National University of Computer and Emerging Sciences
Lahore Campus

Software Engineering (CS3009)

Sessional-II Exam

Total Time (Hrs): 1
Total Marks: 45
Total Questions: 3

Date: April 10th 2025

Course Instructor(s)
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221-0504 _____ _____
Roll No Section Student Signature

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Attempt all the questions.

1. Do not submit any extra sheet(s).
2. Use of a single-sided, handwritten help sheet of A-4 size is allowed. Photocopies are not allowed.
3. Provide answers in the sequence in which the questions and parts appear on the question paper.

CLO 1: Develop a model of requirements for a software system

Q1: A catering store lends items to customers for a fee. They need a computerized system that helps them run their daily business. Description of their daily business is as follows:

Only a registered customer can borrow items from the store. New customers register by filling out a form with their personal details, credit card details, and paying subscription fee. On successful payment of subscription fee, the customer is issued a membership card by the store. The membership card has a unique membership id which is later used when borrowing items. Each new customer's data is also added to the customer file. A customer can request an item by providing item details, his/her membership id, and payment – payment is always through the credit card used to open the customer account. On the successful payment the customer is handed over the requested item by the store and the record is saved in the loans register. The customer then returns the item to the store after using it and the store updates the loans record. When a borrowed item is overdue by a day the customer's credit card is charged, and a reminder letter is sent to the customer. Each day after that a further transaction on card is made, and each week a reminder letter is sent. This continues until either the customer returns the item, or the charges are equal to the cost of replacing the item - written in the stocks records. Level 1 DFD for the store is given in Figure 1.

To do: List the primitive and non-primitive processes. **Refine** the diagram to level 2. **Strictly** follow the DFD notation. [2+10+3=15 marks]

