

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
DHAKA UNIVERSITY OF ENGINEERING & TECHNOLOGY, GAZIPUR**
B.Sc. Engineering 2nd Year 2nd Semester (Regular) Examination, 2022
Course No.: CSE 2321
Course Title: Database Systems

Time: 3 Hours

Full Marks : 210

- Instructions: (a) Answer any three questions from each section.
(b) Use separate answer scripts for each section.
(c) All questions are of equal value.
(d) Figures in the right margin indicate full marks.

Section- A

1. (a) Define database management system (DBMS) along with its advantages. Briefly describe some applications of database system. [04+08] [CLO1] 12
(b) Define database instances and database schemas. Explain different level of abstraction of database system. [04+06] [CLO1] 10
(c) Briefly describe different types of database user. Explain the functions of database administrator. [06+07] [CLO1] 13

2. (a) Explain the structure of create and insert operation using subquery with example. [CLO1] 10
(b) Consider the relational database. [09+06] [CLO2] 15
author(author_id, name, date_of_birth, address)
author_pub(author_id, pub_id, author_position)
book(book_id, book_title, month, year, editor)
Now,
(i) Create the above tables without any constraint using SQL.
(ii) Add an appropriate constraint by SQL.
(c) Briefly explain the specialization and generalization for a database with logic diagram. [CLO1] 10

3. (a) Consider the following database schema: [04×03] [CLO2] 12
Employees(empno, name, hire_date, job_id, salary, comm, manager_id, deptno)
Departments(deptno, dept_name, manager_id, location_id)
Location(location_id, street, post_code, city, state, country)
Now, write a SQL query to
(i) Display the last name, salary, and commission for all employees who earn commissions. Sort data in descending order of salary and commissions.
(ii) Display the employee number, name and job title for all employees whose salary is more than any average salary of any department.
(iii) Display the manager number and the salary of the lowest paid employee for that manager. Exclude anyone whose manager is not known. Exclude any groups where the minimum salary is less than 6,000. Sort the output in descending order of salary.
(iv) Display the employee numbers, last names, and salaries of all employees who earn more than the average salary and who work in a department with any employee with a u in their name.
(b) Write a query in relational algebra of the above database in question 3(a): [03×03] [CLO2] 09
(i) List the name and salary of employees who earn between 5,000 and 12,000, and are in department 20 or 50.
(ii) Display the last name, job, and salary for all employees whose job is sales representative or stock clerk and whose salary is not equal to 2,500 or 7,000.
(iii) Create a unique listing of all jobs that are in department 30.

- (c) Consider the below table: [06+08] [CLO3]

14

EMP_ID	NAME	JOB_CODE	JOB	STATE_CODE	HOME_STATE
E001	Alice	J01	Chef	26	Michigan
E001	Alice	J02	Waiter	26	Michigan
E002	Bob	J02	Waiter	56	Wyoming
E002	Bob	J03	Bartender	56	Wyoming
E003	Alice	J01	Chef	56	Wyoming

Which normal form it is now? Then convert it to the up to 3NF.

4. (a) Write conditions of normalization up to 4NF. [CLO1] 08
 (b) Write a PL/SQL code to display employee number, name and basic of 5 highest paid employees from the below table. [CLO2] 12

Employee (empno, ename, job, salary, mgr, deptno)

- (c) Create a trigger on the EMPLOYEE_SALARY table for updating and deleting operations. 15
 Finally insert the old values of the above operation into another table (Emp_log_ID) which you have to create as well. [CLO2]

EMPLOYEE_SALARY (Emp_No, Basic, HRA, DA, Total_Deduction, Net_Salary, Gross_Salary)

Section- B

5. (a) What is RAID? Explain RAID levels of a storage system with necessary illustration. 13 [02+11] [CLO2]
 (b) Consider the following allocated memory blocks as an initial relation. Show the runs created on each pass and sorted output using External sort-merge algorithm. Assume M = 3. [CLO2] 12

Initial Relation

19	24	31	22	16	44	7	15	2	33	16	41	32	50	10
d	p	g	c	a	b	m	a	d	r	h	b	e	q	r

- (c) Explain the query processing steps with a proper diagram. [CLO2] 10
 6. (a) Discuss the ACID properties of a transaction. [CLO1] 10
 (b) Given a concurrent schedule S in Figure 1, where the initial balance of account A is 1000 Tk and B is 2000 Tk. Check whether the given schedule is consistent state or not. If it is consistent state, then transformed it a concurrent schedule resulting in an inconsistent state. [07+08] [CLO3] 15

T ₁	T ₂
Read (A)	
A := A - 50	
Write (A)	
	Read(A)
	Temp := A * 10%
	A := A - Temp
	Write(A)
Read (B)	
B := B + 50	
Write (B)	
commit	
	Read (B)
	B := B + Temp
	Write (B)
	commit

