



Midterm 18 December 2017, questions and answers

Introduction to Software Engineering (Carleton University)



## Department of Systems and Computer Engineering

### Midterm Examination

**SYSC 3020: Introduction to Software Engineering, Winter 2017**

**Instructor: Dr. Muhammad Raisul Alam**

**Duration: 70 minutes**

**Total Marks: 50**

**Name:** \_\_\_\_\_

**Student Number:** \_\_\_\_\_

#### **Instructions:**

1. All questions are to be answered on this question paper. **Use the back of pages if extra space is required.**
2. Answer all questions.
3. You are allowed to use a cheat sheet (only one side of the page). No books, calculators or other aids allowed.
4. Use the number of marks allotted for each question to estimate the amount of time you should devote to that question.
5. **Do not detach any pages from your test paper.**

**DO NOT ASK QUESTIONS during the test. If you think there is insufficient information to answer a question, then write down a reasonable assumption that allows you to continue (and continue).**

#### **GRADE**

<b>Q1 / 10</b>		<b>Q3 / 15</b>	
<b>Q2 / 15</b>		<b>Q4 / 10</b>	
<b>Total / 50</b>			

## Part I

### Question 1. Short Questions [10 marks]

a) What are the seven steps of the Waterfall Model of the Software Development Process? [7 marks]

**1 mark for each step, max 6 marks. 1 mark for correct order. Total 7 marks.**

1. Requirements (it could be divided into system requirement and software requirement)
2. Specification (accept as correct answer if they mention “Analysis”)
3. Design
4. Implementation (or coding)
5. Integration deployment (or testing )
6. Maintenance

**The answers could be brief. If attempted, give 1 mark for trying. If not answered, give 0.**

b) What are the limitations of the Waterfall model? [3 marks]

**2 marks for the following point.**

1. Each step was essentially cast in stone, so there was not provision to going back and making changes to earlier phases. Real projects rarely follow sequential flow.

**1 mark for any of the following points (Max 1 mark).**

1. Difficult for stakeholder to state all requirements at once.
2. Working software comes late in process.
3. Testing doesn't start until implementation complete.

**The answers could be brief. If attempted, give 1 mark for trying. If not answered, give 0.**

## Part II

We are performing requirements elicitation and analysis for a library self-checkout system. The system of interest does not include the main library management system, it is only the software running at the self-checkout station itself.

The self-checkout system is a counter where library patrons can checkout the books they want to borrow, without requiring the assistance of a librarian. The system includes a card reader (for library cards), a touchscreen, a barcode scanner, and an electronic device to activate or deactivate the magnetic anti-theft strip attached to library books.

The functionality of the system is described by the following scenarios.

**Scenario 1.**

Alice arrives at the self-checkout station of the library. She has two books that she wants to check out. She swipes her library card through the card reader, and the touchscreen displays a numeric pad where she types her PIN. The system checks her PIN and account status by communicating with the main library system. Her identity is confirmed, and it is indicated that she already has one book checked out, which is listed on the screen with its due date.

Alice places the book on the machine, and slides the book label under the barcode reader. The system reads the barcode, sends a request to the main library system to validate the book (ensure that it is available) and request its checkout. Meanwhile, the screen displays an hourglass symbol letting the user know that the system is processing the current book. The main library system responds with an ok message and the book information. The system then deactivates the magnetic anti-theft device on the book, and displays the book information on the screen. Alice takes her second book and repeats the operation. The second book is also accepted, and the system is waiting for more books. Alice selects a button on the touchscreen to finish the process. The system then prints a receipt listing the books that Alice has checked out and their due date.

**Scenario 2.**

Alfred arrives at the self-checkout station of the library. He has one book to check out. He swipes his library card through the card reader, and types in his PIN. The system validates his identity and indicates that he already has four books checked out, which are listed on the screen.

Alfred places his book on the machine and slides the book label under the barcode reader. The system requests the checkout. The checkout is accepted. The system calculates that Alfred now has checked out five books, which is the maximum allowed. The system therefore displays a message indicating that the maximum number of books has been reached and automatically terminates the session. The system then prints a receipt listing the books that Alfred has checked out and their due date.

