National University of Computer & Emerging Sciences, Karachi
Faculty of Computing
Final Exam (Fall-2023)
5th January 2024, 09:00 AM – 12:00 Noon

Course Code: SE2001	**Course Name: Software Requirements Engineering**
Instructor Name: Dr. Syed Muazzam Ali Shah	
Student Roll No:	**Section No:**

Time: 180 minutes **Max Marks**: 100 Points

Instructions:

- Out of order questions will not be graded.
- Return the question paper and make sure to keep it inside your answer sheet.
- Read each question completely before answering it. There are **4 questions and 4 pages**.
- In case of any ambiguity, you may make assumptions. However, your assumption should not contradict any statement in the question paper.
- You are **not allowed to write** anything on the question paper (except your ID and section).

Question 1 [25 points] [CLO 1]

A. What are the preferred user classes of stakeholders for requirement elicitation? Furthermore, identify these classes for the Library Management System (LMS). **(5)**

Solution:

Favored user classes are those whose fulfillment is most firmly lined up with accomplishing the undertaking's business goals and objectives. When resolving clashes between requirements from various client classes or making priority need choices, favored user classes get special treatment.

Examples:

a. Library users
b. Library Staff responsible for cataloguing
c. System developers
d. Managers of other library automation systems
e. Library management
f. Book publishers

B. Suppose you are developing a call-center application for customer service representatives (CSRs) who were used to having to page through printed catalogs to find products that customers wanted to order. In order to exactly find the product to which the customer is referring, CSRs have to flip through multiple catalogs, which is very hard to do. Identify which requirement elicitation technique is helpful for you to understand what features they would need in an online product catalog, along with the rationale behind your selection. **(2+3 = 5)**

Solution:

Suitable Techniques:
The most suitable requirement elicitation technique for this specific software will be Requirement reuse as it also stated in the question that the system is already working where CSRs have to flip through multiple catalogues which is very hard to perform. It indicates that the system is there but is unable to perform the desire task that is to find the product at first place rather than going to pages to pages.

Rationale:
The Rationale for Selecting Requirement reuse is that it enables us take the requirements which have been developed for one system and using them in a different system. As the system is already developed before so most of the requirements can be elicited from the existed system and more functionalities can be added.

Requirements reuse will save time and effort as reused requirements have already been analyzed and validated in the existed system.

C. Analyze the following requirement by considering the quality characteristics of the requirements and highlighting all the issues that the given requirement contains. Furthermore, write the revised version of the given requirement. **(5)**

> ***Req:*** *The driver's license ID should be validated online against the master license holder's driver's ID list, if possible.*

Solution:

Issue in the given above requirement:
In the given requirement, the phrase "if possible" is making the Requirement uncertain. Therefore, it isn't offering compulsion to execute or implementation

Revised version of the requirement:
The system shall display an "error message" if the license id is not in the master license holder driver's id list when user enters it.

D. Answer the following questions by considering the use case given on the next page (page 2).

a. Derive five functional requirements from the course registration use case. **(5)**

Course.Register: The system shall allow the student who is logged into the registration system to register the desired course.

Registered.Student: The system shall confirm that student is registered to the department for registering the desired courses.

Register.Student.No: The system shall display a message saying "Please get registered to the department."

Course.Register.Regular: System shall allow regular students to select desired courses.

Display.Course.List: The system shall display the list of available courses to the students.

Course.Check.Prerequisite: The system shall check that the prerequisite course of selected option should be cleared.

Course.Register.CreditHourlimit: The System shall check for the credit hour limit.

b. Analyze and extract five business rules that can be applied to the above business process. **(5)**

BR-1: To be eligible for a course, it is necessary that the course should be cleared.
BR-2: Maximum 50 students to be allowed in each section only.
BR-3: If a section has 50 students, all new applying students therefore will be transferred to another section.
BR-4: To be eligible for a course, prerequisite of that course is that it should be cleared with at-least 2.0 GPA.
BR-5: In case of Failure or low grade, then the student shall repeat the course.

