Question Paper

Exam Date & Time: 08-Dec-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FIFTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, NOV DEC 2023

SOFTWARE DESIGN TECHNOLOGY [ICT 3174]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Write with justification which process model will be suitable for the following scenarios. (5)

A)

a. In a software project where the client frequently changes their requirements due to evolving market demands.

b. Imagine you are tasked with developing a large-scale enterprise system with a multitude of interconnected components.

c. When working on developing safety-critical software, such as for medical devices or aviation systems.

d. You are leading a research and development project where the requirements are not clearly defined at the outset, and experimentation is a key aspect of the development process.

e. In a scenario where the project budget is limited and there is a need for strict control over costs.

B) How does the concept of cohesion manifest in system design, and what distinguishable types can be identified? Demonstrate communicational cohesion through a practical example (3)

C) Provide a scenario where the Spiral Model is well-suited and elaborate on its advantages (2)

2) Discuss the potential challenges and benefits of utilizing Function Points for project estimation. Consider the following functional units and compute the function point for the project. (5)

A)

I. Number of user inputs=17, with a degree of complexity equal to simple

II. Number of user output=12, with a degree of complexity equal to the average

III. Number of user enquiries=5, with a degree of complexity equal to the complex

IV. Number of user files=8, with a degree of complexity equal to simple

V. Number of external interfaces=2, with a degree of complexity equal to the complex

Consider the following values for Adjusting Factors for the calculation.

- Master files updated on-line = 3
- Complexity of inputs, outputs, files, inquiries = 5
- Complexity of processing = 4

- Code design for re-use = 5
- Multiple installations = 3

B) Using the pseudocode below, draw an activity diagram to represent the Process Order Process. If you make assumptions about anything, explicitly state the same in text before your diagram. (3)

Process Order

Sales representative enters details of new order
while special materials required that are not in stock
    place order for special materials with supplier
endwhile
add order to production list
schedule delivery date
if customer has e-mail address
    e-mail customer giving projected delivery date
else
    generate letter to customer giving projected delivery date
endif

C) Which architectural style is helpful in the following execution scenarios? (2)

(a) when the order of computation is fixed, when interfaces are specific, and when components can make no useful progress while awaiting the results of requests to other components.

(b) when a central issue is the storage, representation, management, and retrieval of a large amount of related persistent data.

3) Develop a comprehensive class diagram to represent the Library Management System, accurately capturing all the relationships outlined. The Library Management System encompasses three primary functions: login, register, and logout. Within this system, there are multiple users, numerous books, and a singular librarian. Users, identified by an ID, can be either Staff members associated with a department or Students associated with a class. Each user has account-related functions such as verification, checking account status, and obtaining book information. The account keeps track of reserved books, borrowed books, lost books, and calculates fine amounts. Users are capable of borrowing multiple books, each with its own title, author, ISBN, and functions related to reservations, dues, and renewals. Librarians, responsible for managing books, have stored names and passwords. A librarian oversees a centralized database containing a list of books, with the ability to perform actions such as adding, deleting, updating, searching, displaying, and modifying book entries. Both books and user accounts are integral components of the library database, forming a cohesive Library Management System. (5)

A)

B) The PQR Institute has developed a system for assessing programming assignments submitted by students. The system receives the number of correct answers (out of 50) and the number of bonus points (out of 10). It calculates the total score and provides a grading as follows: (3)

Greater than or equal to 40 - "Excellent"

Greater than or equal to 30 and less than 40 - "Good"

Less than 30 - "Needs Improvement"

In addition, if the total score is less than 0 or greater than 60, an error message ("Invalid Score") is displayed. Design test cases using equivalence class partitioning and boundary value analysis for

this programming assessment system.

C) Consider a software project that involves developing an enterprise-level web application for a financial institution. The project requires high reliability and security due to the sensitive nature of financial transactions. The team estimates the size of the project to be approximately 100,000 lines of code (KLOC). The project is expected to be developed in an organic mode with a relatively experienced and cohesive development team. (2)

a) Using COCOMO II, compute the effort estimation for the project, considering the provided size estimate and project characteristics.

b) Determine the duration and staffing requirements based on the effort estimation

4) Design the test cases for the following code snippet using path testing. You are expected to follow the following steps to design an effective test case with a high probability of revealing defects. (5)

A)

1. Draw the CFG (Control Flow Graph)
2. Find the Cyclomatic Complexity using three methods.
3. Identify the independent paths (Basic Path Set)
4. Derive test cases

```
int main() {

printf("Start of the programn");

for (int i = 1; i < = 5; i++) {

printf("Iteration %d (for loop)n", i);

if (i % 2 == 0) {

printf("Even iterationn");

} else {

printf("Odd iterationn");

}

}

while (j < = 3) {

printf("Iteration %d (while loop)n", j);

j++;

if (j == 2) {

printf("Second iteration in while loopn");

}

}

printf("End of the programn");

return 0;

}
```

B) Discuss challenges in understanding and recording software requirements. Highlight the importance of clarity in the early stages of a project. Identify issues related to disorganized requirement recording and propose mechanisms for effective change control. (3)

C) Utilizing a Gantt Chart, estimate the time required to complete the project based on the provided figure indicating activity duration and predecessor relationships. Considering Saturdays and Sundays as holidays, and commencing the project on December 1 (Friday), determine the anticipated completion date of the project. (2)

Activity	Predecessor Activity	Optimistic time estimate (to days)
A	-	2
B	A	2
C	A	6
D	A	2
E	B	2
F	C	6
G	D, E, F	6

5) Incorporating the provided figure with associated optimistic durations and predecessor information, determine the total project duration using an activity precedence chart. Tabulate the earliest start, and latest start and slack times, for each activity. If Activity E experiences a delay of 3 days what happens to the project duration? Identify and explain the critical path based on the figure (5)

A)

Activity	Predecessor Activity	Optimistic time estimate (to days)
A	-	2
B	A	3
C	A	8
D	B	9
E	C	8
F	D, E	16
G	D, E	19
H	F	2
I	G	1

B) Analyze the significance of risk categorization in the context of software projects. Compare and contrast the approaches to risk categorization, emphasizing the impact each category can have on project planning, quality, and overall success. (3)

C) Analyze the features of software and compare the development process of software with that of hardware. How does the custom-built nature of most software impact its quality compared to component-based construction? (2)

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