Bangladesh Open University

School of Science and Technology

B. Sc in Computer Science and Engineering Program

182 Term 2nd Year 2nd Semester Final Examination

Course Code & Title: ECO2221 Economics

Time: 3 hours   **Total Marks: 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) Define scarcity, efficiency, and economic goods.   6
   (b) What are the differences between positive economics and normative economics?   3
   (c) What do you mean by Production Possibility Frontier (PPF)? Explain with graph.   5

2. (a) What is the supply schedule? What is the supply curve? Draw a supply curve from a hypothetical supply schedule.   2+2+6
   (b) What is the law of supply? What do you mean by market equilibrium?   2+2

3. (a) Using the following table calculate Total Cost (TC). Marginal Cost (MC), Average Cost (AC), Average Variable Cost (AVC) and Average Fixed Cost (AFC).   10

Quality (Q)	Fixed Cost (FC)	Variable Cost (VC)
0	100	0
1	100	50
2	100	80
3	100	100
4	100	110
5	100	130
6	100	160
7	100	200
8	100	250
9	100	310
10	100	380

   (b) What are the tools of fiscal policy?   4

4. (a) Define price elasticity of demand.   2
   (b) List and explain some of the determinants of the price elasticity of demand.   5
   (c) What are the problems in computing national income in Bangladesh? Explain.   7

5. (a) What do you mean by utility?   2
   (b) Distinguish between total utilithyy and marginal utility.   4
   (c) Define budget constraint.   2
   (d) Consider O'Briens, who has a monthly income of $1200. In a world of two goods, X, and Y the price of X is $100 and the price of Y is $80. Construct O'Brien's budget constraint.   6

6. (a) What is tax? Explain the canon's of tax.   7
   (b) Briefly explain the causes of inflation in Bangladesh.   7

7. Write short notes on the following: 3.5×4
   (i) Indifference curve;
   (ii) Shut-down point;
   (iii) Instruments of monetary policy;
   (iv) GDP and GNP.

Bangladesh Open University
School of Science and Technology
B. Sc in Computer Science and Engineering Program
182 Term 2nd Year 2nd Semester Final Examination
Course Code & Title: CSE2234 Information System Analysis and Design

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) Define System? Write the elements of System. What are information systems and who are the stakeholders in the information systems game? 2+2+1

   (b) Define data and information. If you want to pursue a career as a systems analyst, what knowledge and skills do you need to acquire? 2+1+2

   (c) All good information has the characteristics, mention them. How is data converted into information? Show with diagram. 2+2

2. (a) What is technical feasibility, operational feasibility and economic feasibility? 6

   (b) If an information system were to be designed for a retail grocery store, what would be the strategic, technical, statutory and operational information? 4

   (c) Differentiate between system design and analysis. Is it possible to start designing without analysis? How? 4

3. (a) Define the terms project and project management and differentiate between project and process management. Describe the causes of failed information systems and technology projects. 3+2

   (b) Describe eight activities in project management. Define joint project planning and its role in project management. 2+3

   (c) Describe the preliminary investigation, problem analysis, requirement analysis, and decision analysis phases in terms of purpose, participants, inputs, outputs, techniques, and steps. 4

4. (a) What do you mean by system testing? Mention the differences between white box, grey box, and black box testing with example. 6

   (b) Define information system security. Briefly describe physical security and data security with example. 4

   (c) What are the differences between open ended questionnaires and close ended questionnaires regarding information gathering tool? 4

CSE2234

5. (a) Differentiate between Computer-Aided Systems Engineering (CASE), Application Development Environments (ADEs), and process and project management technology as automated tools for system development.   2+2

(b) Distinguish between internal, external, and turnaround outputs. Differentiate between detailed, summary, and exception reports.   2+2

(c) Consider hospital management project scenario and formulate Gantt chart and network diagram.   3+3

6. (a) Write the Observation Guidelines and Procedure to Conduct an Interview.   3+2

(b) What are the major threats to system security? Write down the guidelines to control the access.   2+3

(c) Discuss the concept of MIS and DSS. How are they related and how do they differ?   2+2

7. Consider the following scenario: 7+7

"Cooperative Bank Ltd." has automated banking management system and human resource management system. Every employee has their unique user IS and password to access information systems. This bank offer online customer bank account opening process. A customer can apply for open a bank account via web based interface from anywhere of the world by submit required documents. After verification of personal details and other system uses National ID cad or TIN certificate and any recent utility bill for address verification. Customer will receive unique user id and OTP for active his/her account. To activate his/her account customer have to deposit minimum 500 taka. After activating account customer can apply for ATM card or cheque book. Then customer can withdraw money from bank of ATM booth.

