

Bangladesh Open University
School of Science and Technology
B. Sc in Computer Science and Engineering Program
172 Term (2nd Year 2nd Semester) Final Examination
Course Code & Title: CSE2238 Database Management Systems

Time: 3 hours

Total Marks (5×14): 70

*[N.B.: Answer any 5 (five) questions. The figures in the right margin indicate the full marks.
All portions of each question must be answered sequentially.]*

1. (a) To store data of your organization, why would you choose databases and DBMS over regular files and files systems? Explain. 5
- (b) Discuss some scenarios where using a DBMS may not be beneficial. 3
- (c) What are some of the services DBMSs provide? 3
- (d) What are instances and schemas of Database? Explain with example. 3
2. (a) Define union and set difference operations in relational algebra. Consider the given relations r and s. 2+1
Using the relational algebra find out: (i) $r \cup s$ (ii) $r - s$.

A	B
α	1
α	2
β	1

r

A	B
α	2
β	3

s

- (b) Relational schema defines attributes of an entity or object. Each attributes have domains associated with their value. Define attributes and domains. 4
- (c) Explain the following: (i) composite attributes (ii) atomic attributes (iii) single-valued attributes (iv) multi-valued attributes. 4
- (d) Using an example, explain referential integrity constraint for a foreign key. 3
3. (a) You have the following relations - 4
STUDENTS(national_id, student_id, name, dob, phone_no)
COURSES(course_code, course_title, descriptions)
COURSES_TAKEN(national_id, course_code, year_taken) [this relations is to keep track of which students has completed what courses and in what years]
For each of those relations above, identify candidate keys, primary keys and foreign key (if exists) and justify your answer.
- (b) As a freelance database designer you got a project to design a database for a real estate company. 8
After much discussions with the client, you understood the following –
 - (i) The company has several large projects like Blah Lake City projects, Jheelpar Bangalows and so on. And each project contains plots of varying sizes like 2 katha, 3 katha and so on.
 - (ii) A client can create a booking for a plot in any of those projects by filling out a paper form at this time.
 - (iii) Each client has to make monthly payments against their booking.
 - (iv) Client must have at least one nominee information provided to create the booking.
 - (v) Each booking also has a sales agent associated who gets commissions for the sale.You did some brainstorming and came up with the best ER (Entity-Relationship) schema possible. Show that schema.
- (c) Explain aggregate functions with examples. 2

4. (a) Explain the ACID properties of Database Transaction. 5
 (b) What is cascading rollback and cascade less schedules? Explain the testing procedure for viewing Serializability with example. 3+3
 (c) What is lock? Describe the types of locks used in concurrency control. 1+2
5. (a) Explain the concept of functional dependency and its types. If B is a composite key, then what are the conditions that A be fully functionally dependent on B? 2+2
 (b) Mention the merits and demerits of normalization. 4
 (c) How would you normalize the table below? Show the normalization process. 6

national_id	name	phones	exam_code	exam_long_nme	Result
111	John	0182222222, 01752258963	SSC	Secondary School Certificate	3.5
111	John	0182222222, 01752258963	HSC	Higher Secondary Certificate	3.7
222	Jane	0182222222, 01752258963	SSC	Secondary School Certificate	3.9
Jane 222	John Jane	0182222222, 01752258963	HSC	Higher Secondary Certificate	4.0

6. (a) Explain DDL and DML with examples. 3
 (b) What is the use of group by clause in SQL query statement? Explain with an example. 3
 (c) Explain natural join in SQL query with an example. 3
 (d) Consider the following database schema of a sample university: 5
 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 ID10101.
 (iii) Find the name 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.
7. (a) Large globally distributed organizations may need to distribute their databases. What is your understanding of distributed databases and why do you think organizations may need to distribute their databases? 6
 (b) There are two strategies in distributing a database - replication and fragmentation. Explain these two techniques along with their advantages and disadvantages. 8

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172 Term (2nd Year 2nd Semester) Final Examination
Course Code & Title: CSE22P9 Database Management System Lab

Time: 3 hours

Total Marks: 60

A. Choose and perform one experiment by lottery from out of the following experiments.

1×40=40

Exp 1. Create the following tables-

agents(agent_no, agent_name, agent_dob)

plot_sales(sale_id, plot_address, totla_katha, price_per_katha, agent)