Use Case ID:	UC-DMS-01
Use Case Name:	Course Registration
Actors:	Admin, Student
Description	This use case describes the scenario where students can register a course with the respective teacher. Trigger: Student indicates register course button from the dashboard.
Preconditions:	1. The student should be registered to the department. 2. The student has logged in to the system successfully.
Postconditions:	1. The student has been registered to his respective course successfully, or seats of the respective course are full.
Normal Flow:	1. System prompts the user to select a student's option (regular or irregular). 2. Student selects the option. 3. Student goes to the course register page. 4. System displays a registration form. 5. The student will click on the course he or she wants to register. 6. Admin will check that seats are full or not. 7. If seats are not full, the student will get a confirmation message. 8. If all seats are occupied, then an apology message will be displayed that all seats are occupied with respect to the course registration.
Alternative Flows:	In the step 2 of normal flow, if the student doesn't see his or her desired course. 1. Student will search for his desired course. 2. The list of all courses will appear. The use case will resume to step 3. In step 4 of normal flow, if the student has not cleared the prerequisite course of the selected course option. 1. System displays a message saying the prerequisite course is not cleared. You cannot register for this desired course. 2. Use case resumes to step 5.
Exceptions:	5A) If a student will not get a confirmation message, 1. The system will ask to press the enter button again. 2. The use case resumes in the next step. 6A) If the student does not get an apology message. 1. The system will redirect to the course page again.

Question 2 [25 points] [CLO 4]

A. Review the given requirements using the checklist & discover possible problems with them. **(10)**

The following requirements are for a library system, which is an interactive system providing access to a large document database and which allows the automated ordering and electronic delivery of documents to local and remote end-users. Some requirements for this system are:

Req. 1 The user interface shall be HTML. Users shall access the system via standard web browsers such as Netscape and Internet Explorer.

Req. 2 The system shall be primarily an end-user system. Users shall use the system within the constraints of the permissions assigned by the administrator to identify, locate, order, and receive documents.
Req. 3 Users shall communicate with the system mainly via the HTML interface.
Req. 4 User shall provide input to the system via the HTML interface.
Req. 5 The system shall give output to the user via the HTML interface, email, and print. The print output will mainly be documents.

Solution:

Redundancy:
Requirement 1 and requirement 3 are same.

Conflict:
There is a conflict between requirement 1 and requirement 4 as both contradict each other. Requirement 1 says to access the user via web. Requirement 4 says to access the user via html interface. Make it clear for users so that they donot have to write html interface directly.

Completeness:
Requirement 5 states that the output shall be 'mainly' documents, remove mainly and define the type of document. Define the html standards and browser version. The word 'standard version' is not defined properly.

B. What is the impact of not including the source and owner attributes of each requirement in a requirements catalog? Select the most appropriate option with justification: **(5)**

a. The requirements would no longer be atomic.
b. The requirements would be more difficult to prioritize.
c. The requirements would be difficult to trace.
d. The requirements would no longer be specific.

Solution:

c. The requirements would be difficult to trace.
If the source and owner attributes for each requirement than the requirements are difficult to trace back the origin from where the requirements are generated and also impossible to determine the exact stakeholders for the requirement.

C. What are the advantages of an organization of having a defined set of traceability policies rather than asking each project manager to specify the traceability information which should be maintained? **(5)**

Solution:

Establishing traceability can help an organization:
1. Track a requirement from conception through to delivery,
2. Plan and manage testing and defect triages better,

3. Reduce leakage, wastage of precious resource on non-priority, or simply non-requirements,
4. Document adequately, and
5. Work effectively in a world of integrations.

D. Suggest how prototyping may be used in the requirements change management process? **(5)**

Solution:

- Streamline change management processes, from identifying and evaluating proposed changes to implementing and tracking them
- Ensure clear communication and alignment among team members, stakeholders, and clients throughout the change process
- Minimize disruptions and risks by effectively managing the impact of changes on ongoing projects
- Maximize success rates by tracking and analyzing the outcomes of implemented changes

Question 3 [25 points] [CLO 3]

A. Explain how security and performance, which are non-functional requirements, may conflict; illustrate your answers with examples. **(5)**
Solution:

Security vs. Performance:

Security means that all data or information related to system inside or its parts will be protected against any virus attacks or any unauthorized access to the system. Performance requirements means how well the software system accomplishes certain functions under specific conditions. This includes the software's speed of response, throughput, execution time and storage capacity. Performance requirements are based on supporting end-user tasks. Performance is basically backend process that is invisible to users. Two attributes can clash because adding more security layers may result in a hit to the performance. Examples: An online video game wants to have low lag but also wants to have an advanced anti-cheat system. These two requirements can clash because an advanced anti cheat system will put extra processing time on each sent packet, which will increase the lag. An antivirus increase security of pc but on the other side, if will occupy most of the RAM which leave greater impact on performance. That' why performance will be decreased. Easy paise application works slow due to security layers and its authentication. It can add more security layers and authentications but the transfer of money will be slow with increasing the security.

