ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION   **SUMMER SEMESTER, 2021-2022**
DURATION: 1 HOUR 30 MINUTES   **FULL MARKS: 75**

SWE 4601: Software Design and Architectures

Programmable calculators are not allowed. Do not write anything on the question paper.
Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

---

1. A group of 8 developers created an application using monolithic architecture. However, after some releases, they realized that the application's ability to handle increased loads through vertical scaling was insufficient. They also noticed that different parts of the application needed to utilize different technological systems. The team believed that moving to a microservice architecture would solve these issues, so they quickly made the switch without carefully considering the consequences. Currently, the developers are facing problems to ensure the following:

   a)   i. Change of one microservice requires changes to other microservices. 5×4
         ii. Inconsistency of data across the databases for multiple services.   (CO2)
        iii. Configurations of the environments can not be decoupled from the application code.   (PO2)
        iv. Discovery of active instances of microservices.
         v. Duplication of code across multiple services to support some functionality like authentication and authorization.

   Identify the design faults that created the problems. Propose and defend your solution for each problem by recommending microservice patterns.

   b) What is a snapshot in event sourcing? Briefly explain event sourcing with an example.   5
        (CO1)
        (PO1)

2. a) Some people argue that software design should be completed prior to coding, while others   5
   believe that coding itself constitutes software design. Which viewpoint do you support and   (CO1)
   why?   (PO2)

   b) Suppose an application has two endpoints to interact with it.

   - *GET /api/products/*   for retrieving all products from a database.
   - *POST /api/:user_id/image_upload*   for uploading an image of a user.

   The first endpoint can be accessed either with authentication or without, however, the second endpoint requires authentication. Uploading an image also requires compressing, resizing, and storing the image in the database.

        i. Create a serverless architecture to depict this system and explain its components.   8
        (CO2)
        (PO2)

        ii. Mention possible advantages and disadvantages of serverless architecture in relation to   6
        the given scenario.   (CO2)
        (PO2)

   c) Abstraction and Separation of Concerns are two desirable characteristics of software design.   6
   How do Layered, Microservice, and Serverless architecture realize these characteristics?   (CO1)
        (PO1)

3. a) A user named Alice wants to use a ride-sharing app like Uber. She inputs her destination, and vehicle type to request a ride. Based on availability, a driver named Bob accepts the ride request. The app calculates the fare based on the distance of the ride and displays it to Alice. Bob picks up Alice and they start the ride. At the end of the ride, Alice pays the fare through the app using a credit card. Alice and Bob rate each other on the app to provide review and feedback.

    i. Design a reporting database schema by identifying at least 5 tables, relevant fields at least 4 for each table, and relations to represent the system.

        12
        (CO2)
        (PO2)

    ii. Suppose, the **Rides** table has a field named **destination** along with other fields. A new change request proposes to add a field **Metropolitan area** which may have values (yes, no) in the table. Now, write a SQL migration script by following evolutionary database practices such as *change_log*.

        6
        (CO2)
        (PO2)

b) Briefly explain a scenario where a layered software architecture is desirable by mentioning bad principles which need to be avoided.

        7
        (CO1)
        (PO1)