Figure 1: Concurrent Schedule S

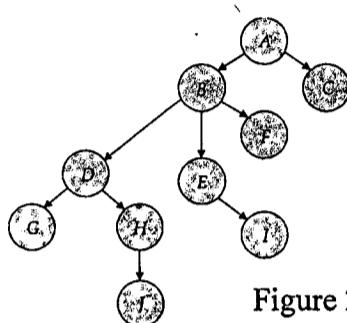
- (c) What do you mean by concurrency control? Write the advantages of concurrent executions. [03+07] [CLO1] 10

7. (a) What are the advantages of B^+ -tree indexing files over the indexed-sequential files? 07 [CLO2]
 (b) Consider the following set of key values and the number of pointers of a node is $N = 4$. 20 [13+07] [CLO3]
 [Rahman, Karim, Jamal, Belal, Kim, Mostofa, Jalil, Washim, Ibrahim, Einestein]

Now,

- (i) Construct B^+ -tree using set of key values.
- (ii) Insert a new key value "Abraham".

- (c) Explain sparse indexing with a suitable example. [CLO1] 08
 8. (a) The statement "A schedule S is conflict serializable if and only if its precedence graph is acyclic"-Justify the statement using a suitable example. [CLO3] 12
 (b) A tree-structured database graph and four transactions are shown in Figure 2. [10+05] 15 [CLO3]



T_{10} : lock-X(B); lock-X(E); lock-X(D); unlock(B); unlock(E); lock-X(G); unlock(D); unlock(G).
 T_{11} : lock-X(D); lock-X(H); unlock(D); unlock(H).
 T_{12} : lock-X(B); lock-X(E); unlock(E); unlock(B).
 T_{13} : lock-X(D); lock-X(H); unlock(D); unlock(H).

Figure 2: Tree-structured database graph and instructions (T_{10} to T_{13})

Now,

- (i) Create a serializable schedule under the tree protocol using four transaction instructions.
 - (ii) Check whether the created serializable schedule in (i) is conflict serializable or not and does it ensure the freedom from deadlock?
- (c) Why is wait-for graph used? Explain the deadlock recovery methods. [02+06] [CLO1] 08

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
DHAKA UNIVERSITY OF ENGINEERING & TECHNOLOGY, GAZIPUR
B.Sc. Engineering 3rd Year 1st Semester (**Regular**) Examination, 2022
Course No.: CSE-3311
Course Title: Database System

Time: 3 Hours

Full Marks: : 210

- Instructions: (a) Answer any three questions from each section.
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(d) Figures in the right margin indicate full marks.

Section-A

1. (a) Define database instances and database schemas. Explain different database schemas. 10
(06+04) [CLO1]
 - (b) What is database administrator? Briefly explain the functions of database administrator. 10
(02+08) [CLO1]
 - (c) Consider the following relational database: [CLO3] 15
Orders(order_no, purch_amount, order_date, customer_id, salesman_id)
Customer(customer_id, cust_name, city, grade, salesman_id)
Salesmar(salesman_id, name, city, commission)
- Now, write SQL Command to create the tables and use appropriate constraints that will make the database more user friendly.
2. (a) Mention some advantages of PL/SQL. [CLO1] 05
 - (b) Consider the following database schema: [CLO3] 15
Employees(emp_id, name, hire_date, job_id, salary, comm, manager_id, dept_id)
Departments(dept_id, dept_name, manager_id, location_id)
Location(location_id, street, post_code, city, state, country)
Write a SQL query to find the following queries:
 - (i) Display the department number, name, job and department name for all employees in the CSE department.
 - (ii) Write a query to display the employee name and hire date for all employees in the same department as Mr. X.
 - (iii) Write a query to display the employee number, name and job title for all employees whose salary is more than any average salary of any department.
 - (c) Write a PL/SQL Cursor program that will update the emp_id table of Database 2(b) and increase the salary of an employee 'ROSE' by 500 and use the cursor attributes to determine the number of rows affected. [CLO3] 15
3. (a) Consider the below table: [CLO2] 10

EMP_ID	EMP_NAME	EMP_PHONE	EMP_STATE
14	John	7272826385, 9064738238	ACT
20	Harry	8574783832	NSW
12	David	7390372389, 8589830302	QLD

Is the table in first normalization form? Explain it. If the answer is NO, then convert it to first normalization form.

- (b) Briefly explain different mapping cardinalities with mapping diagram. [CLO1] 10
- (c) Create a table [**Dept_ID(deptno, dname, loc)**] in oracle database. Then Create a trigger on the Dept_ID table and reflect the action into the new table [**dept_log_ID(deptno, danme, operation)**] for inserting and deleting operation. Finally check the trigger and insert the values (inserted and deleted) into **dept_log_ID** table. [CLO3] 15

4. (a) What are the basic characteristics of second normal form? [CLO2] 08
 (b) Briefly explain data definition language and data manipulation language with example. 12 [CLO1]
 (c) Suppose you have the below database schema: [CLO3] 15

Employees(emp_id, name, hire_date, job_id, salary, comm, manager_id, dept_id)

Departments(dept_id, dept_name, manager_id, location_id)

Location(location_id, street, post_code, city, state, country)

Now, write SQL Command to include primary key, foreign key of the database. Also use appropriate constraint for restricting salary with 20000 to 200000.

