Patuakhali Science and Technology University

Faculty of Computer Science and Engineering

Dept. of computer Science and Information Technology

2nd Semester (Level-1, Semester-II), Final Examination of B.Sc. Engg. in (CSE) July-December-2021

Session: 2020-21

Course Code: CIT-121 Course Title: Discrete Mathematics

Full Marks: 70 Time: 3 Hours

[Figures in the right margin indicate full marks]Answer any 5 of the following questions.

1. (a) What kinds of problems are solved using discrete mathematics? 2

   (b) Define propositional logic and list the application of propositional logic. Show that $\neg(p \rightarrow q)$ and $(p \wedge \neg q)$ are logically equivalent. To model the 8-queens' problems as a satisfiability problem. Solve the problem where one queen in each row, no column contains more than one queen, and no diagonal contains two queens. 6

   (c) Translate the statement $\forall x(C(x) \vee \exists y(C(y) \wedge F(x,y)))$ into English, where $C(x)$ is "x has a computer," $F(x,y)$ is "x and y are friends," and the domain for both x and y consists of all students in your school. 2

   (d) Define rules of inference, modus ponens, and resolution. Assume that "For all positive integers n, and is greater than 4, then n^2 is less than 2^n" is true. Use universal modus ponens to show that $100^2 < 2^{100}$. 4

2. (a) What is optimization problem? State Cashier's algorithm for n cents, using any set of denominations of coins, as greedy algorithm. List the applications of string matching. 4

   (b) Define Big-O notation. Show that $f(x) = x^2 + 2x + 1$ is $O(x^2)$. Demonstrate the growth of the following functions: $1, \log n, n, n\log n, n^2, 2^n, n!$ commonly used in big-O estimates. Distinguish P and NP class problem in the complexity of algorithms. 6

   (c) Write the formal definition of modular arithmetic. State the Euclidean algorithm for estimating the greatest common divisor, GCD. Find the GCD of 414 and 662 using Euclidean algorithm. 4

3. (a) Specify the following sets by listing their elements: 3

   i. $A = \{x: x \in R, -5 < x < 5\}$. ii. $B = \{x: x \in N, x \text{ is a multiple of } 3\}$.

   iii. $C = \{x: x \text{ is a U.S. citizen}, x \text{ is a teenager}\}$.

   (b) $U = \{1,2,3,\ldots,8,9\}$, $A = \{1,2,3,4\}$, $B = \{2,4,6,8\}$, $C = \{3,4,5,6\}$ 3

   Find: i. $A \cap (B \cup C)$ and ii. $(A \cap B) \cup (A \cap C)$.

   (c) Shade the set $A \cup (B \cap C)$.

   (d) Determine which of the following sets are finite.

   i. A = {seasons in the year} ii. B = {state in the Union} iii. C = {positive integers less than 1}

   iv. D = {odd integers} v. E = {positive integral divisors of 12}

   vi. F = {cats living in the United states}

4. (a) Suppose that 100 of the 120 mathematics students at a college take at least one of the languages French, German, and Russian. Also suppose

65 study French	45 study German	42 study Russian
20 study French and German	25 study French and Russian	15 study German and Russian

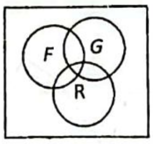


Figure:01

   i. Find the number of students who study all three languages.

   ii. Fill in the correct number of students in each of the eight regions of the Venn diagram of Fig. 01. Here F, G, and R denote the sets of students studying French, German and Russian, respectively.

   iii. Determine the number k of students who studying (x) exactly one language, and (y) exactly two languages.

   (b) Let $A = \{1, 2, 3\}$ and let $R = \{(1, 1), (2, 1), (3, 2), (1, 3)\}$ be a relation on A (i.e., a relation from A to A).

   Determine whether each of the following is true or false:

   i. $1R1$ ii. $1\not R 2$ iii. $2R3$ iv. $2\not R 1$ v. $3R2$ vi. $3\not R 1$

Please turn over

[D] Write a Java program to print a pyramid using star pattern. Number of rows input from keyboard.

[A] What is the static variable? Explain a java program with and without static variable.

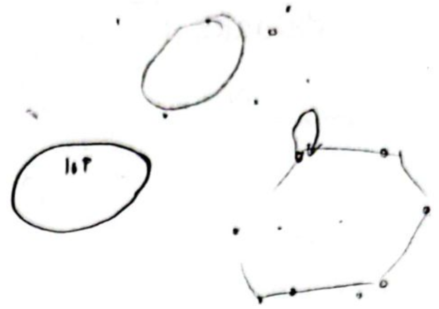
[B] i) What is the difference between static (class) method and instance method?

ii) What are the main uses of this keyword?

(c) Show that the following argument is not valid

S_1: All students are lazy.
S_2: Nobody who is wealthy is a student.
S: Lazy people are not wealthy.