**Scenario 3.**

Anna arrives at the self-checkout counter with four books. She swipes her card and keys in her PIN. The system communicates with the main library system, and the response is that the PIN is incorrect. A message indicating this is displayed on the touchscreen. Anna tries a second time, and again her request is denied. Anna decides she must have forgotten her PIN and selects the "cancel" button next to the numeric pad. She then goes to the main circulation desk to resolve her problem.

**Question 2: Use case [15 marks]**

Based on these three scenarios, write a complete description of the "checkout book" use case. Include pre- and post-conditions, the list of actors involved in the use case (specify which is the primary actor), and the flow of events.

Include the specific alternative flows illustrated by the scenarios. Do not describe any functionality which is not given by the scenarios.

**Use Case:** Checkout Books. (1 mark for a name)

**Pre-conditions:** None (system running and idle). (1 mark)

**Post-conditions:** The magnetic stripe has been de-activated for the checked out books. Patron has checked out a maximum of 5 books. (1 mark)

**Actors:** Patron (primary actor), Library system. (1 mark for identifying the primary actor)

**Max. 2 marks for the following steps.**

**Basic Flow:**

1. A patron swipes their library card.
2. The system displays a keypad on the touchscreen.
3. The patron enters her PIN.
4. The system sends the card information and PIN to the main library system.

**Max. 2 marks for implementing the PIN validation steps properly (see Scenarios 1 and 3).**

(Some student may use **VALIDATE THAT** and include another **Alternate Flow** below)

5. The main library system responds with the account information or a message indicating that the PIN is incorrect.
6. IF the PIN is incorrect THEN return to step 2.

**Max. 2 marks for implementing these steps (see the 2<sup>nd</sup> paragraph of Scenario 1).**

7. DO
8. The system displays the user account information on the screen.
9. The patron scans a book under the barcode reader.
10. The system sends the book information to the main library system.
11. The main library system responds with the book information.
12. The system deactivates the magnetic strip on the book.
13. UNTIL the user selects the “finish” button.

**1 mark for the following step.**

14. The system prints a receipt of the checkout.

**Max 2 marks. This flow is related to Scenario 3.**

**Specific Alternative Flow 1:**

RFS Basic Flow Step 3 (1 mark)