B. Write a scenario for deleting information from the library management system, when a student has graduated and left the university. **(5)**

Use Case Name: Delete Information

Priority: 3

Actors: User

Summary: Deleting information allows the user to permanently remove information from the system. Deleting information is only possible when the information has not been used in the system.

Preconditions: Information was previously saved to the system and a user needs to permanently delete the information.

Post-Conditions: The information is no longer available anywhere in the system.

Uses: Record Transactions, Cancel Action

Extends: None

Normal Course of Events:

1. **The use case starts when the user wants to delete an entire set of information such as a user, commission plan, or group.**
2. **The user selects the set of information that he/she would like to delete and directs the system to delete the information. - Exception 1, 2**
3. The system responds by asking the user to confirm deleting the information.
4. The user confirms deletion.
5. Alternative Path: Cancel Action
6. A system responds by deleting the information and notifying the user that the information was deleted from the system.
7. Uses: Record Transaction
8. This use case ends.

Alternative Path - The user does not confirm Deletion

1. If the user does not confirm deletion, the information does not delete.
2. Uses: Cancel Action

Exceptions:

1. The system will not allow a user to delete information that is being used in the system.
2. The system will not allow a user to delete another user that has subordinates.

Assumptions:

1. Deleting information covers a permanent deletion of an entire set of data such as a commission plan, user, group etc. Deleting a portion of an entire set constitutes modifying the set of data.
2. Deleted information is not retained in the system.
3. A user can only delete information that has not been used in the system.

C. Suggest how the following requirements might be rewritten in a quantitative way. **(5)**

Req. 1 The library system shall be easy-to-use.
Req. 2 The library system shall provide reliable service to all classes of users.
Req. 3 The library system shall provide a rapid response to all user requests for book information.

Solution:

Req. 1: The user shall be able to use the library system after 6 hours of training.
Req. 2: The system shall be reliable in such a way all classes of users can perform their tasks with only 2 errors.
Req. 3: The response time of the system for booking information shall be within 2 minutes for all user requests.

D. You are supposed to develop an interaction matrix for the following case study: **(10)**

You are a software engineer working on the development of an e-commerce platform for a client. The platform aims to provide a seamless shopping experience for users, including features like product browsing, order management, and account settings. The project has a set of diverse requirements that need careful analysis to ensure smooth implementation. The requirements are given below:

R1: The homepage should display featured products with large images.
R2: User authentication should be completed using two-factor authentication (2FA).
R3: The shopping cart icon should be prominently displayed on all pages.
R4: The checkout process should be streamlined to minimize steps.
R5: Product recommendations should be shown based on user browsing history.
R6: The payment gateway should support major credit cards and digital wallets.

Rules for the interaction matrix are given below:
- For requirements that conflict, fill in 100.
- For requirements that overlap, fill in 1000.
- For requirements that are independent, fill in 0.

Solution:

	R1	R2	R3	R4	R5	R6
R1	0	0	0	100	0	0
R2	0	0	100	100	0	100
R3	0	100	0	0	0	0
R4	100	100	0	0	0	100
R5	0	0	0	0	0	0
R6	0	100	0	100	0	0

Analysis:
- **Conflicting Requirements (10):**
  - R1 conflicts with R4.
  - R2 conflicts with R3, R4, R6.
  - R3 conflicts with R2.
  - R4 conflicts with R1, R2, R6.

- R6 conflicts with R2, R4.

- **Overlapping Requirements (0):**
  - There are no overlapping requirements in this set.

Problematic Requirements:

- R2, R4, and R6 are the most problematic requirements due to conflicts with multiple other requirements. Resolving conflicts involving these requirements may require careful consideration and negotiation to maintain a coherent and user-friendly e-commerce platform. Addressing these conflicts early in the development process will help avoid rework and ensure a smoother project implementation.

