UNIVERSITY OF BARISHAL

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

FINAL EXAMINATION

2nd Year 1st Semester, Session: 2020-21

Course Title: Database Management System

Course Code: CSE-2101

Time: 3 hours | Marks: 60

Instructions:

- ✓ Answer any **FIVE** questions from the followings.
- ✓ All the parts of a question must be answered sequentially.
- ✓ Figures in the right margin indicate full marks.
- ✓ Keep your answer script clean and free from overwriting.

1. a) What is database management system (DBMS)? List and explain four reasons why DBMS is used instead of file processing system. [3]

   b) What is the difference between a candidate key, a primary key and a composite key? What considerations might influence the choice of a primary key? [3]

   c) How many attributes you can use in a table? Is there any limitations? Why you need to split the attributes in multiple tables? [3]

   d) What are the functions of DDL and DML in database languages? How they differ from each other? [3]

2. a) Let $R = (A, B, C, D)$. If AB and BD can uniquely identify a tuple in the relation $r(R)$ separately, how many super keys, candidate keys and primary keys are there? [3]

   b) Show with an example the association between a weak entity set and a strong entity set using E-R diagram. [3]

   c) Explain the uses of "***Select***" and "***Project***" relational algebra operations in a single query with appropriate relations. [3]

   d) Draw the E-R diagram for the following relation schemas: [3]

   *Person (**driver_id**, name, address)*
   *Car (**license_no**, year, model)*
   *Accident (**report_number**, date, location)*
   Owns (driver_id, license_no)
   Participated (driver_id, license_no, report_number, damage_amount)

3. a) Explain the distinct between total and partial participation constraints. [3]

   b) State the use of ***"%"(Percentage) and '_' (Underscore)*** characters in string operations. [3]

   c) Let R be binary relationship between A and B entity sets. [6]
      i) Show the mapping cardinalities using E-R diagrams.
      ii) How primary keys can be defined for the relationship set R for different mapping cardinalities?
      iii) How can you combine the tables (if possible) for different mapping cardinalities?

4. a) A library service wants to create a database on **Library Management System** to store details of its libraries, books and borrowers. Details include the following: [8]
   A book has a unique ISBN number, a title and one or more authors. The library service may own several copies of a given book, each of which is located in one of the service's libraries. A given library contains many books, and in order to distinguish different copies of the same book a library assigns a different copy-number to each of its copies of a given book; the price that was paid for each copy is also recorded. Every library has a unique name and is either a main library or a branch library. A main library may have zero or more branch libraries and every branch library is a branch of exactly one main library. A borrower has a name and a unique ID code.

A borrower can have many books on loan, but each copy of a book can only be on loan to one borrower. A borrower could borrow the same book on several occasions, but it is assumed that each such loan will take place on a different date.
Now, create an **ER** diagram that captures this information about the **Library Management**

b) Production tracking is important in many manufacturing environments (e.g., the pharmaceuticals industry, children's toys, etc.). The following (**in the Figure 1**) ER diagram captures important information in the tracking of production. Specifically, the ER diagram captures relationships between production lots (or batches), individual production units, and raw materials. [4]
Now, convert the ER diagram into a relational database schema. Be certain to indicate primary keys and referential integrity constraints.

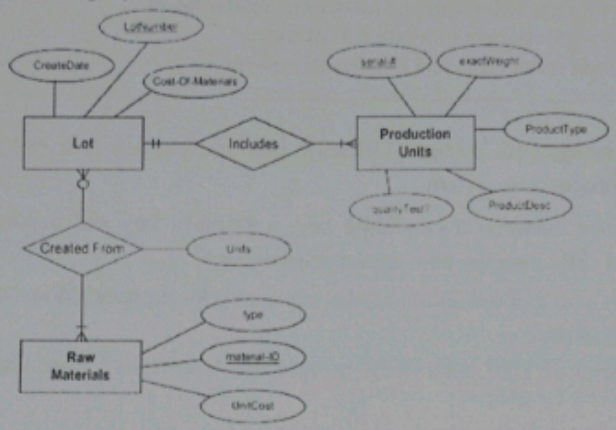

Figure-1: ER Diagram of a production tracking system

5. a) Consider the database schema below: [10]

employee (ename, street, city)
emp_company (ename, cname, salary, jdate)
company (cname, city)
manager (ename, mname, shift)

Note: A manager is also an employee of a company.
Give SQL and RA expressions for the following queries:

(i) Find names, street addresses and cities of residence of all employees who work under manager Sabbir and who joined before January 01, 2019.

