National University of Computer and Emerging Sciences

Lahore Campus

FSPM

(SE4003)

Date: December 24th 2024

Course Instructor(s)

Ms. Momna Zainab

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Do not write below this line

Attempt all the questions.

Students are allowed to bring a A4 sized, handwritten, double-sided cheat-sheet to exam.

Roll No _____ Section _____ Student Signature _____

Final Exam

Total Time (Hrs):	**3**
Total Marks:	**95**
Total Questions:	**6**

Printed , and photocopied sheets are not allowed.

Question 5 & 6 are for Section B only.

Question 4 is for Section A only. Attempt Question 4 on question paper ONLY.

CLO 4: Apply approaches to manage and optimize the software development processes

Q1: We as a software company have been awarded a maintenance project. Initially, we are required to determine if the continued maintenance of the software application under maintenance is affordable anymore. During this phase, our step will be to determine the cost of fixing defects by performing three activities. The first is to design and execute usage scenarios to determine if the application breaks too often during regular use. The second is to design and execute test cases to uncover faults in the application. The third is to remove the faults to see how long it takes to repair the application. The second step will be to modify existing features to determine if the cost of the changes is affordable or not. During this step, we shall modify the existing features and extend the functionality of the application by adding new features to determine the effort required to modify and add new functionality. After the first two steps, an analysis will be performed and it will be decided if the software application should remain in maintenance as before or it should be re-engineered. The first phase will run for 3 months. In the second phase, if the reengineering-related decision has been made, the foremost step of business process reengineering will be performed. This step will define the business goals, identify existing business processes, evaluate the existing processes, and create revised business processes. The second step will be the reengineering of software. This step will include activities such as inventory analysis, document restructuring, reverse engineering, program restructuring, data restructuring, and forward engineering. The third step will be to assess the quality of the resultant software and measure the maintainability of the resultant software.

a. Someone has told us that having a Work Breakdown Structure (WBS) will help us execute the project better. We have also been told that students at FAST Lahore are very good at making WBS to help managers of software projects. Assuming that the decision after phase 1 will be to go for reengineering, provide a WBS for the phases mentioned above to help our company. As an incentive, you'll be awarded good marks if the WBS helps. Use a tree-like structure to show your WBS

10 marks

b. A team of software engineers is working on a project following Scrum. At the start of each sprint, they select a few user stories to work on. Their selected and completed user stories in the first five sprints are as follows: **10 marks**

Sprint 1: The team committed to completing 8 user stories. However, the team could complete 6 of the 8 user stories. Out of those six stories, two stories had 10 story points, three stories had 5 story points, and one story had 3 story points.
Sprint 2: The team committed 10 user stories and completed 9 of the 10 user stories. Out of those nine stories, three stories had 2 story points, four stories had 6 story points, and two stories had 8 story points.
Sprint 3: The team committed 12 user stories and completed 10 of the twelve user stories. All ten user stories had 7 story points.
Sprint 4: The team committed 14 user stories and completed 12 of the 14 user stories. Out of those twelve user stories, six stories had 9 story points, four stories had 5 story points, and two stories had 3 story points.
Sprint 5: The team committed 15 user stories and completed 13 of the 15 user stories. Out of those thirteen user stories, five stories had 10 story points, four stories had 6 story points, and four stories had 2 story points.

1. **Calculate the average sprint velocity based on how many story points are implemented in each sprint.**
2. **Calculate the total number of story points committed and the total number of story points completed for all five sprints.**
3. **Give the estimated story points the team should commit for Sprint 6.**

CLO 4: Apply approaches to manage and optimize the software development processes

Q2: Your software house has signed a new project with Islamic organization to develop a mobile application named Eat-Halal. The application is to be used in the region of Europe.

System will provide following major functionalities:
1. Differentiate between Halal and Haram products
2. Generate smart suggestions of alternative halal products for a product identified as haram by the system.
3. Locate halal food places based on the user's location.
4. Generate smart suggestions for halal eating based on the user's interest and added preferences.

Eat-Halal shall use front end scraping to retrieve ingredient status from Islamic fatwa.com. If a website declares a food ingredient as haram the product will be declared as haram by our application. Machine learning technique “Bayesian classifier” will be used to get alternative options from other food websites. An AI based smart recommender system will be used for generating smart suggestions for halal eating. All the members of the team are experienced with phone application development, however, working with machine learning algorithms is a completely new & challenging task for them. Average monthly salary of team members is 80k. Estimated KLOC for the project is 35k.

Software Projects	A	B	C	D
Organic	2.4	1.05	2.5	0.38
Semi-Detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32

Read above mentioned information carefully and apply the suitable cocomo model to answer the following questions.

a. **Compute the Effort (in person-months) for the given project.** **5 marks**
b. **Compute Time (in months) required to develop this project.** **5 marks**
c. **Compute the number of team members required to develop the project.** **5 marks**
d. **Compute estimated total cost of the project.** **5 marks**

CLO 4: Apply approaches to manage and optimize the software development processes

Q3: Using earned value management system track the performance of the project.

You are managing a software development project with a total budget of $400,000 and a planned duration of 5 months. At the end of Month 3, the following information is available:

1. By the end of Month 3, the project was planned to have completed 70% of the total work.
2. The actual work completed so far corresponds to 60% of the total project.
3. The actual costs incurred to date are $250,000.

Additionally, the project involves the following key tasks:

Task	Estimated Effort (Planned Hours)	Actual Effort (Hours)	Work Completed (%)
1	100	110	100%
2	150	140	90%
3	200	220	50%
4	120	130	80%
5	80	70	100%

To Do:

1. Calculate the following Earned Value Management metrics: **10 marks**
   - **Schedule Variance (SV) (Task & Project Level)**
   - **Cost Performance Index (CPI) (Project Level)**
2. Based on your calculations:
   - Assess whether the project is ahead or behind schedule. **5 marks**
   - Determine if the project is cost-efficient or inefficient.

