of Bottom-Up Integration; what will be the sequence of module addition for this type of Call and Return Architecture?



c) Explain briefly about Alpha Testing, Beta Testing and Gamma Testing. (4+3+3)

9. Study the following Software Development Project story of a certain Software Vendor. Find at least 10 metrics from this story and compute their values.

Considering the importance of the project, a high profile technical team was formed consisting of 4 software development engineers and 2 test engineers. Timing was a crucial factor to the customer along with the quality of the final product; that's why the team has been given 6 months to complete the project. While doing initial analysis, the team found that FP calculations gave a value of 160. It was also found that there would be totally 11 modules which need to be developed from scratch. The call and return architecture of this product is exactly as shown in Q8b. Once the flow chart is drawn for each of the modules, it was found that Procedure 2 is the biggest and it has about 10 decision boxes. Procedure 2 is much bigger in other aspects also. For example, it accepts about 6 arguments and returns about 4 values. The total line of codes written by all the engineers (including the test codes) for all the modules is about 20,000 lines. All codes were written in C.

The test engineers put enough effort into testing the product, so that the highest quality of the product is achieved. They did testing in 4 different phases. The first phase of testing was carried out by the software development engineers and they found and corrected about 80 bugs in that phase. The testing of 2nd Phase, 3rd Phase and 4th Phase were carried out by the test engineers. They found about 10, 4 and 2 bugs respectively in all those phases. All these bugs were fixed by the developers. The upper Management was very happy with the testing, because after the release only 4 bugs were found in the customer system.

The team did not ignore the documentation work also. In fact, quite a few documentations were produced starting from SRS to installation manuals. It was found that about 2000 pages of documentation were produced during the lifetime of the project.

As for the project cost, the detailed calculations revealed that about Rs.10,00,000.00 was spent on this project which included man-power costs, resources, infrastructures and other costs. (10)

10.a) Using examples, explain your understanding about Software Maturity Index (SMI)

b) The coupling metric C is given by:-

$$C = 1 - k / (di + (a*ci) + do + (b*co) + gd + (c*gc) + fout + fin)$$

Explain all the parameters of this formula.

c) List down McCall's Quality Factors with respect to different categories. (3+3+4)