(ii) Find the names of the employees living in the same city where Rahim is residing.

(iii) Display the average salary of each company except Square Pharma.

(iv) Increase the salary of employees by 10% for the companies those are located in Barisal.

(v) Delete records from emp_company that contain employees living in Rajshahi.

b) SQL allows a foreign-key dependency to refer to the same relation, as in the following example: [2]

```
CREATE TABLE manager
    (employee-name  CHAR(20),
    manager-name  CHAR(20),
    PRIMARY KEY employee-name,
    FOREIGN  KEY  (manager-name)  REFERENCES  manager(employee-
    name) ON DELETE CASCADE);
```

Here, *employee-name* is a key to the table *manager*, meaning that each employee has at most one manager. The foreign-key clause requires that every manager also be an employee. Explain exactly what happens when a tuple in the relation *manager* is deleted.

6. a) An employee database is to hold information about employees, the department they are in and the skills which they hold. The attributes to be stored are:
employee(emp-id, emp-name, emp-phone, dept-name, dept-phone, dept-mgrid, skill-id, skill-name, skill-date, skill-level)
An employee may have many skills such as word-processing, typing, librarian etc. The date on which the skill was last tested and the level displayed at that test are recorded for the purposes of assigning work and determining salary. An employee is attached to one department and each Department has a unique manager.

i) Derive a functional dependency set for the above database, stating clearly any assumptions that you make. [3]

ii) Derive a set of BCNF relations, indicating the primary key of each relation. [3]

b) Consider the following set of functional dependency F for the schema ***employee***: [6]

id → name, designation, email
name, designation → email, salary,
name → email
email → id

i) Compute a canonical cover for this set of functional dependencies F; give each step of your derivation with an explanation.
ii) Normalize the employee schema with the given constraints and functional dependencies up to BCNF.

7. a) Given a relation schema $R = \{A, B, C, D, E\}$ and FD: $A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, $E \rightarrow A$. Now find out: A^+, $(AB)^+$, $(BC)^+$, $(ABC)^+$ [3]

b) What is database transaction? Discuss ACID properties of database transaction. [3]

c) Check whether the schedule is conflict serializable or not? [3]
S: R1(A); R2(A); R3(B); W1(A); R2(C); R2(B); W2(B); W1(C)

d) What are the different states of Transaction? Explain briefly with necessary diagram. [3]

8. a) Explain dirty read problem in transaction. What are the possible solutions to prevent this problem? [3]

b) What is sparse indexing? How does multilevel indexing improve the efficiency of searching an Index file? [3]

c) When is it preferable to use a dense index rather than a sparse index? Explain your answer. [3]

d) Consider the following dense primary index file corresponding to the sequential file Account sorted on the attribute ***branch_name***. [3]

Branch_name	*Pointer*
Adabor	
C.O.	
Dhanmondi	
Mirpur	
Motijheel	

Index file

Account_no	*Branch_name*	*Balance*
A-9	Adabor	300
A-1	Adabor	500
A-5	C. O. Bazar	560
A-8	Dhanmodi	590
A-3	Dhanmodi	420
A-2	Mirpur	600
A-4	Mirpur	520
A-10	Mirpur	120
A-6	Motijheel	600
A-7	Motijheel	200

Account file

Now make necessary modification to the ***index file*** after deletion of the record for the account no ***'A-5'*** and then ***'A-2'***.

Good Luck!!!