- (a) Insert test data (minimum of three rows in each table) into these tables (remember any relation that may exist)
- (b) The primary keys are underlined. Identify the foreign keys
- (c) Generate queries to do the following :
 - (i) Show ploat_no and plot address and agent name to see plots sold by each agents
 - (ii) Find a list of plots sold by agent with agent no 123

Exp 2. Consider the following relational schema for a banking database application:

STUDENTS(stu_no, name)

COURSES(course_code, course_title)

COURSE_TAKEN(course_code, stu_no, year_taken)

- (a) Create the above mentioned tables and populate test values accordingly
- (b) The primary keys are underlined. Identify the foreign keys
- (c) Show all student numbers that took course with course code "CSE1234"
- (d) Show a list of student names and the course titles of the courses they have taken so far.

Exp 3. Consider the following relational schema for a library management system:

BOOK(BOOKID, TITLE, NO_OF_COPIES)

BORROWER(CARDNO, NAME)

BOOK_LOAN(BOOK_ID, CARDNO, DATEOUT, DUEDATE, STATUS)

Implement a Check Constraint for STATUS ('R' –Returned, 'T' –To be returned)

- (a) Create the above mentioned tables and populate values accordingly
- (b) The primary keys are underlined. Identify the foreign keys
- (c) Develop a SQL query to list the details of borrowers who do not have any books checked out.
- (d) Develop a SQL query to list the details of borrowers who have more than five books checked out.
- (e) Create a view that will keep track of the card number, card holders name and number of books borrowed (Number of books with status 'T')

Exp 4. Create the following tables with the mapping given below.

a. **stu_details**(reg_no, stu_name, address, city)

b. **mark_details**(reg_no, mark1, mark2, mark3, total)

- (a) Insert some values in this table
- (b) Delete the row whose reg_no=161.
- (c) Alter the table mark_details to add a column average with data type as long.
- (d) Display all details whose names begins with 'a'
- (e) Rename the table mark_details as 'academics'.
- (f) Drop the table mark_details.

Exp 5. Create the table **Workers** and the details are-

Name	Designation	Branch Name
Tonmoy	Manager	Dhaka
Anwar	Supervisor	Shylet
Shimul	Assistant	Rajshahi
Tomal	Supervisor	Dhaka
Zico	Manager	Khulna
Sufian	Assistant	Shylet

Perform the following-

- Alter the table by adding a column salary and insert data on it
- Truncate the table
- Copy the table Workers as Workers_info
- Delete the second row from the table
- Sort the table according to the name (Ascending order)
- Group the table by branch name
- Drop the table

Exp 6. Create the following table and insert data into it.

employee (emp_id, emp_name, department, salary, address, city)

- Alter the table by adding a column designation
- Display the information from 'employee' table group by city.
- Find the maximum, minimum and average salary from 'employee' table using aggregate function.
- Delete all the records where salary is less than 10000.
- Find the total number of employees.
- Apply triggers.

Exp 7. Consider the following relational database where the primary key are underlined. Write the SQL command to create the following table with key constraints.

Person (driver_id, address, name)

car (license, model, year)

accident (report_number, location, date)

percipated (driver_id, car, report_number, amount)

Write the SQL command to

- insert some sample data in all the tables.
- Find the name of all person in Dhaka
- Find the name of all person who have a car
- Find all the drivers who participated at least one accident.

B. Notebook on experiments.

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C. Viva-voce.

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[N.B.: Answer any 5 (five) questions. The figures in the right margin indicate the full marks. All portions of each question must be answered sequentially.]

1. (a) What is Database Management System? What are the difference between Database System and File System? 2+4
(b) Briefly describe data abstraction with necessary diagram. 4
(c) Differentiate between the following terms- 2+2
 - (i) DDL and DML;
 - (ii) Instances and schema.
2. (a) Differentiate between weak and strong entity set. 2
(b) Define with example 5
 - (i) Simple and composite attribute;
 - (ii) Single valued and multi-valued attribute;
 - (iii) Derived attribute.
- (c) Consider the following information about a university database: 7
 - The university keeps track of each student's name, student number, social security number, current address and phone, permanent address and phone, birth_date, gender, class (freshman, sophomore, ..., graduate), major department, minor department (if any), and degree program (B.A., B.S., ..., Ph.D.). Some user applications need to refer to the city, state, and zip of the student's permanent address, and to the student's last name. Both social security number and student number have unique values for each student.
 - Each department is described by a name, department code, office number, office phone, and college. Both name and code have unique values for each department.
 - Each course has a course name, description, course number, number of semester hours, level, and offering department. The value of course number is unique for each course.
 - Each section has an instructor, semester, year, course, and section number. The section number distinguishes different sections of the same course that are taught during the same semester/year; its values are 1, 2, 3, ..., up to the number of sections taught during each semester.
 - A grade report has a student, section, letter grade, and numeric grade (0, 1, 2, 3, 4 for F, D, C, B, A, respectively).

