

Marks: 70

Times: 4 Hours

N.B.:

- i. Answer **SIX** questions, taking any **THREE** from each section.
- ii. All questions are of equal values
- iii. Use **separate answer script** for each section.

#### Section A

1. a) What do you mean by Database and Database Management System? What are the benefits of Database system over File system and why? 3  
 b) Discuss different levels of data abstraction. 2.67  
 c) Define instance and schemas. 2  
 d) What is Database administrator? What are the functions of DBA ? 4
  
2. a) Define super key and candidate key. 2  
 b) What is the difference and relationship between Cartesian-Product and Natural-Join? 2  
 c) What is Outer join? Discuss about different types of outer join. 3.67  
 d) Consider the following relational schema of employee database: 4  
     *employee* (person-name, street, city)  
     *works* (person-name, company-name, salary)  
     *manages* (person-name, manager-name)  
 Write down relational algebra for the following queries:  
     (i) Find the names, street address, and cities of residence of all managers who work for City Bank Ltd. and earn more than BDT 100,000 per annum.  
     (ii) Modify the database so that the employee Tuhin Mahmud now lives in Gopalganj city.  
     (iii) Delete all tuples in the *works* relation for the employees of Agrani Bank Ltd.  
     (iv) Find the number of employees in each company.
  
3. a) What is Data dictionary? 1  
 b) What is the difference between a primary index and a secondary index? 2.67  
 c) What is an index? Explain multilevel indexing with example. 3  
 d) What is RAID? Explain RAID levels in briefly 5
  
4. a) What is entity relationship model ? 1  
 b) Discuss different attributes used in ER model. 3  
 c) Define mapping cardinalities. Discuss each type of mapping cardinalities. 3.67  
 d) A car-insurance company maintains data about the following entities: (i) customers: id, 4 name, phone, email, address; (ii) cars: license, model, year; (iii) accidents: report number, date, location.  
 Construct an E-R diagram for the car-insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Document all assumptions that you make about the mapping constraints.

### Section B

5.
  - a) Define SQL. Write down the clauses of SQL. 2
  - b) Briefly explain about string operation. 3.67
  - c) What is aggregate function? Discuss different types of aggregate function. 5
  - d) Consider the following relational schema of student database:
 

$student(student\_id, student\_name, student\_department)$   
 $course(course\_id, course\_title)$   
 $registered(student\_id, course\_id)$

 Write down SQL for the following queries:
    - (i) Define a table for the relation *student*.
    - (ii) Insert the information in the database specifying that a new student named Robi in CSE department with id 60, registered the course Database Management System with course id: CSE-320.
    - (iii) Find the students of EEE department and their registered courses. List the records in alphabetical order according to the names of the students.
    - (iv) Find how many students registered their courses in each department.
    - (v) Update the title of the course "Cryptography" to "Security in Computing".
  
6.
  - a) What is Database Normalization? What are the objectives of normalization? 3
  - b) What do you know about functional dependency and data redundancy? 2
  - c) Differentiate between first normal and second normal form. 3
  - d) A catering company offers different level of service and charges differently for each one. To hold the information of its customers as well as detail the service each one has ordered, the company keeps a database. Initial unnormalized relational schema (R) is as follows:
 

$R = (ClientName, Address, Date, EmpNo, EmpName, Service, AmountDue)$

 The set of functional dependencies F is:
 

$ClientName \rightarrow Address$   
 $EmpNo \rightarrow EmpName$   
 $Service \rightarrow AmountDue$   
 $ClientName, Date \rightarrow EmpNo, Service$

 Apply the normalization technique on the relational schema R in the most effective way possible. 3.67
  
7.
  - a) List the ACID properties of transaction. Explain each of them with example. 4
  - b) Differentiate between shared mode lock and exclusive mode lock. 1.67
  - c) During its execution, a transaction passes through several states. Draw the state diagram of transaction and define each of them briefly. 3
  - d) Explain different types of failure. 3
  
8.
  - a) What is homogeneous and heterogeneous database system? 1.67
  - b) Differentiate between data replication and data fragmentation. 3
  - c) Explain about the several reasons for building distributed database system. 3
  - d) Describe several architectural models for parallel machines. 4



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**3<sup>rd</sup> Year 1<sup>st</sup> Semester B.Sc. (Engg.) Final Examination-2017**