Section-B

5. (a) What do you understand by Transaction and Cascading Rollback? Describe all the transaction states with flow diagram? (04+04+08) [CLO1] 16
 (b) Check whether the following schedule S is view serializable or not: (8+10) [CLO1, CLO4] 11

T1	T2	T3
Read(A)		
	Read(A)	
		Read(A)
Write(A)		

- (c) Consider the following schedule, is there any possibility for cascading rollback? Explain. [CLO4] 08

T5	T6	T7
Read(A)		
Read(B)		
Write(A)		
	Read(A)	
	Write(A)	Read(A)
Abort		

6. (a) Define two-phase locking protocol? What benefit does strict two-phase locking provide? (04+06) [CLO1] 11
 (b) The following table shows an interleaved execution of T1, T2, T3 and T4 transactions, applying two-phase locking (2PL). Is there a Deadlock? If yes, which transactions are involved in Deadlock? [CLO4] 15

Time	Transaction	Code
1	T1	LOCK (A, X)
2	T2	LOCK (B, X)
3	T3	LOCK (A, S)
4	T4	LOCK (B, S)
5	T1	LOCK (B, S)
6	T2	LOCK (D, X)
7	T3	LOCK (D, S)
8	T4	LOCK (C, X)

- (c) Write short note about **Deadlock**, **Starvation** and **Checkpointing**. (3×3) [CLO1] 09
7. (a) Define Sparse and Dense Index. (5+5) [CLO1] 10
 (b) Explain Secondary Indexing with a suitable example. [CLO1] 12
 (c) Construct a B+ tree for the following set of values. Consider the number of pointers in a node is 3. [CLO4] 13

[10, 7, 3, 9, 5, 14, 11, 8]

8. (a) Describe the ACID properties of transaction? [CLO1] 08
 (b) Explain Multi-version Timestamp Ordering protocol. Apply the Multi-version Timestamp Ordering protocol on the following schedule and discuss the result: (09+08) 17
 [CLO4]

T1	T2
Read (X)	
Write (X)	
	Read (X)
	Write (X)
Read (X)	
Write (X)	
	Write (X)

- (c) Following are the log entries at the time of system crash. [CLO4] 10

[start_transaction, T1]
[Write_item, T1, A, 30]
[Commit T1]
[Checkpoint]
[start_transaction, T3]
[Write_item, T3, C, 50]
[Commit T3]
[start_transaction, T2]
[Write_item, T2, C, 40]
[start_transaction, T4]
[Write_item, T4, B, 30]
[Write_item, T2, D, 60] System Crash

If deferred update technique with checkpoint is used, what will be the recovery procedure?

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DHAKA UNIVERSITY OF ENGINEERING & TECHNOLOGY, GAZIPUR

B.Sc. Engineering 3rd Year 1st Semester (Regular) Examination, 2018

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Title: Database System

Course No.: CSE-3311

Time: 3 Hours

Full Marks: 210

- Instructions:**
- (a) Answer any three questions from each section.
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SECTION – A

1. (a) What is DBMS? 05
(b) Explain the concept of physical data independence and its importance in database systems. 10
(c) What are the main functions of database administrator? 10
(d) Explain the difference between two-tier and three-tier architectures. Which is better suited for web applications? Why? [05+03+02] 10

2. (a) What is E-R diagram? List out the components of E-R diagram. [02+06] 08
(b) Explain the following terms in relational database: [03×04] 12
 - i) Surrogate key and Composite key.
 - ii) Generalization and Specialization.
 - iii) Weak entity and Strong entity.
(c) Describe the differences in meaning between the terms relation and relation schema. 06
(d) Consider the following expressions, which use the result of a relational algebra operation as the input to another operation. For each expression, explain in words what the expression does.
 - i) $\sigma_{\text{year} \geq 2009}(\text{takes}) \bowtie \text{student}$
 - ii) $\sigma_{\text{year} \geq 2009}(\text{takes} \bowtie \text{student})$
 - iii) $\Pi_{ID, name, course_id}(\text{student} \bowtie \text{takes})$

3. (a) What is relational algebra? Explain “division” operation of relational algebra with appropriate example. [02+04] 06
(b) Consider the following relational database: [03×04] 12
Orders(order_no, purch_amount, order_date, customer_id, salesman_id)
Customer(customer_id, cust_name, city, grade, salesman_id)
Salesman(salesman_id, name, city, commission)
Write a SQL query to find the following queries:
 - i) Write a SQL statement to make a list with order no, purchase amount, customer name and their cities for those orders which order amount between 500 and 2000.
 - ii) Write a SQL statement to display either those orders which are not issued on date 2012-09-10 and issued by the salesman whose ID is 505 and below or those orders which purchase amount is 1000.00 and below.

