

National University of Computer and Emerging Sciences, Lahore Campus



Course:	Introduction to Software Engineering	Course Code:	SE1001
Program:	BS (SE)	Semester:	Spring 2023
Duration:	180 Minutes (3 Hours)	Total Marks:	85
Paper Date:	June 1, 2023	Weight	40%
Section:	All	Page(s):	10
Exam:	Final term		

Instruction/Notes:

1. Attempt all questions on the question paper. Do not submit any extra sheet
2. You are allowed to use a two-sided, hand-written, A-4 size cheat sheet

Name: _____ **Roll Number:** _____ **Section** _____

Question 1: Read the statements given below and write down the most appropriate software quality attribute also mentioned either its violated or followed according to the statement. (Marks 20) (CLO-1)

Sr. No	Scenarios	Software Quality Attribute?	Followed or violated?
1	A multi-storefront application became unavailable one Friday evening as the third-party CDN server went down.		
2	Due to the intricate nature of the code, implementing a new GDPR in the legacy product (running for more than 20 years) was a true headache for the developers.		
3	A web application for scientists and research students had all of the necessary features, however, some of the sub-menus on one or more pages were concealed (for instance, they were only seen after clicking the ellipsis button). As a result, users had a tough time understanding how to start using those features		
4	Mobile version of event booking software was working fine on Android but had issues with context menus on iOS (iPhone as well as iPad)		
5	An online examination system had a remote proctoring feature. As per the specification, it was required to have the option to enable/disable this functionality as required and to work on all current browser versions. But in the production environment, the admin user couldn't disable this functionality on Firefox.		
6	A survey application was collecting data, which could be downloaded as an MS Excel file. However, the applications started freezing with approximately 5000 records.		
7	One of the APIs of a large customized survey application was accessible without proper authentication. Although only technically skilled individuals could have utilized that API, it posed a significant risk		
8	The development team responsible for building equipment booking software took an unexpectedly long time to integrate the invoicing feature with the external accounting system.		
9	A company has several servers in a cluster, so that if one of the servers fails the other servers will continue processing seamlessly and take over the load of the failed server.		
10	In an application Commonly used features can be identified and developed as shared components		

Question 2 (5+5 = 10 Marks)**(CLO-2)**

List the software process that you think will be most appropriate for the following situations. List your reasons for choosing a particular process. If you just list the process without any justification, you will not be awarded any marks.

- a) A software development company has been contracted to develop a highly innovative and complex software solution for a large healthcare organization. The project involves integrating multiple existing systems from different vendors, ensuring data security and privacy compliance, accommodating frequent regulatory changes, and maintaining interoperability across various healthcare standards. The development team is expected to work closely with domain experts, stakeholders, and external vendors throughout the project duration. The company wants to ensure a balance between maintaining strict control over the development process and accommodating changes effectively while ensuring timely delivery of the software solution.

Software Process:

Reasons:

- b) A software development team is working on a complex project to develop an autonomous driving system for a leading automotive company. The system needs to integrate with multiple sensors, perform real-time data analysis, and make critical decisions in a variety of driving scenarios. The project involves collaboration with a team of domain experts, data scientists, and regulatory authorities to ensure compliance with safety standards and regulations. The company has strict deadlines and wants to ensure the highest level of accuracy, reliability, and safety in the autonomous driving system.

Software Process:

Reasons:

Question 3 (2+6+7 = 15 Marks)**(CLO-3)**

Answer the Following questions related to software engineering principles.

- a) Software, even when it is developed and commissioned for production, undergoes changes. When there are changes, additional costs will be incurred. Which design principle in software development is followed to ensure cost is kept to a minimum.

- a) The following code will take one integer as input and returns its factorial

```
//code snippet starts
int factorial(int n)
{
    int res = 1, i;
    for (i = 2; i <= n; i++)
        res *= i;
    return res;
}
```

Now we want to make this function more generalized to take multiple integers and return their factorials. How can you modify this code to achieve **Generality**? Rewrite the code after the modification(s).

- b) Given the following code to perform calculations. You are required to add functions for giving **better modularity in this code**.

```
#include <iostream>
#include <cmath>

void performOperations() {
    // Perform a series of operations

    // Read input from the user
    std::cout << "Enter a number: ";
    double number;
    std::cin >> number;

    // Compute the square root
    double sqrtResult = std::sqrt(number);
    std::cout << "Square root: " << sqrtResult << std::endl;

    // Check if the number is positive or negative
    if (number > 0) {
        std::cout << "The number is positive." << std::endl;
    } else if (number < 0) {
        std::cout << "The number is negative." << std::endl;
    } else {
        std::cout << "The number is zero." << std::endl;
    }

    // Compute the factorial of the number
    int factorial = 1;
    for (int i = 1; i <= number; ++i) {
```

```

        factorial *= i;
    }
    std::cout << "Factorial: " << factorial << std::endl;

    // Generate Fibonacci sequence up to the number
    std::cout << "Fibonacci sequence up to " << number << ": ";
    int fib1 = 0;
    int fib2 = 1;
    int fib;
    std::cout << fib1 << " " << fib2 << " ";
    while (fib1 + fib2 <= number) {
        fib = fib1 + fib2;
        std::cout << fib << " ";
        fib1 = fib2;
        fib2 = fib;
    }
    std::cout << std::endl;

    // Print the multiplication table for the number
    std::cout << "Multiplication table for " << number << ":" << std::endl;
    for (int i = 1; i <= 10; ++i) {
        std::cout << number << " x " << i << " = " << number * i << std::endl;
    }
}

int main() {
    performOperations(); // Call the function to perform operations
    return 0;
}

```


Question 4 (Marks 10)**(CLO-4)**

Draw a class diagram for an AI-based recommendation system for MovieHub.

Movie Hub is an online streaming platform, which has asked your development team to develop a smart (AI-based) recommender system for them. The system aims to provide personalized movie recommendations to users based on their viewing history, preferences, and user feedback. The system utilizes machine learning algorithms to analyze user data and generate accurate recommendations. The platform also allows users to rate and review movies, which further contributes to the recommendation process. The system should have classes to represent users(attributes such as name, email, user_id, etc), movies(movie_title, movie_id, etc), recommendations(recommendation_id, etc) ratings, and the AI engine responsible for generating recommendations. Other than these given classes, Identify other potential classes and possible attributes for this class diagram as well.

Question No.5: (Marks 20)**(CLO-4)**

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.

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

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

- a) Compute the Effort (in person-months) for the given project.

5

- b) Compute Time (in months) required to develop this project.

5

c) Compute the number of team members required to develop the project. 5

d) Compute estimated total cost of the project. 5

Question No.6: (Marks 10)

(CLO-5)

For a software engineering project, following activities are to be carried out. Their relationship with other activities and expected durations (in days) are mentioned in table below. Draw the activity network diagram (aka activity on node graph) for the activities mentioned in the table. Use the appropriate node structure. Determine and explicitly mention the minimum time required to complete the project (use appropriate units). For each node, also mention the earliest start, earliest finish, latest start, latest finish, and slack. Clearly specify/highlight the Critical path and critical activities.

A	-	3
B	A	4
C	B	5
D	B	3
E	C,D	4
F	C,D	6
G	E	7
H	F,G	3
I	F,G	4
J	H	6
K	I,J	5
L	K	2

