**Midterm Practice and Revision Exercise Questions**

Q1. (Architecture Analysis - 8 points)

Identify and write-down 8 Key Abstractions, from the problem statement given below, for a University's Course Registration system which you have been tasked to design and develop.

**Problem Statement:**

ABC University has asked you to design and develop a Course Registration System (CRS). The system will enable its students to register online for courses each semester, as well as track their progress toward completion of their degree.

When a student first enrolls at the university, he/she uses the CRS to create a plan of study that lists the courses he/she plans on taking to satisfy a particular degree program, and chooses a faculty advisor. The CRS will verify whether or not the proposed plan of study satisfies the requirements of the degree that the student is seeking.

Once a plan of study has been established, then, during the registration period preceding each semester, students are able to view the schedule of classes online and choose whichever classes they wish to attend, indicating the preferred section (day of the week and time of day) if the class is offered by more than one professor.

The CRS will verify whether or not the student has satisfied the necessary prerequisites for each requested course by referring to the student's online transcript of courses completed and grades received (the student may also review his/her transcript online at any time).

Assuming that (a) the prerequisites for the requested course(s) are satisfied, (b) the course(s) meet(s) of the student's plan of study requirements, and (c) there is room available in each of the class(es), the student is enrolled in the class(es).

If (a) and (b) are satisfied, but (c) is not, the student is placed on a first-come, first-served wait-list. If a class/section that he/she was previously waitlisted for becomes available (either because some other student has dropped the class or because the seating capacity for the class has been increased), the student is automatically enrolled in the waitlisted class, and an email message to that effect is sent to the student. It is the student’s responsibility to drop the class if it is no longer desired; otherwise, he/she will be billed for the course.

Students may drop a class up to the end of the first week of the semester in which the class is being taught.

A1.

1. Course

2. Student

3. Transcript

4. Faculty (or Professor or FacultyAdvisor)

5. PlanOfStudy

6. DegreeProgram

7. Section (Class or CourseOffering)

8. \*WaitList

9. Semester

10. \*Block

12. ScheduleOfClasses

13. TuitionBill

Q2. What is Software Engineering?

A2. Software engineering studies the principles for creating

reliable and easily maintainable software, on time and

within budget.

Q3. What are the 4 best practices for engineering good software products?

A3.

1. Visually model software -- we will use UML diagrams

2. Develop software iteratively – RUP and Agile processes/best-practices

3. Use component-based architectures – Enterprise Architectures etc.

4. Manage requirements – use cases and user stories

Q4. What is the difference between Git and Github?

A4.

Q5. In the RUP process model, what are the main artifacts of Requirements Analysis?

A5. 3 Parts to System Requirements Specification (SRS) document

1. The use-case model is composed of :

a. use-case diagram(s)

b. use-case descriptions

2. Supplementary Specifications:- Non-Functional Requirements

1. Objective
2. Scope
3. Reliability
4. Performance
5. Security
6. Design Constraints

Q6. With regards to Use-cases; What is a Scenario? What is a Flow?

A6. A scenario is one path through one use case, while a flow is a collection of scenarios with a similar outcome or structure.

Q7. Answer the following questions with True or False.

7.1 (1 point) A Collaboration diagram is one of the main artifacts that is produced from performing Architecture analysis for a new Software system. True or False?

A7.1 False.

7.2 (1 point) A Sequence diagram is the main artifact that is produced from performing Requirements analysis for a new Software system.

True or False?

A7.2 False

Q8. The following question involves multiple choices; choose the correct option(s) by highlighting or putting a circle around it/each:

8.1 (1 point) In a Software development life-cycle where the Rational Unified Process (RUP) model is followed, in what phase(s) is the Software Testing activities performed?

A. Launch

B. **Elaboration**

C. **Construction**

D. **Transition**

E. **Inception**

Q9. Architecture Analysis practice question on - Identifying Key Abstractions:

**Task**: Read the following problem statement carefully, and identify/write-down 8 Key Abstractions.

You have been hired by the Department of Public Libraries for the City of Fairfield, to update their library record keeping. The department currently owns and runs a network of public libraries at three different locations within the city. Currently the libraries share an electronic card catalog that contains information such as author, title, publisher, description and location of all of the books in the library. All the library member information and book check-in and checkout information, however, is still kept on paper, at each location. This system was previously workable, because the Libraries had only a few hundred registered members. Due to the increasing city population, the Library now needs to automate the check-in/checkout system.