- iii) Write a query to find the sums of the amounts from the orders table, grouped by date, eliminating all those dates where the sum was not at least 1000.00 above the maximum amount for that date.
- iv) Write a SQL statement to display all those orders by the customers not located in the same cities where their salesman live.
- (c) Mention some advantages of PL/SQL. 05
- (d) Write a PL/SQL code to calculate the total salary of first N records of EMPLOYEE_SALARY table. The value of N is passed to cursor as parameter.
EMPLOYEE_SALARY(Emp_No, Basic, HRA, DA, Total_Deduction, Net_Salary, Gross_Salary)
4. (a) Given relations are "Employee" and "Ft-Works" as follows: [5×2] 10

Employee

Employee-name	Street	City
Coyote	Toon	Hollywood
Rabbit	Tunnel	Corrotville
Smith	Recover	Death Vally
Williams	Sea view	Seattle

Ft-Works

Employee-name	Branch-name	Salary
Coyote	Mesa	1500
Rabbit	Mesa	1300
Gates	Redmond	5300
Williams	Redmond	1500

From the above relations find the followings:

- i) Left outer join
ii) Right outer-join
- (b) Consider the relational database: 10
- author(author_id, first_name, last_name)
author_pub(author_id, pub_id, author_position)
book(book_id, book_title, month, year, editor)
pub(pub_id, title, book_id)
- write the below queries in relational algebra:
- i) Write a relational algebra expression that returns the names of all authors who are book editors.
ii) Write a relational algebra expression that returns the names of all authors who are not book editors.
- (c) Write a PL/SQL code to create Package specification and Package body in which the procedures can perform insert, retrieve, update and delete operations on a student table. 15
- STUDENT(Roll_No, Student_Name, Course, Gender)*

SECTION – B

5. (a) Why is normalization necessary in database? 05
 (b) Suppose the table and functional dependency are as follows: 12

SID	Major	Advisor
123	Physics	Faculty-1
123	Music	Faculty-2
456	Bio	Faculty-3
789	Physics	Faculty-4
999	Physics	Faculty-1

Functional dependencies in the relation:

$\text{SID Major} \rightarrow \text{Advisor}$

$\text{Advisor} \rightarrow \text{Major}$

Find out the Boyce-codd Normal Form (BCNF) of the above table.

- (c) Suppose $R = \{A, B, C, G, H, I\}$ and set of functional dependencies F as follows: 12
 $A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H$
 Find out whether $(AG)^+$ is a super key or not?
- (d) Define lossless join decomposition. 06
6. (a) Briefly describe the shadow-copy technique for atomicity and durability. 10
 (b) Explain distinction between the terms serial schedule and serializable schedule. 08
 (c) Suppose that there is a database system that never fails. Is a recovery manager required for this system? 08
 (d) Explain why the read-committed isolation level ensures that schedules are cascade-free. 09
7. (a) Why is concurrency control necessary in database? 05
 (b) Explain Timestamp-ordering protocol. 12
 (c) What are the rules followed by multiple granularity locking protocol? 12
 (d) How does Thomas' write rule modify timestamp-ordering protocol? 06
8. (a) What are the reasons of failure of the computer system? Explain. 08
 (b) Write notes on the followings: [6×2] 12
 i) Write Ahead Logging (WAL).
 ii) Fuzzy checkpoint.
 (c) Compare the shadow-paging recovery scheme with the log-based recovery schemes. 08
 (d) Explain procedures of ARIES recovery algorithm. 07

– END –

DHAKA UNIVERSITY OF ENGINEERING & TECHNOLOGY, GAZIPUR

B.Sc. Engineering 3rd Year 1st Semester (Regular) Examination, 2017

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Title: Database Systems

Course No.: CSE-3311

Full Marks: 210

Time: 3 Hours

- Instructions: (a) Answer any three questions from each section.
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SECTION - A

1. (a) Explain the following terms in a relational database:

16

- i) Super key
- ii) Candidate key
- iii) Primary key
- iv) Foreign key

- (b) Define the referential integrity constraint in a relational database. Explain why this constraint is important with a foreign key.

07

- (c) Consider the given relations r and s . Using relational algebra find out:

12

- i) $r \times s$
- ii) $\sigma_{A=C}(r \times s)$

A	B
α	1
β	2

r

C	D	E
α	10	a
β	10	a
β	20	b
γ	10	b

s

2. (a) Define relationship sets. Briefly explain its types.

10

- (b) Using an example explain how a weak entity set is reduced to a relation schema.