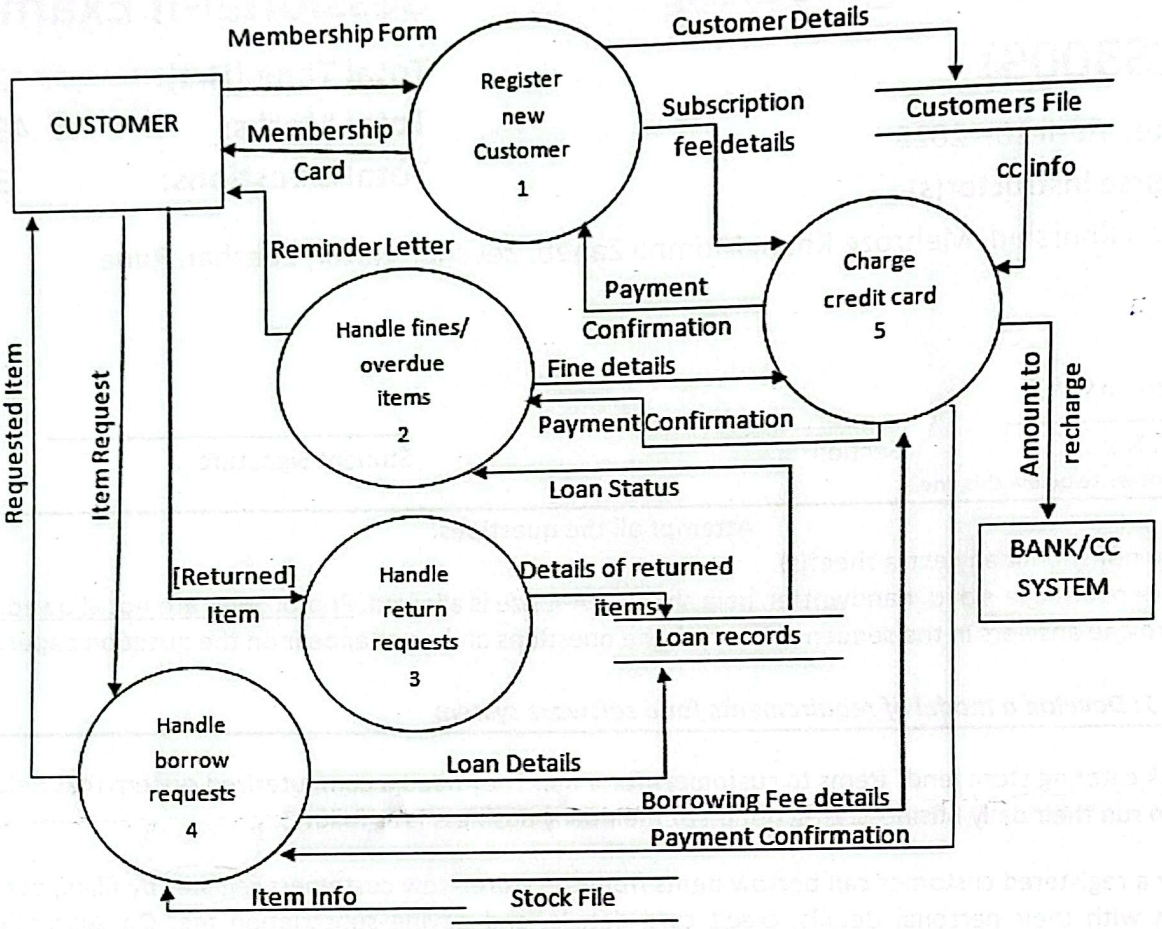

Figure 1: Level-1 DFD for the catering store

CLO 2: Design architecture of a software system by choosing the most appropriate archi styles

Q2: A cryptocurrency mining app (namely CryptoM) allows its users to grow their digital currency holdings directly through the mobile phones of the users. It also serves as a wallet to hold the digital assets of the users. This mobile app is energy-light and uses the resources as efficiently as possible. This app uses the mobile devices of the users as edge devices and allows the CryptoM company to avoid the need of high end computers and incur high electricity bills. This user centric decentralized app involves nodes (smartphones) that communicate with each other to mine the cryptocurrency securely. These nodes use a consensus algorithm to validate transactions and host a distributed ledger in parts. This distributed ledger (either whole or in parts) is available at multiple nodes. When requested by a particular node, the concerned node(s) share(s) the available version of the ledger with all concerned.

Suggest in one line the architecture style(s) that should be used for the architecture of CryptoM application. **Provide** an architecture diagram for the CryptoM application having 5 nodes actively involved in mining. **Label** the diagram completely and correctly. **Give reason(s)** for selecting the architecture style(s). [1+10+1+3 =15 Marks]

CLO 2: Design architecture of a software system by choosing the most appropriate archi styles

Q3: Consider the DFD in Figure 2 for a library management system. Arrow labels have been removed for simplicity. **Perform** structured design and **provide** the call-and-return architecture for this DFD. Design heuristics should be used to produce the final (i.e., most refined) architecture. Also **mark the flow boundaries** in the DFD provided Figure 2. The following information should be used for mapping:

- There are 2 Transaction center: " f ", " h ".
- There are 2 Transform center: "m" and "n" (together); "q". [15 marks]

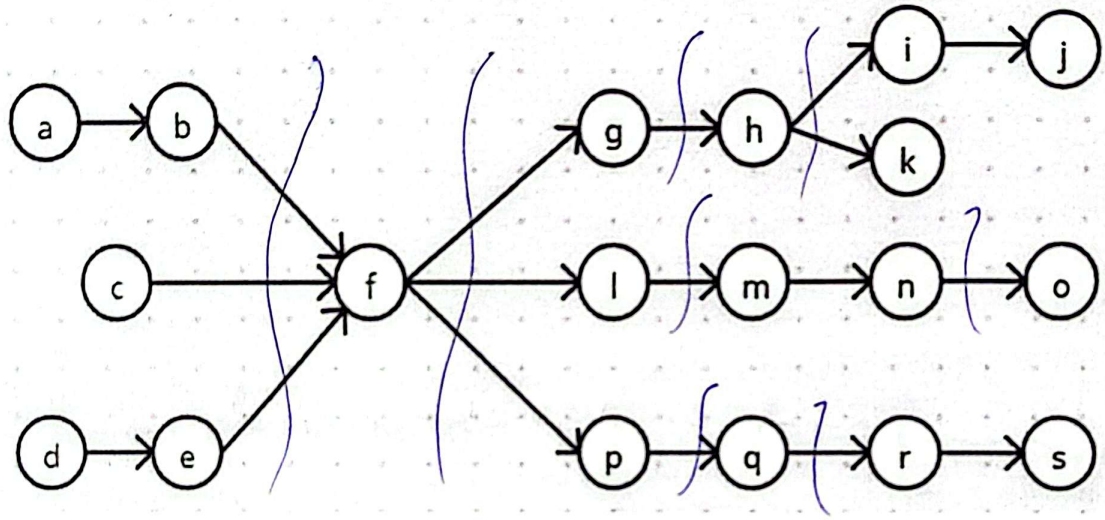

Figure 2: DFD for Library Management System