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MAIN EXAMINATION

MAY – AUGUST 2021

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER AND INFORMATION SCIENCE

REGULAR PROGRAMME

CMT 109: DATABASE SYSTEMS

Date: AUGUST 2021	**Duration: 2Hours**
INSTRUCTIONS: Answer Question ONE and any TWO Questions	

1. a) Consider the following SQL data definition for maintaining information about employees at a hypothetical company.

```
Create Table emp
( num       INTEGER       NOT NULL,
  Name      VARCHAR(20)   NOT NULL,
  Dept      VARCHAR(20)   NOT NULL,
  Salary    INTEGER       NOT NULL,
  Boss      INTEGER       NOT NULL,
PRIMARY KEY(num),
FOREIGN KEY(boss)REFERENCES     emp(num));
```

The assumption is that there is one president that has herself/himself as the boss, that all other employees have a boss that is someone else and that there are no cycles in the boss hierarchy for anyone other than the president. (A cycle would exist if, for example, Fred was the boss of Mary and Mary was in turn the boss of Fred.)

i) Translate each of the above queries on the schema to SQL. In each case, also indicate if the query can be expressed in the relational algebra.

[5 Marks]

ii) The number and name of each employee, excluding the president, together with the number and name of the employee's boss. The result

should be sorted by the name of the boss and then by the name of the employee. **[5 Marks]**

iii) The names of the departments with the highest average salary of their employees. **[6 Marks]**

b) Write SQL statement to:

(i) Create a database known as project and a table known as EMPLOYEE. Enforce the necessary constraints. **[4 Marks]**

(ii) Insert a tuple for the relation **[1 Marks]**

(iii) Update the relation such that it captures the following details,
Employers-name- Princess Stella,
Position- HR,
Payroll_Num- 0156,
Salary – 15000 **[3 Marks]**

(iv) A statement that will return all the positions for various employess in the EMPLOYEE table **[1 Marks]**

(v) A statement that can be used to rename attribute Employees name to Employee Fname and Employee last name **[1 Marks]**

c) Ensuring data integrity is an important issue in data design. Identify two features of data design that embody data integrity concerns. For each, describe how the feature is related to the general issue of data integrity **[4 Marks]**

2. Today, instead of purchasing physical machines like servers, an alternate approach to running a database management system is to run it in the cloud. One of the key promises of the cloud is the illusion of infinite resources and the ability for users to elastically grow and shrink the resource consumption of their DBMS. Explain why it can be difficult to scale a relational DBMS. **[8 Marks]**

b) In order to save costs, an Internet Service Provider (ISP) hosts both the website and the database of a company on the same web server. Discuss **TWO** disadvantages of this decision from a security point of view. **[4 Marks]**

c) Explain why it might be worthwhile to write SQL stored procedures when developing an application. For example, is there any incentive relating to performance? **[6 Marks]**

d) Explain atleast two disavantages of the file based approach **[2 Marks]**

3. Belowisasampletakenfromalibrarydatabasecreatedfromdatainun-normalizedform.Discuss**THREE**problemofinsertingdataintothistable. **[6 Marks]**

Borrower Name	Daniel McBride
Borrower Address	11 Danforth Terrace
Borrower Phone No.	01632 961435
Book Title	A Long Way Home
Book Author	Elaine McAllister
Date Borrowed	21/07/07

a) Draw an ER diagram with an entity set E that is over constrained, that is, for which it is not possible for E to have any entities. **[5 Marks]**

b) Companyemploysanumberofstylistseachofwhomhasanumberofregularcustomers.Detailsofappointmentsarekeptinadatabasecreatedfromdatainun-normalizedform.Thesamplebelowshowsanentryinthedatabase.

Describe**THREE** problemsthatwouldbeencounteredwhenmodifyingthecustomer'stelephonenumberinthedatabase. **[9 Marks]**

Stylist	**maladia**
Appointment Date	**24/04/2020**
Appointment Time	**10.00**
Customer Name	**Pharis Tenders**
Customer Phone Number	**0724876543**

4. a.) The following transaction runs in a highly concurrent database application (for example, sales order processing). UPDATE customer SET discount = discount+0.03 WHERE customerArea = 'Machakos' COMMIT;

   i. Translate each of the transaction on this schema to SQL and display sale order transaction details in a table form**.** **[5 Marks]**

   ii. Assume the UPDATE fails to COMMIT and is unable to fully complete its execution. Explain the effect this might have on database integrity, assuming there were no concurrency control mechanisms **[6 Marks]**

   iii. Describeoneproblemwhichmayarisewhenarecordisdeletedfromthisdatabase [**4 Marks]**

b.) Consider the assertion: it is not possible to avoid the overhead of query optimization if one uses the dynamic embedded SQL standard. Is this true or false? Justify your answer. [**5 Marks]**

5. a.) Production tracking is important in many manufacturing environments (e.g., the pharmaceuticals industry, children's toys, etc.). Required: Draw an ER diagram which will capture all the important information that is necessary in the tracking of production. Specifically, the ER diagram should capture relationships between production lots (or batches), individual production units, and raw materials. [**10 Marks]**

b.) Convert the above ER diagram into a relational database schema. Marks will be awarded for primary keys and referential integrity constraints clearly indicated. [**10 Marks]**

END