12

- (c) A department has a number of teachers and a number of students. For a teacher the name, joining date and salary should be stored. The important information for a student are: student_id, name, and address. Draw ER diagrams considering the following business rules:

13

- i) Every student must have a teacher as an advisor (total participation).
- ii) A teacher can advise 0 (Zero) or more students; but a student must have only one (1) advisor, cannot have multiple advisors.

3. (a) Consider the following database schema of a sample university:

20

```

classroom(building, roomNumber, capacity)
department(deptName, building, budget)
course(courseId, title, deptName, credits)
instructor(tID, name, deptName, salary)
section(courseId, secId, semester, year, building, roomNumber, timeSlotId)
teaches(tID, courseId, secId, semester, year)
student(sID, name, deptName, totCred)
takes(sID, courseId, secId, semester, year, grade)
advisor(sID, tID)
timeSlot(timeSlotId, day, startTime, endTime)
prereq(courseId, prereqId)

```

Write the following queries in SQL:

- i) Find the names and average salaries of all departments whose average salary is greater than 50000.
 - ii) Find the total number of (distinct) students who have taken course sections taught by the instructor with ID 10101.
 - iii) Find the names of all instructors with salary between \$90,000 and \$100,000.
 - iv) Find courses offered in Fall 2009 but not in Spring 2010.
 - v) Find names of instructors with salary greater than that of some instructors in the Biology department.
- (b) Using suitable examples explain the differences between Cartesian product and Natural join. 10
- (c) Explain the terms: DDL and DML. Which one of these includes the select statement? 05
4. (a) Define functional dependency and briefly explain its types. Consider A is a composite key. What does it mean that an attribute B is fully functionally dependent on A? 10
- (b) Mention the requirements for a good normalized set of tables. 05
- (c) Given the sales data in the following table, normalise the table to the third normal form by considering the business rules stated below. 20

Date	Product	Price	Client	Phone	Address
11 Jan	Widget	100	Nurk Inc.	666-999	11 Bush Ave
12 Jan	Gizmo	120	Klutz & Co	131-313	13 Luck Rd
12 Jan	Widget	100	Bloggs Ltd	123-456	12 High St
13 Jan	Widget	100	Klutz Coy.	131-323	13 Luck Rd
14 Jan	Gizmo	120	F. Nurk Inc.	666-999	11 Bushy Ave

Table 4(c): Sales Data

Case1:

- i) Each client makes no more than one order per day
- ii) No two clients have the same name
- iii) Each order consists of a single product

Case2:

Assuming that in any single day:

- iv) Clients sometimes make several orders
- v) Each order is for a different product

Include the dependency diagrams for identifying and removing the partial and transitive dependencies. If you make any assumptions in the process then mention those assumptions.

SECTION - B

2

5. (a) Define DBMS. What are the main characteristics of database approach? 10
 (b) What do you know about transaction? Why we should control the concurrent transaction. 10
 (c) When two operations in a schedule are said to be conflicted? 05
 (d) What do you mean by conflict equivalent? Consider the following serial schedule: 10

S_1 :

T1	T2
Read (A).	
Write (A).	
Read (B).	
Write (B).	
	Read (A).
	Write (A).
	Read (B).
	Write (B).

Now write at least 03(three) schedule that are conflict equivalent to S_1 .

6. (a) Explain the ACID properties of database transaction. 07
 (b) Define lock manager. Describe the lock table with figure. 08
 (c) Check the validity of the following sequence using validation-based protocol:
 (if $TS(T_i) < TS(T_j) < TS(T_k)$) 12
 i) Start (T_j) < Finish(T_i) < Validation(T_j)
 ii) Start (T_k) < Validation(T_j) < Validation(T_i) < Finish(T_j)
 (d) Explain multi-version timestamp ordering protocol. 08
7. (a) What is dense and sparse index? Construct a B+ tree for the following set of 20 values. Consider the number of pointers in a node is 3.
 {8, 5, 1, 7, 3, 12, 9, 6} 20
 (b) What do you know about shadow paging? Explain shadow paging technique with an example. 15
8. (a) Define two-phase locking protocol. Consider the following two transactions: 15

T_{25} : Read (A); Read (B); If A=0 then B: B+1; Write (B);	T_{30} : Read (B); Read (A); If B:=0 then A=A+1; Write (A);
--	--

Now, add lock & unlock instruction according to Two-phase locking protocol.
 Can the execution of the above transaction result in a deadlock?

