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Department of Computer Science and Engineering

B.Sc. in Computer Science and Engineering (CSE)

Semester Final Examination 2018 (Jan-Jun)

Level 3 Semester I Course Code: CSE 305 Credit: 3.0

Course Title: Database

Duration: 3 Hours **Total Marks: 90**

[NB: The figure in the right margin indicates the marks for the respective question and Split answer of any question is unacceptable]

Section-A

Answer any 3 (three) questions from the following

1. a) Data could be stored and organized in different ways. Do you think *Database* (*DB*) is the better way to organize data? Explain your opinion with proper reasons. 4

   b) What are the responsibilities of a *DBMS*? Describe in brief. 4

   c) Define *functional dependency*. How can designer decompose a relation in *relational model*? Explain in brief. 1+2

   d) Describe different states of a *DB trqnsaction*. 4

2. a) Define *schema* and *instance* of a *DB*. How does a weak entity set of *ER diagram* is represented in *schema diagram*? 2+1

   b) What are *candidate key* and *super key*? If *primary key* is enough to identify each record than, why do we need all these keys? Explain your opinion. 2+1

   c) (2, 23, 5, 7, 31, 17, 19, 3, 29, 11, 10, 40)
   Construct a *B+ tree* from the key values given above. Consider that the number of keys that will fit in one node (order of the tree) is as follows:
      i) Three
      ii) Four
   3+3

   d) What is *normalization*? What are the roles of *normalization* in good *DB* design? 1+2

3. a) Consider the following *schema* and write the expression in *relational algebra* for the questions bellow: 3*2
   employee (<u>person_name</u>, street, city)
   works (<u>person_name</u>, company_name, salary)
   company (<u>company_name</u>, city)
   manages (<u>person_name</u>, manager)
      i) Find the names of all employees who works in his own city.
      ii) Find the names of all employees in this database who do not work for "Eastern Bank".
      iii) Find the names of all employees who earn more than every employee of "Western Bank".

   b) Briefly describe the phases of database design a designer should go through to create an optimally functional database. 4

   c) Define storage *block*. Explain the process of storing *variable length* record in storage system. 1+2

   d) Consider that a table has 25,000 *records* and each record takes 1 memory *block* in the disk. If you have *2 levels* of *sparse index* on those record with each *index* can identify up to 5 *records*. Then, how many *blocks* should be accessed to search for a specific *record*? 2

4. Consider the the schema in *Question 3. a)*. Now write the *SQL* for each of the following queries. 1.5*10
   a. Find the names and cities of residence of all employees who work for First Bank Corporation.
   b. Find the names, street addresses, and cities of residence of all employees who work for First Bank Corporation and earn more than $10,000.
   c. Find all employees in the database who live in the same cities and on the same streets as do their managers.
   d. Find all employees in the database who do not work for First Bank Corporation.
   e. Find all employees in the database who earn more than each employee of Small Bank Corporation.
   f. Assume that the companies may be located in several cities. Find all companies located in every city in which Small Bank Corporation is located.
   g. Find all employees who earn more than the average salary of all employees of their company.

h. Find the company that has the most employees.
i. Find the company that has the smallest payroll.
j. Find those companies whose employees earn a higher salary on average than the average salary at First Bank Corporation.

Section-B

Answer any 3 (three) questions from the following

1. a) Define *DB* and *DBMS*. Write some applications of *DB* in our daily life. 1+3

   b) What is meant by *constraints*? Enlist the *constraints* that *DDL* must check to preserve data integrity. 1+3

   c) Describe the issues that the designers may face to design *ER diagram*. 4

   d) How does a query is decided to be processed by the *query processor*? Explain the procedure. 3

2. a) Define *foreign key*. How can one ensure *referential integrity constraint* in a *database*? Explain in brief. 1+2

   b) Explain, how do the *selection* and *projection* operation work in the *relational algebra*? 3

   c) Consider the following table where the attributes are represented with short names as- 1+4
   Eum = Employee number, Ename = Employee Name, Stbranch = Store Branch
   Sprice= Sales price, ItemDesc= Item Description

Enum	Ename	Stbranch	Dept	ItemNo	ItemDesc	Sprice
211306801	*Jim*	*Downtown*	*Hardware*	*TR100* *SA10* *PT 165* *AB165*	*Router* *Saw* *Drill* *Lawnmower*	*$35* *$19* *$21* *$245*
301421011	*Bill*	*Dadeland*	*Home Appliance*	*TT14* *DS104*	*Humidifier* *Dishwasher*	*$114* *$262*
419846204	*A. Jim*	*Cutler Ridge*	*Auto Parts*	*MC164* *AC1462* *BB1000*	*Snow tire* *Alternator* *Battery*	*$85* *$65* *$49*

   i) Identify all the *functional dependencies*.
   ii) Convert the table into a database with all tables in *3NF*.

   d) Define *deadlock*. Describe the reasons those may lead the concurrent of transactions to fall in *deadlock* condition. 1+3

3. a) What are *cardinality* and *participation* of *entity sets* in order to make *relationship*? Describe each of their types in brief. 2+3

   b) What is meant by *weak entity set*? How does it make relationship with a *strong entity* set? Describe with example. 1+2

   c) What is *starvation*? Consider the following two transactions: 1+2+2

   T_3: *read(A);*
   read(B);
   if A = 0 then B:= B +1;
   write(B).

   T_4: *read(B);*
   read(A);
   if B = 0 then A:= A +1;
   write(A).

   Add *lock* and *unlock* instructions to transactions T_3 and T_4, so that they maintain the *2-phase locking (2PL)* protocol. Can the execution of these transactions result in a *deadlock*? Why?

   d) Describe simple locking protocol. What problems may arise while using simple locking? 1+1

4. a) Define *RAID*. Describe the different *RAID* levels with example. 1+3

   b) What are *indexing* and *hashing* in *DB*. How does *multilevel indexing* can help finding data much faster? Explain with example. 1+3

   c) What problems may arise if sufficient care is not taken for concurrent execution of multiple transactions. Describe in brief. 4

   d) Define Generalization and specialization. Describe various types of constraints on generalization. 1+2