Design and draw an ER diagram that captures the information about the university. Use only the basic ER model here; that is, entities, relationships, and attributes. Be sure to indicate any key and participation constraints.
3. (a) During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Using a suitable diagram explain how each state transition may occur. 2+2
(b) Describe the ACID properties of transaction. 2
(c) What is lock? Describe the types of locks used in concurrency control. 1+2
(d) Suppose a transaction to transfer \$50 from account A to account B is as follows: 5
 1. read(A)
 2. A:=A-50
 3. write(A)
 4. read(B)
 5. B:=B+50
 6. write(B)

Using this example explain the consistency and isolation requirements of a transaction.

4. (a) Using suitable examples explain left and right outer join in SQL query. 4
 (b) What is the function of "%" and "_" in string operations? 2
 (c) What is the functionality of order by and group by in SQL? Explain it with example. 3
 (d) Consider the following insurance database, where the primary keys are underlined. Construct the following SQL queries for this relational database. 5

person (driver_id, name, address)

car (license, model, year)

accident (report_number, date, location)

owns (driver_id, license)

participated (report_number, license, driver_id, damage_amount)

- (i) Find the total number of people who owned cars that were involved in accidents in 2009.
 (ii) Add a new accident to the database; assume any values for required attributes.
 (iii) Delete the Mazda(Car) belonging to "John Smith".
 (iv) Find the number of accidents in which the cars belonging to "John Smith" were involved.
 (v) Update the damage amount for the car with the license number "AABB2000" in the accident with report number "AR2197" to \$3000.
5. (a) What do you understand by functional dependencies? Explain different rules of inference for functional dependencies. 2+5
 (b) Consider the relation R, which has attributes that hold schedules of courses and sections at a university;
 $R = \{Course_no, Sec_no, Offering_dept, Credit_hours, Course_level, Instructor_ssn, Semester, Year, Days_hours, Room_no, No_of_students\}$.
 Suppose that the following functional dependencies hold on R:
 $\{Course_no\} \rightarrow \{Offering_dept, Credit_hours, Course_level\}$
 $\{Course_no, Sec_no, Semester, Year\} \rightarrow \{Days_hours, Room_no, No_of_students, Instructor_ssn\}$
 $\{Room_no, Days_hours, Semester, Year\} \rightarrow \{Instructor_ssn, Course_no, Sec_no\}$
 Try to determine which sets of attributes form keys of R. How would you normalize this relation? 7

6. (a) Consider the given relations r and s. Using relational algebra find out: 2+2
 (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

- (b) Explain the distinctions among the terms primary key, candidate key, and super key. 3
 (c) Selection and projection are two fundamental relational algebra operations. Define them with examples. 3
 (d) The relations are- 4

branch (branch_name, branch_city, assets)

customer (customer_name, customer_street, customer_city)

account (account_number, branch_name, balance)

loan (loan_number, branch_name, amount)

depositor (customer_name, account_number)

borrower (customer_name, loan_number)

Write down the relational algebra for the following:

- Find the names of all customers who have a loan, an account, or both, from the bank.
 - Find the names of all customers who have a loan at the Gulshan branch.
 - Find the names of all customers who have a loan at the Gulshan branch but do not have an account at any branch of the bank.
 - Find all customers who have an account at all branches located in Dhaka city.
7. (a) What is a distributed database? Discuss the homogeneous and heterogeneous distributed databases. 2+2
 (b) Explain replication and fragmentation in distributed databases. Discuss the advantages and disadvantages of these two approaches. 2+4
 (c) What is data transparency in a distributed database? Explain its different forms. 1+3