- (b) How does "Thomas Write Rule" modify the test for Write(X) operations? 08
 (c) Discuss about data chaching and check-pointing. 12

8

DHAKA UNIVERSITY OF ENGINEERING & TECHNOLOGY, GAZIPUR

B.Sc. Engineering 3rd Year 1st Semester (**Regular**) Examination, 2016

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Title: Database Systems

Course No.: CSE-3311

Time: 3 Hours

Full Marks: 210

- Instructions: (a) Answer any three questions from each section.
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SECTION – A

1. (a) What is database management system? List four significant differences between a file processing system and DBMS. 13
(b) What are the five main functions of database administrator? 10
(c) Explain the differences between physical and logical data independence. 12

2. (a) Explain the difference between a weak and strong entity set. 05
(b) Show an example of E-R diagram including different types of attributes. 08
(c) Briefly explain different mapping cardinalities with mapping diagram. 10
(d) Consider the following relational database: 12

Employee(person_name, street, city)
Works(person_name, company_name, salary)
Company(company_name, city)
Manages(person_name, manager_name)

Give an expression in the relational algebra to express the following queries:

- (i) Find the names of all employees in the database who live in the same city as the company for which they work.
(ii) Find the names of all employees who do not work for the AB bank.
(iii) Find the names of all employees who earn more than every employee of SB limited.
(iv) Find the names of all employees who work for FB limited.

3. (a) Consider the following database schema: 15

Employees(emp_id, name, hire_date, job_id, salary, comm, manager_id, dept_id)
Departments(dept_id, dept_name, manager_id, location_id)
Location(location_id, street, post_code, city, state, country)

Write a SQL query to find the following queries:

- (i) Display the department number, name, job, and department name for all employees in the Finance department.
(ii) Write a query to display all the information of the employees who do not work in those departments where some employees work whose id within the range 100 and 200.
(iii) Write a query to display the employee name and hire date for all employees in the same department as Clara.
(iv) Write a query to display the employee number, name (first name and last name) and job title for all employees whose salary is more than any average salary of any department.
(v) Write a query to display the department id and the total salary for those departments which contain at least one salaried employee.

- (b) Mention some advantages of PL/SQL. 05
- (c) Write a PL/SQL code to retrieve salary of an employee from *emp* table and calculate its Gross salary according to following: 15
- (i) *Salary* <=10000: *HRA*=20%, *DA*=80%. (ii) *Salary* <=20000: *HRA*=25%, *DA*=90%.
- (iii) *Salary* >20000: *HRA*=30%, *DA*=95%
- Use procedure with an input parameter to calculate the Gross salary.
4. (a) Create a package that contains two same procedures with the following information. 15
- (i) *EmpInformation(eName varchar2, eSal number)*
- (ii) *EmpInformation(eName varchar2, eSal number, managerID number)*
- The main task of each function is to retrieve and display the mentioned information from the **EMP** table for a given **empno** where *eName* means employee name, *eSal* is employee salary. Finally execute the above package functions in a PL/SQL block.
- (b) Define ordered indices and hash indices. Briefly explain the evaluation factor to measure the indices performance. 10
- (c) Explain the basic algorithm for updating rules of single level indices. 10

SECTION – B

5. (a) List the ACID properties. Explain the usefulness of each. 12
- (b) Explain the distinction between the terms serial schedule and serializable schedule. 10
- (c) What is recoverable schedule? Why is recoverability of schedules desirable? Are there any circumstances under which it would be desirable to allow non-recoverable schedules? Explain your answer. 13
6. (a) Why do we need concurrency control in database? 05
- (b) Describe time-stamp based protocol. To what point has time-stamp based protocol been modified in Thomas' Write rule? 20
- (c) In the multiple-granularity locking, what is the difference between implicit and explicit locking? 10
7. (a) Explain what is meant by repetition of information and inability to represent information. Explain why each of these properties may indicate a bad relational database design. 12
- (b) Suppose that we decompose the schema $R=(A,B,C,D,E)$ into (A,B,C) and (A,D,E) . Show that this decomposition is a lossless join decomposition if the following set F of functional dependencies holds: $A \rightarrow BC$, $CD \rightarrow E$, $B \rightarrow D$, $E \rightarrow A$. 13
- (c) Explain why $4NF$ is a normal form more desirable than $BCNF$. 10
8. (a) Discuss the different types of transaction failures. What is meant by catastrophic failure? 10
- (b) Explain the write ahead logging protocol. Identify three typical lists of transactions that are maintained by the recovery subsystem: 15
- (c) Describe the three phases of the ARIES recovery method. 10

DHAKA UNIVERSITY OF ENGINEERING & TECHNOLOGY, GAZIPUR
B.Sc. Engineering 3rd Year 1st Semester (Regular) Examination, 2015

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Title: Database Systems

Course No.: CSE-3311

Time: 3 Hours

Full Marks: 210

- Instructions: (a) Answer any three questions from each section.
(b) Use separate answer scripts for each section.
(c) All questions are of equal value.
(d) Figures in the right margin indicate full marks.

SECTION - A

1. (a) What is DBMS? Describe the difficulties of typical file processing system. 10
(b) Describe Entity-Relationship(ER) model with example. 10
(c) Explain different level of data independence. 10
(d) Explain the strong and weak entity set with example. 05

2. (a) Define primary key, foreign key, super key and candidate key. 10
(b) Draw an E-R schema diagram for a hospital with set of patients and a set 15
of doctors. Associate the patients with log of visits to a doctor with advices,
various tests and examinations.
(c) Find out the primary key, foreign key and other attributes of the problem 10
given in question 2(b).