Every deposit and withdrawn transaction is recorded in a file and the customer can collect specific date wise bank statement from the bank.

Now answer the questions given below:
   (a) Draw DFD to withdraw money from bank using either ATM card or Cheque.
   (b) Draw use case diagram for account opening process.

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B. Sc in Computer Science and Engineering Program
182 Term 2nd Year 2nd Semester Final Examination
Course Code & Title: CSE22P5 Information System Analysis and Design Lab

Time: 3 hours

Total Marks: 60

A. Choose one experiment by lottery from out of the following experiments.   1×40=40

Exp 1. "SN Transport" is a highway bus transport company which travel from Dhaka to Cox's Bazar in both way. Now the authority want to implement web based ticket reservation and automation system.
Perform a "SN Transport" automation system mentioning the phases: **Analyze Planning, Design, Documentation, Training and Support, Implementation.**

Exp 2. "ITHub" receives order from distributors, resellers and individuals for computer accessories. They want full web based application for their smooth management.
Perform an "ITHub" automation system mentioning the phases: **Analyze Planning, Design, Documentation, Training and Support, Implementation.**

Exp 3. "Arther Asha" is a NGO, which provide loan to the customer and collect installment with interest. They are now maintain excel file for their loan and installment purpose.
Propose web based full automation system for them which includes the phases: **Analyze Planning, Design, Documentation, Training and Support, Implementation.**

Exp 4. "BdFashion Ltd" is a fashion wares house. They have 25 showrooms in Dhaka city and every showroom has several sales persons. Company has total 250 employees. HR section of this company want to automation system for HR management.
Perform a "BdFashion Ltd" HR automation system mentioning the phases: **Analyze Planning, Design, Documentation, Training and Support, Implementation.**

Exp 5. "TM Pharmacy" renowned pharmacy. They have all categories of drugs. For their smooth sales and quality search of drugs they want to implement mobile application.
Perform a "TM Pharmacy" Mobile application system mentioning the phases: **Analyze Planning, Design, Documentation, Training and Support, Implementation.**

Exp 6. Robin and Rayhan is a computer science student lives in a mess. All mess members are maintain a notebook for their daily expenses. Rayhan wants to implement a mobile application for their monthly expense calculation individually.
Now design a Mobile application system mentioning the phases: **Analyze Planning, Design, Documentation, Training and Support, Implementation.**

Exp 7. As a computer science student propose a mobile based tour management application which provides event create option, member adding option, fund collection option, cost management(individual) option and so on.
Now design a Mobile application system mentioning the phases: **Analyze Planning, Design, Documentation, Training and Support, Implementation.**

CSE22P5

Exp 8. Perform of **Online Shopping System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 9. Perform of **Hospital Management System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 10. Perform of **Library Management System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 11. Perform of **University Medical System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 12. Perform of **Online Ticketing System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 13. Perform of **Pay Role System of an Organization** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 14. Perform of **Online Course Registration System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 15. Perform of **BOU Student Information System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

Exp 16. Perform of **Car Parking Management System** mentioning the phases: Planning, Analysis, Design, Documentation, Training and Support, Implementation.

B. Notebook on experiments. 10

C. Viva-voce. 10

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School of Science and Technology
B. Sc in Computer Science and Engineering Program
182 Term 2nd Year 2nd Semester Final Examination
Course Code & Title: CSE2232 Microprocessors and Microcontrollers

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) Write short notes on the following: 3
            (i) Debugger;
            (ii) Linker;
            (iii) Assembler.
    (b) What is flag register? Explain all flag registers of 8086 microprocessor with necessary diagram.   1+6
    (c) What will be the status of flag register (SF, PF, ZF, CF and OF) after the following instructions: 4
            (i)   SUB AL, BL (where AL=80H, BL=80H);
            (ii) ADD AX, BX (where Ax=8000H, BX=30BFH).

2. (a) Describe the block diagram of 8086 internal architecture.   5
    (b) Explain different types of instructions in 8086 with example.   6
    (c) What is instruction pointer? How is the physical address of instruction is calculated?   3

3. (a) How a stepper motor is interfaced to the 8255A? Sketch the interfacing diagram and explain the operation.   6
    (b) Draw the block diagram of 8254 time controller.   4
    (c) What do you mean by I/O interface? Distinguish between direct I/O and memory-mapped I/O.   2+2

4. (a) What are the major actions, if any interrupt is occurred in 8086?   5
    (b) Describe the major types of interrupt in 8086.   4
    (c) Draw the inernal block diagram of 8259A priority interrupt controller.   5

5. (a) Explain with the example of following assembler directives: 5
            (i) ORG; (ii) ASSUME; (iii) PROC; (iv) ENDM; (v) SEGMENT.
    (b) What do you mean by software interrupt? How does microprocessor respond when an interrupt   1+2
         occurs or initiated?
    (c) Draw the internal structure of the 80X87 arithmetic coprocessor. Discuss and compare RISC and   2+4
         CISC processors.