The new system will have a web-based application to allow librarians to check-in and checkout books. The system should also maintain information about each publisher, including their head officeheadoffice address and main telephone number, to enable the libraries order new supplies of books. All the books in the library are classified under a subject (such as Science, Arts, Medicine, Poetry, Engineering, Music, History etc.), to enable members find books that are pertaining to a subject which they are interested in.

All books in the library have a unique bookid. The books in the library are ordered on the shelves by their bookid. The new system must allow registered library members to search through the electronic card catalog to find the bookid of the desired book.

The system will run on a server hosted by the library. Librarians and library members will be able to gain access into and use the system through a web-browser interface. However, only librarians are able to check-in and checkout books.

The system will retain information on all library members, including their addresses, phone numbers and their fees payment options (in form of the debit or credit card information, to be used to pay any fees owed). Only valid identifiable residents of the City of Fairfield can become library members. To be registered as a Library member, a valid City of Fairfield-issued identification card is required to be presented to the Librarian. Standard members can check-out books for a maximum of 21 days. If a standard member returns a book later than 21 days, then he/she has to pay an overdue fee of 25 cents per day. Member who are staff of the Library, including the Librarians, can also checkout books for a maximum of 21 days, but pay an overdue fee of 10 cents per day. Members who are senior citizens (i.e. those of age 70 or older) can checkout books for a maximum of 100 days, and they pay only 5 cents per day for every book returned late. The system will keep track of the amount of money that each library member owes the library. No member will be able to checkout a book if they have another book overdue or are owing a fee greater than 100 cents.

A9.

1. LibraryMember

2. LibraryLocation (Library)

3. Book

4. ECardCatalogue

5. CheckoutRecord

6. User

7. Publisher

8. Subject (Category)

9. PaymentOption

10. Address

11. LibraryDB

Q10. (20 points) Create a **Use Case Description** for the following new feature, required for the City of Fairfield Library system, described in Q9 above:

We want to allow library members to renew books that they have checked-out. Library members can review the books they have checked out and select those that they want to renew. Books that are already overdue cannot be renewed. The renewal time is 2 weeks. A checked out book may only be renewed by a library member one time. Library Members can not renew a book if they have more than $100.00 in unpaid fines.

For this question, write the complete use case description including the basic success flow.

A10.

Solution:

**Renew a book (Use-case title – 1 point)**

## **1.1** **Brief Description (1 point)**

## This use case allows a library member to renew books that he/she has checked out

## **1.2** **Actors (1 point)**

## Library Member

## **1.3** **Preconditions (1 point)**

Library Member is logged into the system and at the library member welcome page.

## **1.4** **Flow of Events (6 points – for a reasonable basic flow)**

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#### **Basic Flow (4 points for including checks for each of the business rules)**

|  |  |
| --- | --- |
| **User Action** | **System Response** |
| **1. Library member selects the renew book menu option** | **1. The system retrieves the checkout records for the books that this library member currently has checked out and displays them.** |
| **2. Library member selects a book/checkout record and selects renew.** | **2.1The system checks that the checkout record for this book is not currently overdue, and has not been renewed before. The system checks that this library member does not have unpaid fines over $100.**  **2.2 If all those cases are met the system:**  **2.2.1. updates the due date for the checkout record to add an additional 2 weeks,**  **2.2.2 marks the checkout record as renewed**  **2.2.3 displays a success message to the library member with the new due date.**  **2.3 Otherwise, the system returns a failure to renew message with the reason.** |

## **1.1** **Post-Conditions (1 point)**

**For the success case the book checkout record is updated to be 2 weeks in the future and the checkout record is marked as renewed. This information is saved to the database.**

## **1.2** **Business Rules (4 points)**

**a. Books cannot be renewed more than once**

**b. Overdue books cannot be renewed**

**c. Members with more than $100 in fines cannot renew books.**

**d. The renewal time is 2 weeks.**

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## **1.3** **Nonfunctional Requirements – none (1 point)**

Q11. (8 points) Show two alternate flows for the Use-Case description you have given, in your answer to question 10, above. Present these in 2 separate 2-column tables, with one column for User Action and another for System Response.

