

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

SEMESTER FINAL EXAMINATION  
 DURATION: 3 HOURS

SUMMER SEMESTER, 2022-2023  
 FULL MARKS: 150

**CSE 4461: Computer Science and Technology II**

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) What is "Concurrency Control" in database systems? Explain using a relevant example.  | 5<br>(CO1)<br>(PO1)     |
|    | b) Bloom's Bakery is a family-owned bakery with a loyal customer base. Currently, they use a basic on-premise server to store customer data, online order information, and their recipe database. However, they have recently garnered a lot of attention on social media, resulting in a drastic increase of customers. Their on-premise server is getting easily overwhelmed. Given the challenges Bloom's Bakery is facing, what would be your advice on resolving them? Discuss the specific benefits and drawbacks of your proposed solution.   | 15<br>(CO3)<br>(PO3)    |
|    | c) What is a "Transaction" in the context of database design?  | 5<br>(CO1)<br>(PO1)     |
| 2. | a) What are the characteristics that define big data? Analyze each one using a relevant example.   | 6<br>(CO1)<br>(PO1)     |
|    | b) What is a "Primary Key" and a "Foreign Key"?  | 4<br>(CO1)<br>(PO1)     |
|    | c) The Bike Zone is a rapidly growing chain of bicycle stores with locations across several areas. They currently manage their inventory using a basic spreadsheet system. As a result of various issues, they have decided to start using a relational database. Each bicycle has a unique identifier, a manufacturer, information on the store it belongs to, and information about the customer currently renting it. Each customer has an ID, a name, and age. Each unique store has a name, and an address.<br><br>Design the database by writing the SQL code to create the tables and the relationships between them. | 15<br>(CO2)<br>(PO2)    |
| 3. | a) Describe why businesses should use data warehouses using an example.  | 5<br>(CO1)<br>(PO1)     |
|    | b) Answer the following questions regarding the K-Nearest Neighbor (KNN) algorithm.  | 6 × 2<br>(CO1)<br>(PO1) |
|    | i. When using the K-Nearest Neighbor (KNN) algorithm, is there a possibility of getting inconclusive classification results for specific values of $k$ ?   |                         |
|    | ii. How can the K-Nearest Neighbor (KNN) algorithm be enhanced to incorporate a voting scheme that prioritizes the classifications of nearest neighbors with greater similarity to the query point?  |                         |

- c) Show the difference between traditional programming and machine learning using appropriate figure(s).

8  
(CO1)  
(PO1)

4. Consider the data given in Table 1 and Table 2.

5 × 5  
(CO1)  
(PO1)

**Table 1:** A table called "Student" for Question 4 which provides data on students.

Student_ID	Name	Department	CGPA	Semester
11	J. Monroe	CSE	3.41	3
1	T. Iqbal	CEE	2.90	7
31	E. Haque	BTM	3.67	5
16	S. Ballinger	CSE	3.82	1

**Table 2:** A table called "Department" for Question 4 which provides data on departments.

Department	Head of Department	Floor	Building	Budget
EEE	B. Scott	1	South	20000.0
CSE	T. Kim	2	South	60000.0
CEE	S. Brooks	1	North	52000.0
BTM	A. Masud	4	South	22000.0

Here, the "Department" column in Table 1 is a reference to the primary key of Table 2. Now, write SQL queries to answer each of the following questions:

- Show which students are in their last four semesters, assuming that there are eight semesters in total.
  - Show the names of the students whose CGPA is lower than half of the maximum CGPA.
  - Show the total number of students whose department belongs to the "North" building.
  - Update the budget of each department, increasing it by 15%.
  - Show the average CGPA for each department and each semester.
5. a) Illustrate the Entity-Relationship Diagram based on the following scenario by highlighting the entities, relations, and cardinality between them:
- ArtBase is a management software for art galleries. The core of this product is a database with a schema that captures all the information that galleries need to maintain. Galleries keep information about artists; their names, birthplace, age, and style of art. For each piece of artwork: the artist, the year it was made, its title, type of art (e.g., painting, lithograph, sculpture, photograph), and price must be stored. Pieces of artwork are also classified into various groups, for example, portraits, still lifes, works by Picasso, works of the 19th century etc. Note that, a given piece may belong to more than one group. Each group is identified by a name that describes the group. Finally, galleries keep information about customers. For each customer, galleries keep their name, address, total amount of dollars they have spent in the gallery, and the artists and groups of art that each customer tends to like.
- Describe the different machine learning paradigms using relevant examples.

15  
(CO2)  
(PO2)

10  
(CO1)  
(PO1)

6. a) "Fitness Lab" is a local fitness studio known for its personalized training programs. They offer a variety of membership options, allowing clients to choose the level of guidance and class access that best suit their needs. To drive up profit margins, the owner decides to create an application to track a client's health and provide personal training programs automatically. As the owner is not adept in making and maintaining applications, he wants to use a cloud based service.  
Which type of cloud based service should be used and what revenue model should the owner choose? 10  
(CO3)  
(PO3)
- b) Illustrate the deadlock situation when using Pessimistic Concurrency Control (PCC) using a relevant example. 10  
(CO1)  
(PO1)
- c) What is the function of the JOIN clause in the context of SQL? 5  
(CO1)  
(PO1)