6. (a) Write short note on the following: 6
            (i)   Pipeline Hazards   (ii)   Coprocessor status bits and control register
            (iii) Quantizing and encoding
    (b) Discuss about different types of data in 8087 math coprocessor.   8

7. (a) Draw a block diagram of DMA controller. How DMA operations are performed?   2+2
    (b) What is the difference between register and memory? Write down the list of special function   2+3
         registers (SFRs) and it's function.
    (c) Discuss the I/O port programming of 8051 microcontroller.   5

CSE2232   Page 1 of 1

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B. Sc in Computer Science and Engineering Program
182 Term 2nd Year 2nd Semester Final Examination
Course Code & Title: CSE 2236 Computer Algorithms

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) What do you understand by asymptotic notation? Define Ω notation, Θ notation and O notation with proper example.   1+6

   (b) Solve $T(n)=2T(n/2)+c$ the recurrence equation using recursion tree method.   3

   (c) Calculate the time complexity of the following algorithm: 4

   ```
   for ( var i = 0; i < n; ++i ) {
       if ( A[ i ] >= M ) {
           M = A[ i ];
       }
   }
   ```

2. (a) Define divide and conquer strategy. Give some examples for divide and conquer method.   3

   (b) Write the recursive algorithm for quick sort. Draw the partition tree to sort the following sequence of data   2+4
   {5, 10, 3, 20, 70, 60, 25, 18, 30, 35, and 50}.

   (c) Consider five matrixes A1, A2, A3, A4 and A5 with dimensions 4×10, 10×3, 3×12, 12×20 and 20×7 5
   respectively. Find the optimum number of multiplications required and parenthesize the matrixes.

3. (a) Represent the following graph in an adjacency list and an adjacency matrix.   3
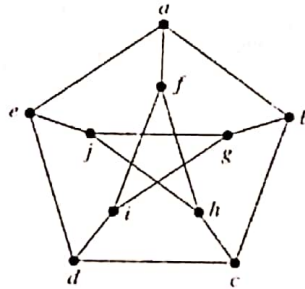
   (b) Find BFS and DFS for the following graph using 'a' as the starting node: 3+3
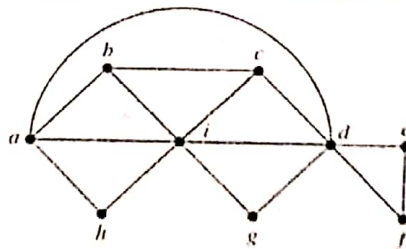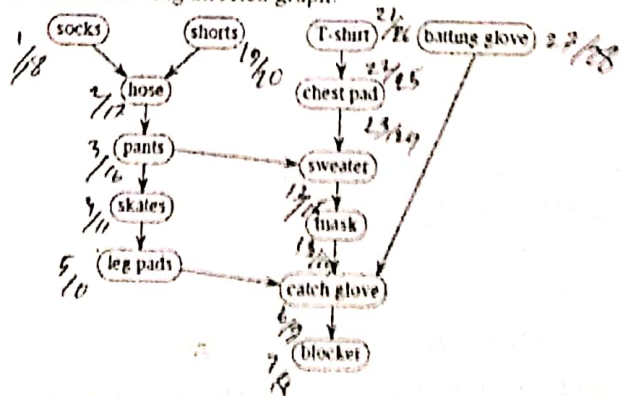
   (c) Perform topological sorts on the following directed graph: 5

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B. Sc in Computer Science and Engineering Program
182 Term 2nd Year 2nd Semester Final Examination
Course Code & Title: CSE22P7 Computer Algorithms Lab

Time: 3 hours

Total Marks: 60

A. Choose one experiment by lottery from out of the following experiments.   1×40=40

Exp 1.   Write a program to implement Dijkstra's algorithm to find the shortest path of a graph.

Exp 2.   Write a program to implement Breadth First Search (BFS) algorithm in a graph.

Exp 3.   Write a program to implement Floyd–Warshall algorithm.

Exp 4.   Write a program to implement Largest Common Subsequence.

Exp 5.   Write a program to implement Depth First Search Algorithm.

Exp 6.   Write a program to implement Heap sort algorithm.

Exp 7.   Write a program to implement activity selection problem.