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1×40=40

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agents(agent_no, agent_name, agent_dob)plot_sales(sale_id, plot_address, total_katha, price_per_katha, agent)

- Insert test data (minimum of three rows in each table) into these tables (remember any relation that may exist)
- The primary keys are underlined. Identify the foreign keys
- Generate queries to do the following :
 - Show plot_no and plot address and agent name to see plots sold by each agents
 - Find a list of plots sold by agent with agent no 123

Exp 2. A database table has following specification.

player_info(player_id, name, nationality, age, total_goals)

- Create the database table from the above specification.
- Insert some sample data into the table.
- Write a SQL command to show the player's name, total_goals and nationality who is above 32 years old.
- Write a SQL command to show all the player details based on total_goals. Where "total_goals" will be in descending order.
- Write a SQL command to show the player name who has the 2nd highest goals among all the players.
- Write an SQL command to find the name, nationality and total_goals of the oldest player.

Exp 3. Consider the following relational schema where the primary keys are underlined. Write the SQL commands to create the following table with the key constraints.

owner(owner_id, name, address)car(license_no, owner_id, car_name, model, year)accident(report_no, license_no, location, date)participated(owner_id, report_number, total_accident)

Write the SQL command to:

- Insert some data in all the tables.
- Find the name all owners lives in New York.
- Find the name of all persons who have a car.
- Find the total number of accident happened in Dhaka.
- Find the name of all cars participated at least one accident.

Exp 4. Create the table Products and the details are-

ID	Name	Brand	Category	Price	Production_Year
101	Laptop	Apple	Electronics	50000.00	2017
102	Car	BMW	Automobile	2000000.00	2018
103	Bike	YAMAHA	Automobile	120000.00	2019

Perform the following SQL operation:

- Alter the table by adding a column Model_No and insert data into it.
- Truncate the table.
- Copy the table Products as Product_info.
- Delete the second row from the table.
- Sort the table according to the Brand names.
- Group the table by Category.
- Drop the table.

- Exp 5.** Consider the following relational schema where the primary keys are underlined. Write the SQL commands to create the following table with the key constraints.
- cricket_team(team_id, team_name, total_win)
worldcup(cup_year, team_id, best_player)
player(player_id, team_id, player_name, total_match, total_goal, birthdate)
- Write the SQL command to:
- Insert some data in all the tables.
 - Display the name of all the teams and best players of the entire world cups in ascending order by year.
 - Find the name all players who played for "Bangladesh".
 - Find the name of the team won the world cup in 2011.
 - Find the name of the player who has highest number of total_goal/total_match ratio.

- Exp 6.** A database table has following specification.
- Employee(Emp_id, Name, Position, Age, Salary)
- Write the SQL command to:
- Create the database table from the above specification.
 - Insert some sample data into the table.
 - Write a SQL command to show the Employee name who is "Programmer".
 - Write a SQL command to show all the employee details based on age. Where "age" will be ascending order.
 - Write a SQL command to show the Employee name who has the 3rd highest salary among all the Employee.
 - Write a SQL command to display Name and Position of each employee who is more than 25 years old and earn more than '20000' taka per month.

- Exp 7.** Consider the following relational schema for a library management system:
- BOOK (BOOKID, TITLE, NO_OF_COPIES)
BORROWER (CARDNO, NAME)
BOOK_LOAN (BOOK_ID, CARDNO, DATEOUT, DUEDATE, STATUS)
- Implement a Check Constraint for STATUS ('R' -Returned, 'T' -To be returned)
- Create the above mentioned tables and populate values accordingly
 - The primary keys are underlined. Identify the foreign keys
 - Develop a SQL query to list the details of borrowers who do not have any books checked out.
 - Develop a SQL query to list the details of borrowers who have more than five books checked out.
 - Create a view that will keep track of the card number, card holders name and number of books borrowed (Number of books with status 'T')

- Exp 8.** Create the following tables with the mapping given below.
- stu_details(reg_no, stu_name, address, city)
mark_details(reg_no, mark1, mark2, mark3, total)
- Insert some values in this table
 - Delete the row whose reg_no=161.
 - Alter the table mark_details to add a column average with data type as long.
 - Display all details whose names begins with 'a'
 - Rename the table mark_details as 'academics'.
 - Drop the table mark_details.

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| B. | Notebook on experiments. | 10 |
| C. | Viva-voce. | 10 |