A11.

Solution:

**Alternate Flow 1:**

|  |  |
| --- | --- |
| **User Action** | **System Response** |
| 1. Library member selects the renew book form | 1. The system retrieves the checkout records for the books that this library member currently has checked out and displays them. |
| 2. Library member selects a book/checkout record and selects renew. | 2. The system checks the current overdue fine total for this library member. This member has greater than $100 in unpaid fines so the system displays a message explaining that the member must pay his/her overdue fines so that they are less than $100 in order to renew books. |

**Alternate Flow 2:**

|  |  |
| --- | --- |
| **User Action** | **System Response** |
| 1. Library member selects the renew book form | 1. The system retrieves the checkout records for the books that this library member currently has checked out and displays them. |
| 2. Library member selects a book/checkout record and selects renew. | 2. The system checks the check-out record for the selected book for whether the book has been renewed once before. The record shows this to be the case, so the system displays a message explaining that the member has already renewed this checked-out book before and so cannot renew it more than once. |

Q12. (4 points) List the sections of a RUP System Requirements Specification; and for each section indicate if adding this new feature from question 10 above, would change the SRS for the Library system. If a section of the SRS will change then describe or give an example of the change that will result from this new feature.

A12.

Answers: (4 points)

· *Use case diagram – will change to add our library member Actor having one new use case for member renews book.*

· *Use case descriptions will change by adding the use case description from question 1.*

· *Non-functional/supplementary specs will not change*

· *Glossary could change to include the definition of what renew a book means; and any other new domain concept/terms involved in this new use-case.*

Q13. (6 points) From considering the addition of this new feature/Use-case from question 10 above, list three (3) outputs that results from performing the **Architecture analysis** activity and for each one, indicate if/how it will change, due to the adding of this new feature.

A13.

Answers:

*1.* *Key abstractions -- this is our first high-level class diagram which shows key classes we need and obvious attributes. We could add new attributes to the checkout record key abstraction class to determine if it has already been renewed, or is overdue.* (2 points)

*2.* *Architecture mechanism – these are system wide solution for common design problems. For example ORM or web application. These should/would likely/probably not change.* (2 points)

*3.* *System structure and layering. For example we may be using the MVC arch pattern for our system structure. This will not change.* (2 points)

*Thought: What other new Use-case(s) may/can result in change(s) in the Architectural mechanism and the System structure/layering?*

Q14. (6 points) **Use-case Analysis:**

Write-down a list of the analysis classes that will be needed for creating a sequence diagram for the new Use-Case introduced and described in problem 10 above. And for each analysis class, indicate which analysis class stereotype it is.

A14.

Answers: (6 points)

#### **1.** **LibraryDBInterface -- <<Boundary>>**

#### **2.** **MemberRenewBookForm – <<Boundary>>**

#### **3.** **LibraryMember – <<Entity>>**

#### **4.** **CheckoutRecord– <<Entity>>**

#### **5.** **RenewBookController – <<Control>>**

#### **6.** **Book - <<Entity>>**

Q15. (5 points) **Sequence diagram:**

Draw a Sequence diagram for the above “Renew book” use-case:

Q16. (5 points) **VOPC diagram:**

Draw a VOPC (View-of-Participating-Classes) diagram, to show the static model for the classes involved in the above “Renew book” use-case:

Q17. Working with Git and Github:

Briefly describe what you will do to accomplish the following:

You want to contribute to an open-source project named SpringBoot-CLI, which is hosted as a repository on github. But you do not have access as a committer/contributor to the project. What is the process that you require to follow, in order to obtain the source code for the project, add a new feature and have the project owners review and incorporate your new feature into the product.

Note: You may write your description using numbered steps of what you will need to do.

A17.

Steps:

1. create a fork of the project

2. make a clone of your fork/version of the project

3. Add your feature

4. commit your changes and you push it to your version on github

5. Send a pull request

**//-- The End --//**