3. (a) Consider the following relation schema: 12

Student (studentId, Name, FathersName, AdmissionDate, RegNo)
Courses (CourseId, CourseTitle, CourseType, Credit, DeptId)
Major (StudentId, DeptId, AdmissionSession)
CourseRegistration (StudentId, CourseId, Year, Semester,
Session)
CourseComplete (StudentId, CourseId, Year, Semester, Session,
GradePoint, GradeLetter)

Write down the expression in relational algebra for:

- (i) List the students of "CSE" department of "1st Year" and "2nd Semester".
 - (ii) List the students of "EEE" who have completed 5 courses.
 - (iii) List the students who get grade point below 2.50 in any course in session 2014-2015.
 - (iv) List the Student Id, Student's Name, and Father's Name of students who got "A+" in course "CSE-3311".
- (b) How can the generalization be converted to a tabular form? How is the 08
primary key of a relation formed in a relational table?

- (c) Consider an insurance database that maintain the following information: 15

Person(DriverNo, Name, Address)
Car(LicenseNo, Model, Year)
Accident(ReportNo, Date, Location)
Owns(DriverNo, LicenseNo)
Participated(DriverNo, LicenseNo, ReportNo, DamageAmount)

Write down the SQL command to find the following queries:

- (i) Find the total number of people whose cars were involved in accident.
- (ii) Find the number of accident in which the car belongs to "Mr. Salam".
- (iii) Delete the "Toyota Corolla" car belongs to "Mr. Salam".
- (iv) Add new accident report for the "Maruti" belongs to "Mr. Ferdous".

4. (a) Explain the steps of database application life cycle. 10
(b) Explain loss-less join property and dependency preservation of a decomposition. 10
(c) Explain 1NF, 2NF, 3NF and BCNF with example. 10
(d) Describe "Admin" option and "Cascade" option in case of creating and dropping users. 05

SECTION – B

5. (a) Consider a relation R = (A, B, C, D, E) with following functional dependencies: 10

$$AB \rightarrow C, CD \rightarrow E, DE \rightarrow B$$

- (i) Is AB a candidate key?
 - (ii) If AB is not candidate key, check with ABD. Explain your answer.
- (b) Let R=(A, B, C, D, E, F, G, H, I, J) is a relation with the set of functional dependencies: 12

$$F = \{A \rightarrow C, AC \rightarrow D, E \rightarrow AD, E \rightarrow H\}$$

$$G = \{A \rightarrow CD, E \rightarrow AH\}$$

Check whether these two functional dependencies are equivalent.

- (c) Describe multi-valued dependencies with example. How can multi-valued dependencies be removed? 08
(d) How can concurrency of multiple transaction be controlled? 05
6. (a) What are the distinctions between the terms serial schedule and serializable schedule? 05
(b) Write the sequence of steps for Read(x) and Write(x) operation using timestamp-based protocol. 10
(c) What is two-phase locking protocol? Why do we need lock conversion in two-phase locking protocol? 10

- (d) Consider the following two transactions:

10

T ₁	T ₂
Read(A); Read(B); If A=0 then B:=B+1; Write(B);	Read(B); Read(A); If B=0 then A:=A+1; Write(A);

Now add lock and unlock instructions to transaction T₁ and T₂, so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock?

7. (a) What is transaction log? Draw a format for transaction log. 07
(b) How can we use checkpoints in case of concurrent transaction? 08
(c) What is meant by concurrent execution of database transaction in a multiuser system? Discuss why concurrency control is needed in a database transaction. 10
(d) Describe the shadow paging recovery technique. What are the circumstances for which a log is not required? 10
8. (a) Define the following with example: 09
(i) Homogeneous distributed database.
(ii) Data replication.
(iii) Data fragmentation.
(b) How does multilevel indexing improve the efficiency of searching an index file? 06
(c) What is timestamp of a transaction? How is timestamp of a transaction implemented? 10
(d) Describe node structure of B⁺ tree. Show necessary steps to insert the data value in the following order: 10

8, 5, 1, 7, 3, 12, 9, 6, 16, 10

– END –

DHAKA UNIVERSITY OF ENGINEERING & TECHNOLOGY, GAZIPUR

B.Sc. Engineering 3rd Year 1st Semester Examination, 2014

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Course Title: Database System

Course No: CSE-3311

Time: 3 Hours

Full Marks: 210

Instructions: (a) Answer any three questions from each section.

(b) Use separate answer scripts for each section.

(c) All questions are of equal value.

