STRATHMORE UNIVERSITY
FACULTY OF INFORMATION TECHNOLOGY
MASTER OF SCIENCE IN INFORMATION SYSTEMS SECURITY
END OF SEMESTER EXAMINATION
MST 8402 - SECURE SOFTWARE MODELLING

DATE: 17 April, 2018 **Time: 2.5 Hours**

Instructions:

1. Answer **Question 1 (Compulsory)** and any other **TWO** questions. Attempts to Questions 1 and 2 should use the **Video Rental System** scenario described below.
2. You can use limited aspects of the Case Study on which to focus your answers. You are not expected to solve the whole case. Support each with design decisions and assumptions.

Video Rental System

Introduction

Jasho Video Store is a rental shop which allows consumers to temporarily obtain a product for a specified period of time in exchange for payment, a process known as renting. Jasho Video Store was established by a group of brothers who joined hands and tried to capture the most attractive sector in our today's life which is the Music Industry. It is a small business situated in the heart of Kericho town and it has rapidly grown due to high demand for latest movies, the advent of new technologies, the launching of rural electrification program by the Government, the need for information, video and music entertainment. Jasho Video Store typically conducts its business with customers under conditions and terms agreed upon in a rental agreement or contract, which may be implied, explicit, or written.

It also offers Music and Computer Games as well. They use kiosk or vending machine to dispense and collect rentals, other types of rentals which they use include cars, truck rentals, construction and heavy equipment and costume rentals. As music entertainment has gained grounds in Kenya and the world at large in both rural and urban homes, places of worship and entertainment joints, Jasho Video Store offers DVDs, VCDs and CDs in a convenient way since one copy can be rented by various people at different times.

Video Renting Concept

Jasho Video Store is a commercially operated Library that lends videos to registered users at a fixed charge per video for a given period of time. A customer must register with the store and pay a registration fee as stipulated in the terms and conditions as stated earlier. A customer then comes to the store and requests for a video. Counter checking is done to verify that the customer is registered and that he has no pending case, if so the customer is able to rent otherwise not. If a customer rents a video and returns late that is after the due date or he loses it then a fee is charged as determined by the management. Jasho Video Store has been facing

challenges due to rigorous competition in the video rental industry due to price reduction from other retailers, in particular from mass merchant retailers, who have affected consumer rental and purchasing behaviour.

Jasho Video Store low number of clientele has been attributed to slow and cumbersome process one has to go through to rent a movie. Research indicates that, the company's inability to generate efficient database queries and capture critical information in a central location is giving competitors the advantage, hence the low number of customers and loss in profit. The complex nature of the existing rental process can be attributed to a number of factors:

- Most of the operations are done manually (a new customer will have to manually fill out an application form before a clerk enters the information into the system) this results in a lot of mistakes being made.
- The manual movement and distribution of paper-based transactions resulted in substantial delays within the process and significantly limited the company's ability to prioritize and improve performance.
- Processes requiring precise coordination between groups in different departments tend out to be very challenging.
- There is no centralized repository, hence change in data by one department may not reflect in another department.
- Customer transactions (i.e. requests for statements, incorrect information, address changes, etc.) are frequently lost due to the mobility of information from one department to the other.
- Tracking and evaluating the rental process by management to determine areas that need improvement is almost impossible.

Unfulfilled Information Needs

The owners of Jasho Video Stores wanted to create a new business plan whereby to rent a video (except the picking up and returning of videos) was done online. Therefore, the new Video Rental System (VRS) would allow the following functionality online: to search for videos, to register as members online and modify membership information, to rent videos and pay overdue fees, to process the rented or returned videos, to add or remove video records to/from his store's video inventory and to manage video information, simplify information retrieval at any point in time and eliminate data redundancy in records.

Question 1 (Compulsory):

(a) For the Video Rental System Case Study above, list at least four stakeholders and explain their respective interests or needs/goals from the proposed System [**3 Marks**]

(b) Using Video Rental System case, draw a Use Case Diagram with at least eight use cases and five actors. Illustrate your understanding of the concepts by establishing <<includes>> and <<extends>> relationships between the use cases where appropriate. [**6 Marks**]

(c) Using Video Rental System Case Study and Appendix Table A1 and A2, create a partial domain model and illustrate it in Unified Modelling Language (UML) notation with at least ten (10) concepts. Show the identified concepts, associations and attributes in a partial domain model diagram. [**8 Marks**].