**1 mark for the following steps.**

1. The customer chooses the cancel button.
2. ABORT use case.

**Max. 2 marks. This flow is related to Scenario 2.**

**Specific Alternative Flow 2:**

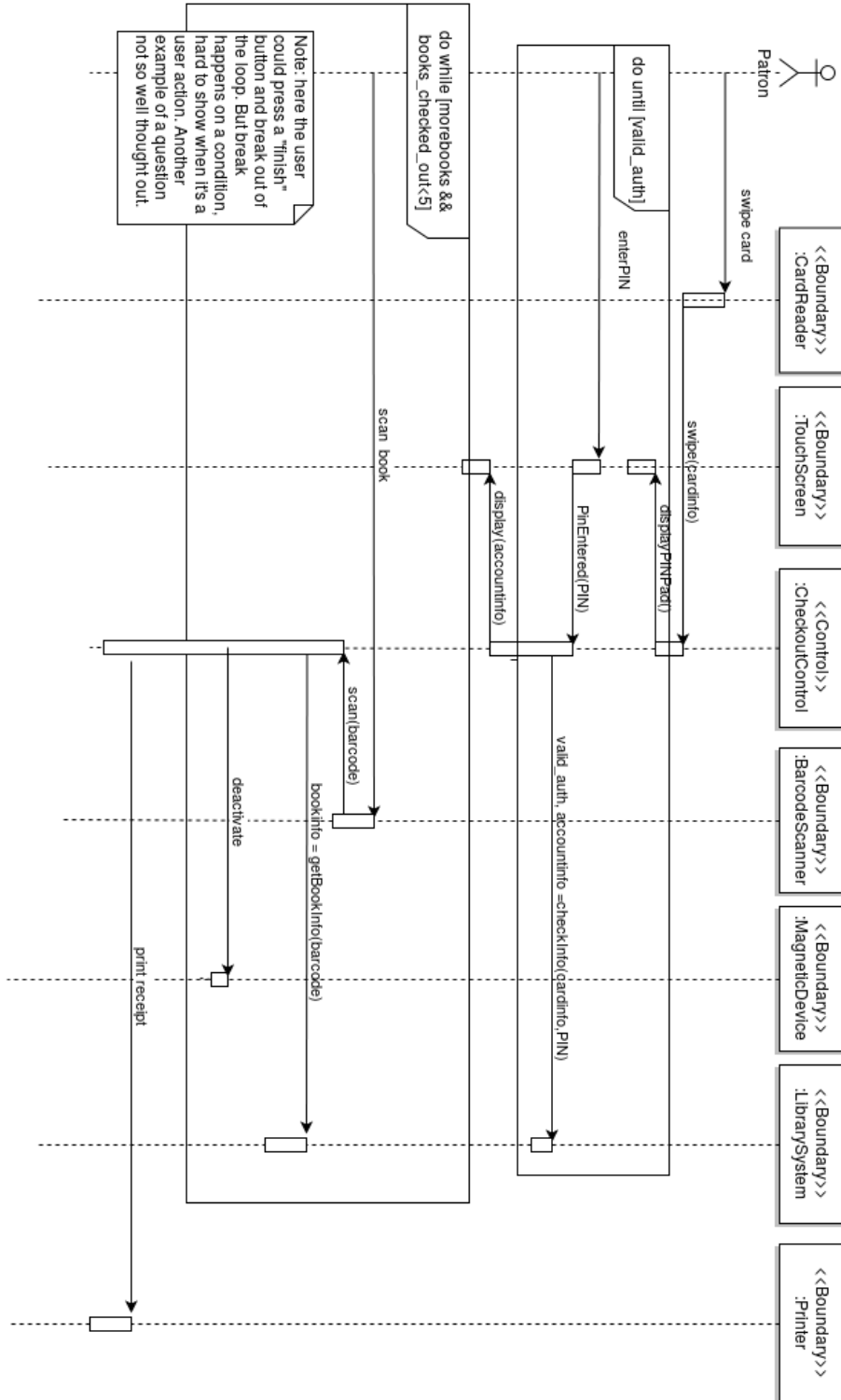
RFS Basic Flow Step 7 (1 mark)

1. IF the patron already has 5 books checked out, THEN RESUME Basic Flow Step 13, END IF. (1 mark)

**This is a sample solution. 2 marks for trying (or instead of use case, they answered use case diagram). 0 mark, if not answered.**

**Question 3. Sequence diagram [15 marks]**

Draw a sequence diagram to illustrate the use case. Annotate each class involved in the use case as entity, boundary, or control. Introduce a class "CheckoutControl" to handle the main use case functionality.