Exp 8.   Write a program to implement Prim's/Kruskal's algorithm to find minimum cost spanning tree of a graph.

Exp 9.   Write a program to implement Knapsack algorithm to find optimal solution from any weight and profit values.
Sample Input: n = 3, m = 20, (P1, P2, P3) = (25, 24, 15) and (W1, W2, W3) = (18, 15, 10)

Exp 10.   Write a program to implement Matrix Chain Multiplication.

B. Notebook on experiments.

10

C. Viva-voce.

10

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

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) 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-
      (i) DDL and DML;
      (ii) Instances and schema.   2+2

2. (a) Differentiate between weak and strong entity set.   2

   (b) Define with example
      (i) Simple and composite attribute;
      (ii) Single valued and multi-valued attribute;
      (iii) Derived attribute.   5

   (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; **7**

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} → {Offering_dept, Credit_hours, Course_level}
{Course_no, Sec_no, Semester, Year} → {Days_hours, Room_no, No_of_students, Instructor_ssn}
{Room_no, Days_hours, Semester, Year} → {Instructor_ssn, Course_no, Sec_no}

Try to determine which sets of attributes form keys of R. How would you normalize this relation?

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:

    i. Find the names of all customers who have a loan, an account, or both, from the bank.

    ii. Find the names of all customers who have a loan at the Gulshan branch.

    iii. 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.

    iv. 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**

CSE2238

Bangladesh Open University

School of Science and Technology

B. Sc in Computer Science and Engineering Program
182 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. A database table has following specification.
     player_info(player_id, name, nationality, age, total_goals)
        (a) Create the database table from the above specification.
        (b) Insert some sample data into the table.
        (c) Write a SQl command to show the player's name , total_goals and nationality who is above 32 years old.
        (d) Write a SQL command to show all the player details based on total_goals. Where "total_goals" will be in descending order.
        (e) Write a SQL command to show the player name who has the 2rd highest goals among all the players.
        (f) 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, liscene_no, location, date)
     participated(owner_id, report_number, total_accident)
Write the SQL command to:
        (a) Insert some data in all the tables.
        (b) Find the name all owners lives in New York.
        (c) Find the name of all persons who have a car.
        (d) Find the total number of accident happened in Dhaka.
        (e) 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:
        (a) Alter the table by adding a column Model_No and insert data into it.
        (b) Truncate the table.
        (c) Copy the table Products as Product_info.
        (d) Delete the second row from the table.
        (e) Sort the table according to the Brand names.
        (f) Group the table by Category.
        (g) 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
  (a) Insert some data in all the tables.
  (b) Display the name of all the teams and best players of the entire world cups in ascending order by year.
  (c) Find the name all players who played for "Bangladesh".
  (d) Find the name of the team won the world cup in 2011.
  (e) 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:
  (a) Create the database table from the above specification.
  (b) Insert some sample data into the table
  (c) Write a SQl command to show the Employee name who is "Programmer".
  (d) Write a Sql command to show all the employee details based on age. Where "age" will be ascending order.
  (e) Write a SQL command to show the Employee name who has the 3rd highest salary among all the Employee.
  (f) 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)
  (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 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)
  (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.

B. Notebook on experiments.

10

C. Viva-voce.

10

Bangladesh Open University
School of Science and Technology
B. Sc in Computer Science and Engineering Program
182 Term 2nd Year 2nd Semester Final Examination
Course Code & Title: CSE2236 Computer Algorithms
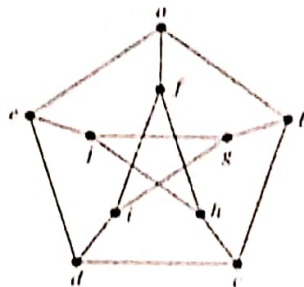
Time: 3 hours

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) What do you understand by asymptotic notation? Define Ω notation, Θ notation and O notation with proper example.   1+6

   (b) Solve $T(n)=2T(n/2)+c$ the recurrence equation using recursion tree method.   3

   (c) Calculate the time complexity of the following algorithm: 4

```
for ( var i = 0; i < n; ++i ) {
    if ( A[ i ] >= M ) {
        M = A[ i ];
    }
}
```

2. (a) Define divide and conquer strategy. Give some examples for divide and conquer method.   3

   (b) Write the recursive algorithm for quick sort. Draw the partition tree to sort the following sequence of data {5, 10, 3, 20, 70, 60, 25, 18, 30, 35, and 50}.   2+4

   (c) Consider five matrixes A1, A2, A3, A4 and A5 with dimensions 4 × 10, 10 × 3, 3 × 12, 12 × 20 and 20 × 7 respectively. Find the optimum number of multiplications required and parenthesize the matrixes.   5