Course No.: CSE320

Full Marks: 60

Course Title: Database Management Systems

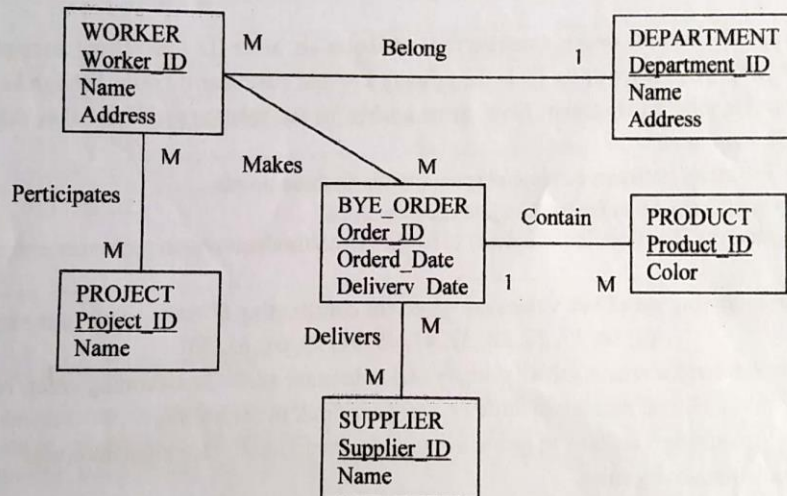
Time: 3 hours

**N.B.:**

- i) Answer **SIX** questions taking, any **THREE** from each section.
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**Section-A**

1. a) "Databases touch all aspects of our lives" – justify this. 3  
 b) Explain four significant differences between a file-processing system and a DBMS. 3  
 c) Explain the different level of abstraction of of RDBMS. 4
2. a) Draw an ER diagram for the following situations – 7  
 "In an organization, several projects are undertaken. Each project can employ one or more employees. Each employee can work on one or more projects. Each project is undertaken on the required of client. A client can request for several projects. Each project has only one client. A project can use a number of items and an item may used by several projects".  
 b) What do you understand by *Super Key*, *Candidate Key* and *Primary Key*. 3
3. a) Transform the following ER diagram (**Figure-2**) into relations. [(\*) sign indicates the identifying attribute] 7



**Figure-2: ER diagram.**

- b) Define mapping cardinalities. Discuss each type of mapping cardinalities. 3
4. a) Normalize the following invoice (**Figure-2**) of a book company up to 3NF. 7

ALPHA BOOK HOUSE							
Gopalganj-8100							
Date: XX-XX-XXXX							
Customer No	Customer Name	Customer Address	ISBN	Book Title	Author Name	Author Country	Unit Price
...	...	...	...	...	...	...	...

**Figure-2: Invoice of a book company.**

- b) When the Boyce-Codd normal form will be applied in a relation? Explain with proper example. 3

## Section-B

5. a) Consider the database schema below:

employee (person-name, street, city)  
works (person-name, company-name, salary)  
company (company-name, city)  
managers (person-name, manager-name)

Note: A manager is also an employee of a company.

Give SQL and RA expressions for the following queries:

- Find names, street addresses and cities of residence of all employees who work for First Bank Corporation and earn more than Tk. 30000.
- Find all employees in the database who earn more than any employee of Medium Bank Corporation.

- b) Consider the relational database of **Figure-4**, where the primary keys are underlined. 6

TRAIN (Name, Start, Destination)

TICKET (PNR\_NO, Start, Destination, Fare)

PASSENGER (Name, Address, PNR\_NO)

**Figure-4:** Database schemas.

Write SQL expressions for the following queries:

- List the names of passengers who are travelling from the start to the destination station of the train.
- Change the destination address of "Tungipara Express" to "Ghonapara".
- Find the name of all passengers whose address includes the substring "Gopalganj".

6. a) Suppose a relation *order*, contains four attributes i.e. order ID, order date, description and customer ID, where order ID is the primary key and customer ID is the foreign key, comes from the relation *customer*. Now create a table for this relation and then delete this using the SQL command. 3

- Differentiate between dense and sparse index in three points. 3
- Explain the condition for lossless-join decomposition. 2
- Explain why the allocation of records to blocks affects database-system performance significantly. 2

7. a) The following set of key values are given for constructing B<sup>+</sup>-tree: 6  
(3, 10, 17, 23, 28, 31, 41, 45, 51, 59, 61, 65, 70)

Assume that the tree is initially empty and values are added in ascending order. Now Construct B<sup>+</sup> -tree such that maximum three pointers are fitted in each node.