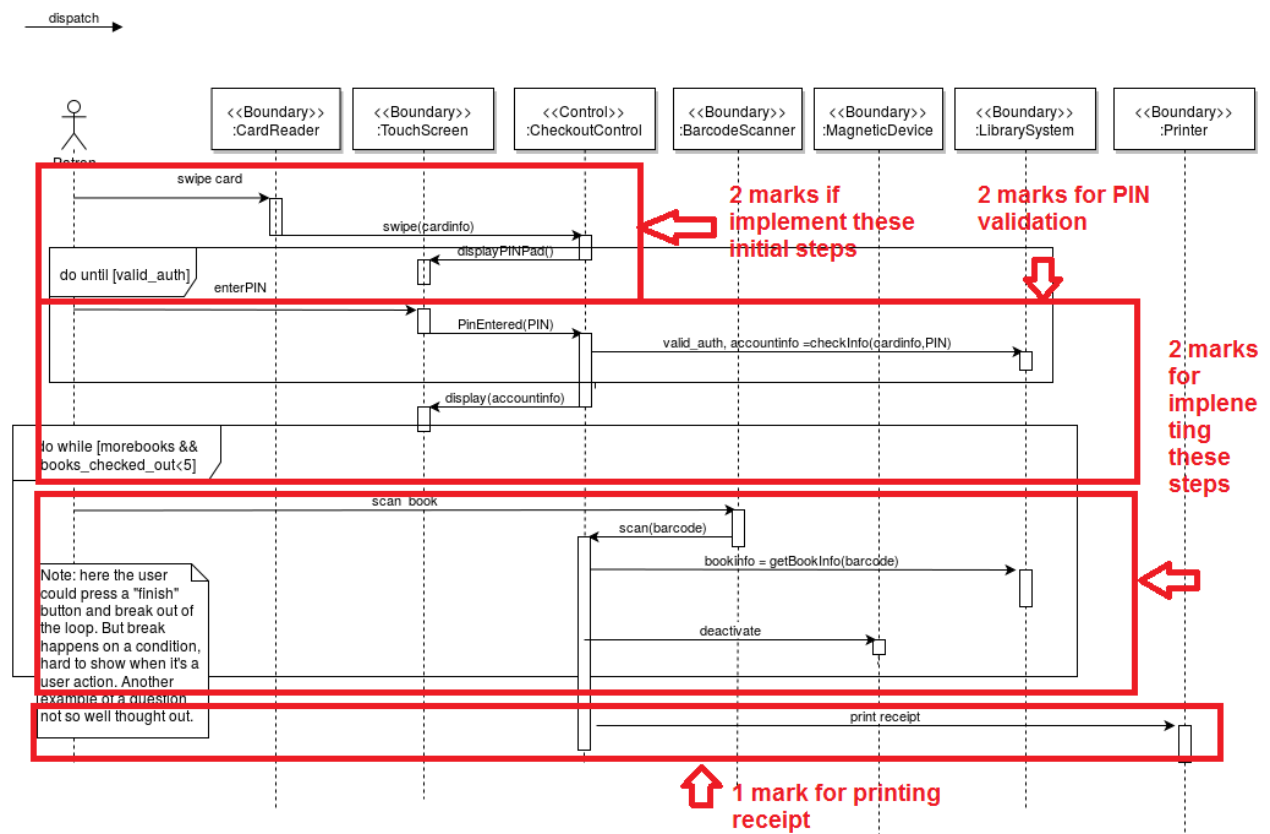


1 mark: If there is an actor (Patron)

1 mark for each class (if the class name seems logical). Max. 5 marks.

2 marks if the entity, boundary and control class identified properly (considering the classes are correct, verify that they identified these 3 types correctly).

7 marks as shown in the following figure. For each marking break down, give full mark if attempted or partial implementation. For example, if a student attempted PIN validation sequences, give him 2 marks.



Sample solution. 2 marks for trying. 0 mark, if not answered.

**Part III**

You are doing some requirement analysis for a hotel management system. Here is some information about the system.

The client is a chain (e.g. Hilton), that manages multiple hotels. Each guest may reserve one or several rooms. Reservations can only be applied to available rooms, which then become reserved. If the customer cancels the reservation or does not show up by 5pm on the start date of the reservation, the room goes back to being available. Once the customer checks in, the room becomes occupied. Once the customer checks out, the room must be cleaned before it becomes available again.

**Question 4. State Diagram [10 marks]**

Draw a UML state diagram to model this process. Identify which class this diagram relates to.

**Class name (Max. 1 mark)**

**1 mark: If the student can identify the class as “Hotel Room” or “Room”**

**States: (Max. 4 marks)**

**4 marks: If identified all 4 states correctly**

**3 marks: If identified 3 states correctly**

**2 marks: If identified 2 states correctly**

**1 marks: If identified 1 state correctly**

**Transitions: (Max. 5 marks)**

**5 marks: If identified all 5 transitions correctly**

**4 marks: If identified 4 transitions correctly**

**3 marks: If identified 3 transitions correctly**

**2 marks: If identified 2 transitions correctly**

**1 marks: If identified 1 transition correctly**

**Total 10 marks. If attempted, give 2 marks for trying. If blank, give 0.**