3. (a) Represent the following graph in an adjacency list and an adjacency matrix.   3

   (b) Find BFS and DFS for the following graph using 'a' as the starting node: 1+3
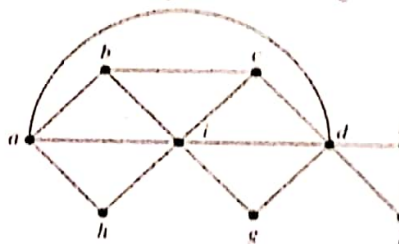
   (c) Perform topological sorts on the following directed graph: 5
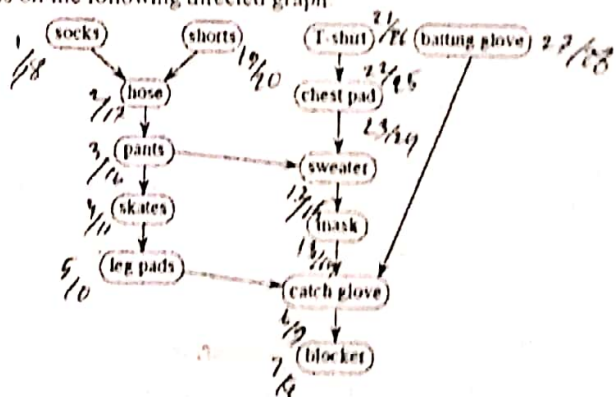
4. (a) Define Dynamic Programming. Differentiate between Greedy method and Dynamic Programming technique.   3

(b) Consider the strings "HEAGAWGHEE" and "PAWHEAE". Find the longest common substring using dynamic programming technique.   5

(c) Imagine you have a homework assignment with different parts labeled A through G. Each part has a   3+3
"value" (in points) and a "size" (time in hours to complete). The values and times for assignment are:

|	A	B	C	D	E	F	G
Value	7	9	5	12	14	6	12
Time	3	4	2	6	7	3	5

Say you have a total of 15 hours. Now,
   (i) Using 0/1 Knapsack, find out which assignments you should perform to gain maximum value.
   (ii) Using fractional Knapsack, find out which assignments or part of assignment you should perform to gain maximum value.

5. (a) Consider the following directed, weighted graph: 6
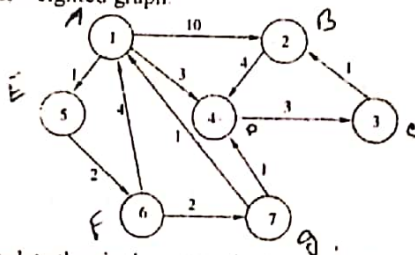
Use Dijkstra's algorithm to calculate the single-source shortest paths from vertex A to every other vertex.

(b) Compute minimum spanning trees for the following undirected, weighted graph: 4+4
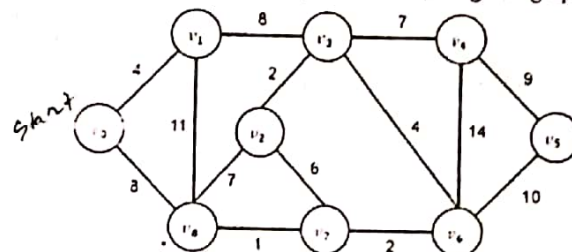
   i) Use Prim's algorithm to calculate a minimum spanning tree starting from vertex A.
   ii) Use Kruskal's algorithm to calculate a minimum spanning tree of the graph.

6. (a) Find the shortest paths from node S to every other node in the following graph using the Bellman and Ford algorithm.   6
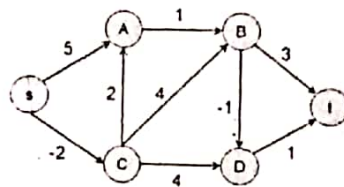
(b) Consider the following graph: 8
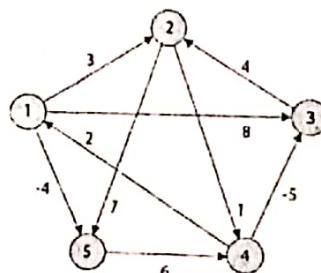
The numbers next to the edges denote the length of the edge. Determine the shortest paths between all pairs of nodes using Floyd -Warshall algorithm.

7. (a) What are NP, P, NP-complete and NP-Hard problems?   5

(b) What are differences between decision and optimization problems?   2

(c) What is Reduction? How to prove that a given problem is NP complete?   2+2

(d) Prove that an undirected graph $G = (V, E)$ on n nodes has at most $\binom{n}{2}$ global min-cuts.   3