

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

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SEMESTER FINAL EXAMINATION

SUMMER SEMESTER, 2022-2023

DURATION: 3 HOURS

FULL MARKS: 150

SWE 4601: Software Design and Architectures**Programmable calculators are not allowed. Do not write anything on the question paper.**Answer all **6 (six)** questions. Figures in the right margin indicate full marks of questions with corresponding COs and POs in parentheses.

1. A mobile app called "TravelMate" is designed to enhance travel experiences. The app allows users to plan trips, discover new destinations, and share their adventures with friends. Upon launching the app, users are greeted with a personalized dashboard displaying weather updates, local events, and travel tips based on their preferences and current location.

To plan a trip, users can enter their destination and travel dates. The app then suggests popular attractions, restaurants, and accommodations in that area. Users can view detailed information about each suggestion, including reviews, photos, and directions. They can also add these suggestions to their itinerary and share it with friends.

For navigation, TravelMate integrates with map APIs to provide real-time directions, traffic updates, and estimated arrival times. Users can also explore nearby attractions and find the best routes to reach them. Additionally, the app offers offline maps for areas with limited connectivity, ensuring users can navigate even without internet access.

To enhance social interaction, TravelMate allows users to connect with friends and share their travel plans. Users can see their friends' upcoming trips, and join them if interested. The app also includes a chat feature for easy communication between travelers.

TravelMate prioritizes user privacy and security. It requests access to contacts and media storage to facilitate trip planning with friends and to share photos and videos. It also provides high-performance and good user interfaces.

Based on this scenario answer all sub-questions of Question 1 and Question 2.

- | | |
|---|----------------------|
| a) What is the purpose of an architectural context diagram? Draw an architectural context Diagram of the scenario. | 5
(CO2)
(PO1) |
| b) Draw a component-level diagram by identifying major and granular components. Design at least 4 analyses and design classes of identified components. | 15
(CO2)
(PO1) |
| c) What is the purpose of the deployment diagram? Draw a deployment diagram for the application. | 5
(CO2)
(PO1) |
| 2. a) Identify possible states and draw a state transition diagram for the 2 nd paragraph of the aforementioned scenario. | 10
(CO3)
(PO2) |
| b) Identify at least 6 views of the application and create NSU for those views. | 9
(CO3)
(PO2) |
| c) Draw a user interface for the nearby attractions view. | 6
(CO2)
(PO1) |

3. a) A software development team has been working on a large-scale web application for several years. Initially, the architecture was well-defined and followed best practices. However, as the project evolved, the team encountered challenges in maintaining the architectural integrity. Moreover, the system's overall complexity is increased and development speed is decreased. Experts suggested that the system is facing architectural decay.
Do you agree with the expert's opinion? Justify your answer by mentioning the symptoms of architectural decay. What are the practices that you can apply to identify architectural decay.
- b) What is the purpose of Message Broker? Briefly explain the key components of Message Broker Architecture with a diagram.
- c) What are the key design goals for a web application in terms of consistency?
4. a) Describe the role of event-driven architecture in building scalable and responsive software systems. Provide an example scenario where event-driven architecture would be beneficial.
- b) Briefly explain various types of session states by mentioning suitable use cases and limitations.
- c) Describe the necessity of vertical and horizontal partitioning to derive program architecture.
- d) Suppose, you have two microservices. One is Book service which is responsible for serving the details of books, and another is Author service which is responsible for serving the details of authors. Table 1 contains several endpoints for the application.

Table 1: A table of APIs for Question 4.d

Method	End Point	Description
GET	/api/books/	Get all books
GET	/api/books/:id	Get a book details, including author_id
POST	/api/books/	Add a new book
GET	/api/authors	Get all authors
GET	/api/authors/:id	Get author details, including book_id
POST	/api/authors/	Create a new author

Now, you have to implement a search feature that will return all authors whose name starts with 'J'; and return all books written by the authors whose book title starts with 'R'. Assume, there will be thousands of calls to the services and you have to uphold specific availability and throughput of the application.

- What problems will you encounter if you keep the aforementioned two services and implement the search feature?
- What are the alternative solutions that can be used? Give your constructive feedback.

- a) Differentiate MVC from MVP architecture by representing appropriate figures. 6
(CO1)
(PO1)
- b) Suppose, you have developed a very basic Version Control System (VCS). Figure 1 shows the revision history of a project that was done using your VCS. Abdullah and Bushra, two developers of the project, split into two branches from the main branch at revision 0. Bushra merged her changes in the main branch in revision 11, Abdullah merged in the main branch at revision 12. 4 + 4
(CO2)
(PO2)



Figure 1: Git commit representation for Question 5.b

- i. Abdullah and Bushra both changed a file named *thecode.c* in their respective branches. The VCS, unfortunately, cannot track which files were changed. What problem can happen in this situation?
 - ii. The system has an auto-sync feature which pull changes automatically, when any change is pushed. Bushra has enabled this feature. For a critical bug, she had to manually check all the 30 files in a folder. When she was looking into the 20th file (sorted alphabetically), Abdullah pushed 3 files into that folder. What problem can happen in this situation?
- c) A software development team is working on a web application developed using Node JS. The team uses Git for version controlling and has set up a Continuous Integration (CI) pipeline using GitHub Actions. The CI pipeline is configured to trigger a build whenever changes are pushed to the main branch. The build process includes installing dependency, compiling the code, running unit tests, and deploying the application to a staging environment for testing. Once the application passes all tests in the staging environment, it is automatically deployed to production. 6 + 8
(CO2)
(PO2)
- i. Define workflow. Write a workflow script considering the above description.
 - ii. What are the possible anti-patterns the team could face? Briefly discuss each of those.
6. a) "Coupling view code with business logic code is considered bad architectural design." Briefly explain the phenomenon for web applications. Propose an architecture along with partial code to resolve the problem. 3 + 7
(CO3)
(PO3)
- b) How to perform database migration by following evolutionary database practices? Explain with a diagram. 8
(CO2)
(PO1)
- c) Differentiate between the Snowflake and Star schema of the reporting database. 4
(CO1)
(PO1)