(d) What are the most common mistakes to partial domain modeling exercise for such a Case Study like the Video Rental System mentioned here? [**3 Marks**]

Question 2:

Consider a *Use Case Scenario* for "Save a document to a HTML File" below for a System under Discussion for an institution of higher learning like Strathmore University:

1. The uses commands the software to save a file.
2. The software presents a File Save dialog box, where the directory, filename and document type can be viewed and modified.
3. If the file is being saved for the first time and it has not been given a filename by the user, a filename is constructed based on the first line of the text in the document and a default file extension.
4. The user selects a HTML document type from the File dialog's options, which replaces the default file extension to ".htm" if needed.
5. The user adjusts the filename and the directory location as desired.
6. The user commands the software to complete the Save Document command.
7. The software warns the user that formatting information may be lost if the file is saved in HTML format. The user is presented with the option of cancelling or continuing the save operation.
8. The user chooses to save the document in the HTML format.
9. The software saves the document and redisplays the newly reformatted contents. Certain formatting information, such as bullets, indentations, and font choices, may have been altered from their original.

(a) In what phase of Software Modeling as per the Unified Process (UP) is a System Sequence Diagram (SSD) drawn? Why? [**3 Marks**]

(b) From the use case scenario give above, prepare the appropriate System Sequence Diagram (SSD) to Save a Document File to HTML File use case narrative. [**7 Marks**]

(c) In the format of NextGen Point of Sale (POS) demonstrated in our lectures, create an operation contract for *confirmFileSavePossibility().* Choose the appropriate parameters for this operation contract. If you make any assumptions, do note them down clearly. [**5 Marks**]

Question 3:

(a) In our Lecture Series we had an example Case of the Library Information System. In this case, consider as scenario whereby a Patron takes a Book to Library Assistant for borrowing as given:

- The Library Assistant checks ***PatronRecord()*** *and* continues with the borrowing process if ***PatronRecord()*** shows that Patron does not have overdue books/fines.
- The Library Assistant checks the ***BookRecord()*** and continues with the borrowing process if ***BookRecord()*** show that the Book can be borrowed.
- The Library Assistant issues the Book to the Patron by updating the Patron's ***PatronRecord().***
- The Library Assistant updates the Book's ***BookRecord().***

Based on the above series of events in the scenario, draw n System Sequence diagram showing the flow of message as described in this book borrowing scenario? [**8 Marks**]

(b) Briefly explain the advantages of test-first programming in the process of mapping design to code? [**4 Marks**]

(c) What do you understand as a responsibility when it comes to behaviour to interacting objects in modeling? Briefly explain the two responsibilities [**3 Marks**]

Question 4:

(a) Consider an Information System for a *Golf Membership* from your general knowledge about the game of Golf. Using a UML collaboration diagram confirm one is a member of the Golf Club, *confirmMembership(MemberID),* let a staff check the status of the annual fees subscription, *confirmSubscriptionStatus (MemberID)* and finally let administrative staff record the use of golf services like room allocation etc. to a full paid-up member, *recordRoomAllocation(MemberID).*
You should indicate on the diagram all the three incoming messages with the first having been given below. Annotate every message with the hint GRASP (Expert, Creator, and so on) and/or other pattern that justifies it. If you add responsibilities not explicit in the contract (because you think they are important to fulfil), please briefly explain these additions [**12 Marks**]

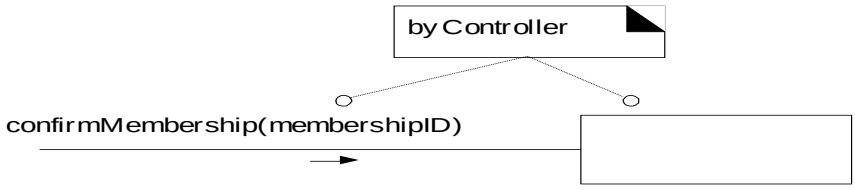

Figure Q3: GRASP Pattern Diagram

(b) Explain using an appropriate example how attribute visibility is attained in a Design Model? [**3 Marks**]

Appendix A: Conceptual Modelling Lists

Table A.1: Conceptual Class Category List

S/No.	Conceptual Class Identification
1.	Physical or Tangible Objects
2.	Specifications, Designs or Discipline of Things
3.	Places
4.	Transactions
5.	Transactions Line Item
6.	Roles of People
7.	Container of Other Things
8.	Things in Container
9.	Other Computer or Electro-mechanical Systems external to System
10.	Abstract Noun Concepts
11.	Organizations
12.	Events
13.	Processes (often note represented as a concept by my be)
14.	Rules and Policies
15.	Catalogs
16.	Financial Instruments and Services

Table A.2: Common Association List for associations between Concepts X and Y

S/No.	Commons Associations List
1.	X is physical part of Y
2.	X is logical part of Y
3.	X is physically contained in Y
4.	X is logically contained in Y
5.	X is a description for Y
6.	X is a line item of a transaction or report of Y
7.	X is known/ logged/ recorded/ reported/ captured in Y
8.	X is a member of Y
9.	X uses or manages Y
10.	X is next to Y