- b) Use Armstrong's axioms to prove the soundness of Union, Decomposition and Pseudotransitivity rules. 4

8. a) Write the distribution properties of ideal hash function. 1  
b) Compare between static and extendable hashing. 2  
c) Give the main principle of the timeout-based schemes for handling deadlock state. 3  
d) Specify the four considerations to select a transaction (or set of transactions) is needed to be rollback after detection the deadlock. 4



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**SECTION - A**

1. (a) What do you mean by Database and Database Management System? What are the goals of a Database Management System? Explain briefly. 2+  
3 $\frac{2}{3}$   
(b) Explain the differences between physical and logical data independence. 2  
(c) Describe different types of database-system users, differentiated by the way their interaction with the system. 4
2. (a) With examples define the terms Super Key, Candidate Key and Primary Key. 3  
(b) Consider the following relational schema of employee database:  
*employee* (person-name, street, city)  
*works* (person-name, company-name, salary)  
*manages* (person-name, manager-name)  
Write down relational algebra for the following queries:  
i. Find the names, street address, and cities of residence of all managers who work for City Bank Ltd. and earn more than BDT 100,000 per annum. 2 $\frac{2}{3}$   
ii. Modify the database so that the employee Rafiqul Alam now lives in Gopalganj city. 2  
iii. Delete all tuples in the *works* relation for the employees of HSBC Bank Ltd. 2  
iv. Find the number of employees in each company. 2
3. (a) Define DDL and DML. 2  
Consider the following relational schema of employee database:  
*employee* (person-name, street, city)  
*works* (person-name, company-name, salary)  
*manages* (person-name, manager-name)  
Write down SQL for the following queries:  
(b) i. Define a table for the relation *works*. 2  
ii. Insert the information in the database specifying that a new employee Towhidul Alam, street: 2/3, Motijheel in Dhaka city joined in Agrani Bank Ltd. with the salary BDT 130,000 per annum. 2 $\frac{2}{3}$   
iii. Find all the employees' name, street, company and salary in the database who live in the Khulna city. 2  
iv. Give all employees of HSBC Bank Ltd. a 10 percent raise if the salary becomes greater than BDT 100,000; otherwise, give only a 5 percent raise. 3
4. (a) What are mapping cardinalities? Define them with example. 2 $\frac{2}{3}$   
(b) A university registrar's office maintains data about the following entities (a) Courses: including number, title, credits, syllabus, and prerequisites; (b) course Offerings: including



course number, year, semester, section number, instructor(s), timings, and classroom; (c) students: including student-id, name, and program; and (d) 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. Construct an E-R diagram for the registrar's office. Document all assumptions that you make about the mapping constraints.

- (c) Perform E-R to Relational Model mapping and construct appropriate tables for the above <sup>university</sup> ~~ear-~~ <sub>3</sub>  
~~insurance company~~ database stated in 4(a).  
 (d) Explain the difference between a weak entity set and a strong entity set. 2

### SECTION-B

5. (a) Define functional dependency. What are the design goals for relational database design?  $2\frac{2}{3}$   
 (b) Consider the set of functional dependencies:  $F = (A \rightarrow BC, B \rightarrow C, A \rightarrow B, AB \rightarrow C)$  for the relational schema  $R = (A, B, C)$ .  $3+$   
 i. Find the candidate keys for R. 3  
 ii. Compute the canonical cover  $F_c$  of R.  
 (c) What are the differences between BCNF and 3NF? 3

6. (a) What is normalization? What are the aims of normalization? 3  
 (b) A catering company offers different level of service and charges differently for each one. To hold the information of its customers as well as detail the service each one has ordered, the company keeps a database. Initial unnormalized relational schema (R) is as follows:  $4\frac{2}{3}$

$R = (ClientName, Address, Date, EmpNo, EmpName, Service, AmountDue)$

The set of functional dependencies F is:

$ClientName \rightarrow Address$

$EmpNo \rightarrow EmpName$

$Service \rightarrow AmountDue$

$ClientName, Date \rightarrow EmpNo, Service$

Apply the normalization technique on the relational schema R in the most effective way possible.

- (c) Consider the following authorization on *student* and *instructor* relations. Create appropriate roles and give authorizations to the users for Alice, Bob, Zafar, and Albert. 4

User	Role	Relation/Table	Privileges
Alice	Learner	student	SELECT
Bob			
Zafar	Faculty	student	SELECT, UPDATE
Albert		instructor	ALL PRIVILEGES

7. (a) What is the usefulness of indexing in DBMS? Classify different types of indices. 3  
 (b) Distinguish between primary and secondary indices. Explain the concept of multilevel indexing. 2  
 (c) What are the causes of bucket overflow in a hash file organization? What can be done to reduce the occurrence of bucket overflows?  $3\frac{2}{3}$
8. (a) List the ACID properties of transaction. Explain each of them with example. 4  
 (b) During its execution, a transaction passes through several states. Draw the state diagram of transaction and define each of them briefly. 4  
 (c) What is a recoverable schedule? Why is recoverability of schedules desirable?  $3\frac{2}{3}$