ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION **SUMMER SEMESTER, 2018-2019**

DURATION: 3 Hours **FULL MARKS: 150**

CSE 4461: Computer Science and Technology II

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **8 (Eight)** questions. Answer any **6 (Six)** of them.

Figures in the right margin indicate marks.

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1. Consider the following database schema:
   Sailors (sid, sname, rating, age)
   Boats (bid, bname, color)
   Reserves (sid, bid, day)
   Here, primary keys are underlined.
   a) Write DDL statements to create these tables. Make sure to include proper integrity constraints and references. 5
   b) Write SQL statements to perform the following operations: 2.5 ×8
      i. Find the sailors with a rating above 7.
      ii. Find the names of sailors who have reserved at least one boat.
      iii. Find the ages of sailors whose name begins and ends with B and has at least three characters
      iv. Find the names of sailors who are older than the oldest sailor having a rating of 10.
      v. Find all information of sailors who have reserved boat id 101.
      vi. Find the names of sailors who have reserved a red boat, and list in the order of age.
      vii. Find the name and the age of the youngest sailor.
      viii. Find the average age of sailors for each rating level that has at least two sailors.

2. A university registrar's office maintains data about the following entities:
   - Courses, including number, title, credits, syllabus, and prerequisites;
   - Course offerings, including course number, year, semester, section number, instructor(s), timings, and classroom;
   - Students, including student-id, name, and program;
   - Instructors, including identification number, name, department, and title.

   Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled.
   a) Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints. 15
   b) Reduce the ER model that you have designed into a set of relations with proper justification. Identify the appropriate primary key for each relation. 10

3. Consider a relation, R = (A, B, C, D).
   Its functional dependencies are, F = {C→D, C→A, B→C}.
   a) Identify all candidate keys for R. 3
   b) Is this relation in BCNF? Justify your answer by explaining the rules of being in BCNF form. If you answer is no, decompose the relation into BCNF, showing your decomposition steps. 8

c) Write down the Armstrong's axioms and additional rules that can be inferred from Armstrong's axioms for functional dependency. 8

d) Discuss the properties of B+ tree? 6

4. a) Write a serial schedule for the following: 4
Let T1 transfer $50 from A to B, and
T2 transfer 10% of the balance from A to B.

b) For each of the following schedules: 10

S1 = w3(A); r1(A); w1(B); r2(B); w2(C); r3(C);
S2 = r1(A); r2(A); w1(B); w2(B); r1(B); r2(B); w2(C); w1(D);
S3 = r1(A); r2(A); r1(B); r2(B); r3(A); r4(B); w1(A); w2(B);

Answer the following questions:

i. What is the precedence graph for these schedules?
ii. Are these schedules conflict-serializable? If so, what are all the equivalent serial schedules?

c) List the ACID properties. Explain the usefulness of each properties 8

d) Write the differences between view and conflict serializablility. 3

5. a) Write down the Bayes theorem with explanation. 3

b) Imagine that you are given the following set of training examples in Table 1. 15
Each feature can take on one of three nominal values: a, b, or c.

F1	F2	F3	Category
a	c	a	+
c	a	c	+
a	a	c	–
b	c	a	–
c	c	b	–

Table 1: Dataset

How would a Naive Bayes system classify the following test example? Be sure to show your work.
F1 = a, F2 = c , F3 = b

c) What is naïve in naïve Bayes? 3

d) Explain the difference between a weak and a strong entity set. 4

6. a) Consider the following Five transactions from a supermarket in Table 2 15

TID	List of items
1	Beer, Diaper, Baby Powder, Bread, Umbrella
2	Diaper, Baby Powder
3	Beer, Diaper, Milk
4	Diaper, Beer, Detergent
5	Beer, Milk, Coca-Cola

Table 2: Transactions

Here, minimum support is 40% (2/5) and the minimum confidence is =70%. Apply the Apriori algorithm to the dataset of transactions and identify all frequent 2-itemsets. You must show all candidates that pass the minimum support and confidence threshold.

b) List significant differences between a file-processing system and a DBMS 5

c) What are the main functions of a database administrator? 5

7. a) For the B+ tree in Figure 1, 5

i. What is *n*?
ii. How many values can be stored in non-leaf nodes?
iii. Would a new value fit into one of the existing leaf nodes?
iv. In which block would the value "Frederick" be stored?
v. In which block would the value "Arbutus" be stored?

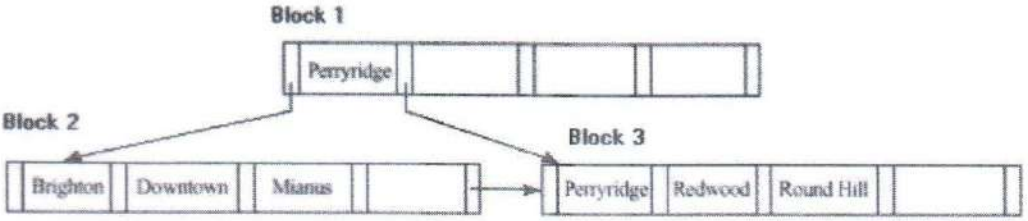

Figure 1: B+ tree for question 7.a.

b) Consider constructing a B+-tree of order 3 (i.e., n = 3, each index node can hold n keys and n + 1 pointers). Show the resulting tree step by step after inserting keys in this order: 40; 10; 50; 30; 90; 80; 70; 20; 60; 100 13

c) Discuss the disadvantages of using Static Hashing in database? How can we solve this problems? 7

8. Consider the following set *F* of functional dependencies for relation schema
R = (A, B, C, D, E).
$A \rightarrow BC$
$CD \rightarrow E$
$B \rightarrow D$
$E \rightarrow A$

a) Compute the closure (*F+*) of the given set of functional dependencies 6
b) Using these functional dependencies of set *F*, compute the canonical cover Fc 6
c) Define Normalization. What are the benefits and Goals of normalization in relational-database design? 10
d) In designing a relational database, why might we choose a non-BCNF design? 3