CLO 1: Understand project management principles and techniques

Q4: Provide the correct answers for following questions. (For section A only)

A. Choose the correct personality type for each person i.e. ISFJ,INFJ.

10 marks

Person Profile	Personality Type
A scientist who spends hours formulating theories and exploring complex ideas in physics.	
A party host who keeps everyone entertained with humor, music, and spontaneous activities.	
A nurse who goes above and beyond to provide compassionate care for patients.	
A community leader who inspires others to join a cause and works tirelessly to achieve collective Goals.	
A meticulous accountant who ensures all financial records are precise and deadlines are always met.	

B. Correctly identify the stages of team formation.

10 marks

Description	Stage
Control established over resistance. A cohesive set of rules and standards is developed in the group.	
The purpose of the group is fulfilled.	
What the team will be doing? Interpersonal and task relationships are characterized by courtesy , confusion and caution.	
Members showing resistance. Lots of ongoing tension, criticism and confrontation.	
Group is focused on the task accomplishment. Issues of interpersonal relations, member status & division of task are settled.	

C. Fill in the blanks. **10 marks**

a. Team members that are under the direct managerial control of the project leader are called _____.
b. Criteria of project success lies within the range of three constraints_____, _____,_____.
c. ISO 9126 identifies _____ major external software quality characteristics.
d. _____ refers to the ability of the software to share resources with other software components; unlike 'interoperability', no direct data passing is necessarily involved.
e. risk exposure = (_____) x (probability of occurrence).

f. The _____ defines the specification and constructs the high-level design, and then partitions the remaining tasks of detailed design, viz., coding, testing, documentation, etc., into many smaller tasks, and assigns them to the team members.
g. _____ and _____ are the advantages of a fixed price contract.
h. Oldham and Hackman suggest that the satisfaction that a job gives is based on _____ factors.
i. The _____ is skilled at creating a good working environment, for example, by 'jollying people along'.
j. McCall's factor model classifies all software requirements into _____ software quality factors.

D. The software requirement document for the tender for development of "Super-lab", a software system for managing a hospital laboratory, consists of chapters according to the required quality factors as follows: correctness, reliability, efficiency, integrity, usability, maintainability, flexibility, testability, portability, reusability and interoperability. In the following table you will find sections taken from the mentioned requirements document. For each section, write the name of the factor that best fits the requirement (choose only one factor per requirements section). 10 marks

Requirement	Quality Factor
1. The probability that the "Super-lab" software system will be found in a state of failure during peak hours (9 am to 4 pm) is required to be below 0.5%.	
2. The "Super-lab" software system will enable direct transfer of laboratory results to those files of hospitalized patients managed by the "MD-File" software package.	
3. The "Super-lab" software system will include a module that prepares a detailed report of the patient's laboratory test results during his or her current hospitalization.(This report will serve as an appendix to the family physician's file.) The time required to obtain this printed report will be less than 60 seconds; the level of accuracy and completeness will be at least 99%.	
4. The "Super-lab" software to be developed for hospital laboratory use may be adapted later for private laboratory use.	
5. The training of a laboratory technician, requiring no more than three days, will enable the technician to reach level C of "Super-lab" software usage. This means that he or she will be able to manage reception of 20 patients per hour.	
6. The "Super-lab" software system will record a detailed users' log. In addition, the system will report attempts by unauthorized persons to obtain medical information from the laboratory test results database. The report will include the following information: network identification of the applying terminal, system code of the employee who requested that information, day and time of attempt, and type of attempt.	

7. The "Super-lab" software system will process all the monthly reports for the hospital department's management, the hospital management, and the hospital controller according to Appendix D of the development contract.	
8. The software system should be able to serve 12 workstations and eight automatic testing machines with a single model AS20 server and a CS25 communication server that will be able to serve 25 communication lines. This hardware system should conform to all availability requirements as listed in Appendix C.	
9. The "Super-lab" software package developed for the Linux operating system should be compatible for applications in a Windows NT environment.	
10. The "Super-lab" subsystem that deals with billing patients for their tests may eventually be used as a subsystem in the "Physiotherapy Center" software package.	

CLO 1: Understand project management principles and techniques

Q5: Answer the following questions (For Section B)

a. What do you mean by the characteristics of invisibility and complexity of Software project management? **5 marks**

b. Define risk identification and ranking. **5 marks**

c. Mention the important causes of stress encountered in projects. **5 marks**

d. Briefly explain the different phases of project management life cycle using an illustration **5 marks**

e. What is the difference between verification and validation and how does it help in software quality **5 marks**

f. What are different choices of risk planning after having identified risks? Describe them briefly. **5 marks**

CLO# 4 Apply approaches to manage and optimize the software development processes

Q6: You have to manage a project with activities and their respective durations as listed in table below (For Section B only)

Activity	Immediate Predecessor	Duration (months)
A	**-**	**2**
B	**A**	**4**
C	**A**	**2**
D	**B**	**2**
E	**B, C**	**4**

F	**A, E**	**6**
G	**D**	**4**
H	**D, E, F**	**2**
I	**G, H**	**6**
J	**H, F**	**6**
K	**H, I, J**	**4**

a. Construct Precedence diagram to analyse your project **6 marks**
a. What is the project duration **1 mark**
a. What are the critical activities **1 mark**
a. Show/Highlight critical path on your precedence diagram **1 mark**
a. When is the earliest D activity can possibly be completed **1 mark**