Question 4 [25 points] [CLO 4]

A. You need to develop the requirements traceability matrix for the requirements of your semester project. The matrix should contain the five most essential requirements, with five most significant aspects against which these requirements will be assessed. **(5)**

Solution:

Answer is based on your semester project.

B. Discuss different costs (two types of costs) involved in prototyping and also discuss the drawbacks of prototyping.
(2+3=5)

Solution:

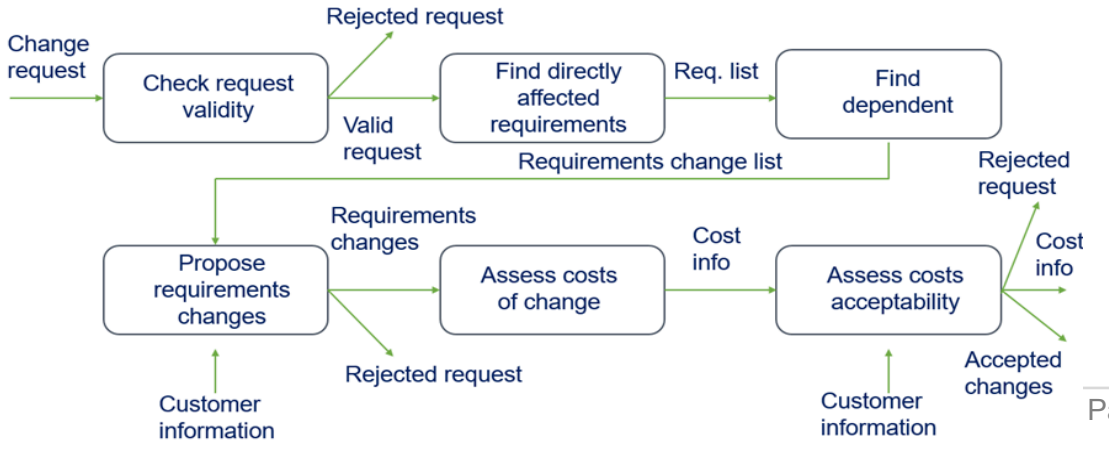
Costs:

❖ **Training costs:**
➢Prototype development may require the use of special purpose tools.
❖ **Development costs:**
➢Depend on the type of prototype being developed.

Draw backs of Prototyping:

❖ **Extended development schedules:**
➢ Developing a prototype may extend the schedule although the prototyping time may be recovered because rework is avoided.
❖ Incompleteness:
➢ It may not be possible to prototype emergent system requirements

C. Using the change analysis process in Figure 1. suggest how software which is commonly available on personal computers (word processor, spreadsheet, etc.) could be used to support this



process.
(5)

Figure 1

Solution:

Take the example of the spell and grammar checker to be added to the existing word processor application. When the customer made a change request to include the spell and grammar checker to the existing system. Once the request is made by the customer, the request is validated, if it is not a valid request it is directly rejected, if valid consider for further processing.

In this case, it seems that the change requested is a valid request, so it is accepted, and in the next step, it is checked that if we incorporate the spell and grammar checker into the existing system, how severely it affects the requirements of the existing system directly. In this way we get the list of requirements, then we try to identify the dependent requirements that may be changed when a spell checker is incorporated. In this way we suggest proposed changes to the requirements. Then we assess the cost of that change. Then we need to assess whether the cost assessment is feasible or not. If feasible changes were approved, if not, the request is rejected.

D. Classify the following requirements from a library system as stable or volatile requirements with valid justification. **(5+5 = 10)**

Req. 1 The cafeteria ordering system shall operate with the following Web browsers: Microsoft Internet Explorer, Netscape Communicator, and Netscape.
Req. 2 The system shall let a patron who is logged in to the cafeteria ordering system place an order for one or more meals.
Req. 3 The patron shall specify whether the order is to be picked up or delivered.
Req. 4 The Cafeteria Ordering System shall send an e-mail message to the patron to confirm acceptance of an order, price, and delivery instructions.
Req: 5 The system shall accommodate 400 users during the peak usage time window of 8:00 a.m. to 10:00 a.m. local time, with an estimated average session duration of 8 minutes.

Solution:

Req. 1: Volatile
Req. 2: Stable
Req. 3: Stable
Req. 4: Stable
Req. 5: Volatile

---------- BEST OF LUCK ----------