SECTION - A

1. (a) Define and differentiate the terms database, DBMS and database systems. 09
(b) What are the different types of database end users? Discuss the main activities of each. 10
(c) Explain the main characteristics of the database approach and how it differs from traditional file systems. 10
(d) Write short note on following terms: 06
 (i) Data Dictionary.
 (ii) Database Instance.
2. (a) What is data model? Depict ERD for a system as your choice with using all categories of notation, attributes and mapping cardinalities. 12
(b) Define Data Manipulation Language(DML) and Data Definition Language(DDL) with example. 10
(c) Explain primary key, candidate key, super key and foreign key with example. 13
3. (a) Depict all symbols(name) for different operations of relational algebra and give an example for each of them in a tabular form. 10
(b) Write the formal definition of relational algebra. 05
(c) Explain physical storage media with example. 15
(d) Which factor should consider for performance measures of DISKs. 05
4. (a) Mention different database architectures. Briefly describe the centralized database system. 11
(b) Consider the following relational database. 12

employee (employee_name, street, city)

works (employee_name, company_name, salary)

company (company_name, city)

Give an expression in relational algebra to express each of the following queries:

- (i) Find the names of all employees who live in city "DHAKA".
- (ii) Find the names of all employees whose salary is greater than BDT100,000.
- (iii) Find the names of all employees who live in "DHAKA" and whose salary is greater than BDT100,000.
- (c) What are the main goals of the RAID technology? How does it achieve them? What characterize the levels in RAID organization? 12

SECTION – B

5. (a) Why should NULLs in a relation be avoided as much as possible? Discuss the problem of spurious tuples and how we may prevent it. 08
- (b) Consider the following relation for published books: 15
- BOOK(BookTitle, AuthorName, BookType, ListPrice, AuthorAffiliation, Publisher)*
- Suppose the following dependencies exist:
- BookTitle → BookType, Publisher*
BookType → ListPrice
AuthorName → AuthorAffiliation
- (i) What normal form is the relation in? Explain your answer.
(ii) Apply normalization until you cannot decompose the relations further. State the reasons behind each decomposition.
- (c) Define Boyce-Codd normal form. How does it differ from 3NF? Consider the following relation: 12
- COURSE(StudentId, StaffId, ClassCode, EnrollGrade)*
- Is this relation in 3NF or BCNF? Why or why not? How would you normalize it completely?
6. (a) Define multivalued and join dependencies. How can you normalize these dependencies? Explain with example. 12
- (b) Consider the following employee database, where the primary keys are underlined.
- employee (employee_name, street, city)*
works (employee_name, company_name, salary)
company (company_name, city)
manages (employee_name, manager_name)
- Give an expression in SQL for each of the following queries:
- (i) Find the names and cities of residence of all employees who work for "SONALI BANK".
(ii) Find the names, street addresses, and cities of residence of all employees who work for "SONALI BANK" and earn more than BDT10,000.
(iii) Find all employees in the database who do not work for "SONALI BANK".
(iv) Find all employees in the database who earn more than each employee of "AGRANI BANK".
(v) Assume that the companies may be located in several cities. Find all companies located in every city in which "AGRANI BANK" is located.
(vi) Find those companies whose employees earn a higher salary, on average, than the average salary at "SONALI BANK".
- (c) Describe SQL self join operation with example. 05
7. (a) What is transaction? Discuss the actions taken by the `read_item` and `write_item` operations on a database transaction. 10
- (b) Explain the distinction between the terms serial schedule and serializable schedule with example. 10
- (c) What is two-phase locking protocol? How does it guarantee conflict serializability? Why need lock conversion in two phase locking protocol? 12
- (d) When are two operations said to be conflicted in a schedule? 03

8. (a) How tree-protocol of concurrency control works? Also explain how tree-protocol ensures serializability and deadlock freedom. 12
- (b) What is B-tree? Show the B-tree after performing the following operations 15
on the B-tree of order 5 shown in figure 8(b).
- (i) Insert 12
 - (ii) Insert 53
 - (iii) Delete 37
 - (iv) Delete 16

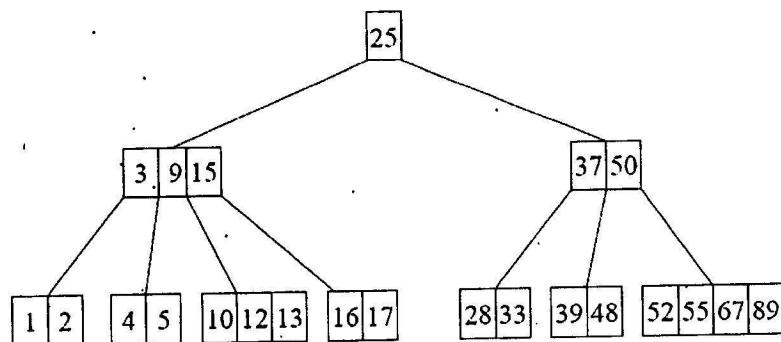


Figure: 8(b)

- (c) How does a B-tree differ from a B+-tree? Why is a B+-tree usually 08
preferred as an access structure to a data file?

- END -