(d) Define a graph and Multigraph. Draw the graph $k_{2,5}$. 4



5. (a) Let R and S be the relation on $X = \{a, b, c\}$ defined by $R = \{(a, b), (a, c), (b, a)\}$ and $S = \{(a, c), (b, a), (b, b), (c, a)\}$ Find the composition $R \circ S$ for the relation R and S. 4

(b) Let S be the relation on $X = \{a, b, c, d\ e, f\}$ defined by $S = \{(a, b), (b, b), (b, c), (c, f), (d, b), (e, a), (e, b), (e, f)\}$ Draw the directed graph of S. 3

(c) Given $A = \{1,2\}$, $B = \{x, y, z\}$, and $C = \{3, 4\}$. Find $A \times B \times C$ and $n(A \times B \times C)$. 4

(d) Let $B_1 = \{1, 2\}$, $B_2 = \{3, 4\}$, and $B_3 = \{5, 6\}$. Find $\prod B_i$. 3

6. (a) Sketch the graph of $h(x) = \begin{cases} 0, & if\ x = 0 \\ \frac{1}{x}, & if\ x \neq 0 \end{cases}$. 5

(b) Let $A = \{a, b, c, d, e\}$, and let B be the set of letters in the alphabet. Let the function f, g, and h form A into B be defined as follows: 4

i.	ii.	iii.
$a \xrightarrow{f} r$	$a \xrightarrow{g} z$	$a \xrightarrow{h} a$
$b \rightarrow a$	$b \rightarrow y$	$b \rightarrow c$
$c \rightarrow s$	$c \rightarrow x$	$c \rightarrow e$
$d \rightarrow r$	$d \rightarrow y$	$d \rightarrow r$
$e \rightarrow e$	$e \rightarrow z$	$e \rightarrow s$

Are any of these functions one-to-one?

(c) Let a and b denote positive integers. Suppose a function Q is defined recursively as follows: 5

$$Q(a, b) = \begin{cases} 0, & if\ a < b \\ Q(a - b, b) + 1 & if\ b \leq a \end{cases}$$

i. Find the value of $Q(2,3)$ and $Q(14,3)$. ii. What does this function do? Find Q(5861, 7).

537

0 1 2 -1 -2 3 -3

x	h(x)
-4	-2
-3	-1.3
-2	-2
-1	[illegible]
0	0
1	[illegible]

What is the purpose of join method?

How to perform two tasks by two threads?

What is the Thread Scheduler and what is the difference between preemptive scheduling and time slicing?

Faculty of Computer Science and Engineering
Patuakhali Science and Technology University
Final Examination of B. Sc. Engg.(CSE) July-December 2020
Level-1, Semester-II (Session:2019-2020)
Course Code: CIT-123, Course Title: Discrete Mathematics

Time: 3 Hours | Full Marks: 70

N.B: Answer any seven questions from the followings. (Split answers are highly discouraged)

1. (a) What is discrete mathematics? What kinds of problems are solved using discrete mathematics? 2
   (b) Find: (i) $\lfloor 7.5 \rfloor, \lfloor -.999 \rfloor$ (ii) $\lceil 7.5 \rceil, \lceil -7.5 \rceil$ 2
   (c) Find the power set $P(A)$ of $A=[\{a, b\}, \{c\}, \{d, e, f\}]$ 2
   (d) List the elements of the following sets; here Z= {integers}. 3
      (i) $A=\{x: x \in Z, 3< x <9\}$
      (ii) $B=\{x: x \in Z, x^2+1=10\}$
      (iii) $C=\{x: x \in Z, x \text{ is odd}, -5< x <5 \}$
   (e) Describe in words how you would prove each of the followings: 2
      (i) A is equal to B
      (ii) A is subset of B
      (iii) A is a proper subset of B
      (iv) A is not a subset of B
   (f) Let $B_1=\{1,2\}$, $B_2=\{3,4\}$, $B_3=\{5,6\}$ Find $\prod B_i$ 3
2. (a) Suppose that 100 of the 120 mathematics students at a college take at least one of the languages French, German, and Russain. Also suppose 7

65 study French	20 study French and German
45 study German	25 study French and Russain
42 study Russain	15 study German and Russain

   (i) Find the number of students who study all three languages.
   (ii) Fill in the correct number of students in each of the eight regions of the Venn diagram of Fig. 1-1. Here F, G and R denote the sets of students studying French, German, and Russain respectively.
   (iii) Determine the number K of students who study (x) exactly one language, and (y) exactly two languages

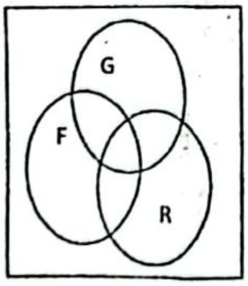


Figure: 1-1

   (b) Find: (i) $(A \cup B)^c$ and (ii) $A^c \cap B^c$ 2
   (c) Shade the set $A \cap B \cap C^c$ 3
   (d) Show that the following argument is not valid by constructing a Venn diagram in which the promises hold but the conclusion does not hold: 2

   S_1 : Some students are lazy.
   S_2 : All males are lazy.

   S: Some students are males.

3. (a) Define the graph of function $f: A \to B$ 2
   (b) Sketch the graph of the function $g(x) = x^4-10x^2+9$ 3
   (c) Which of the function in fig: 2-1 are one-to-one and onto? 4

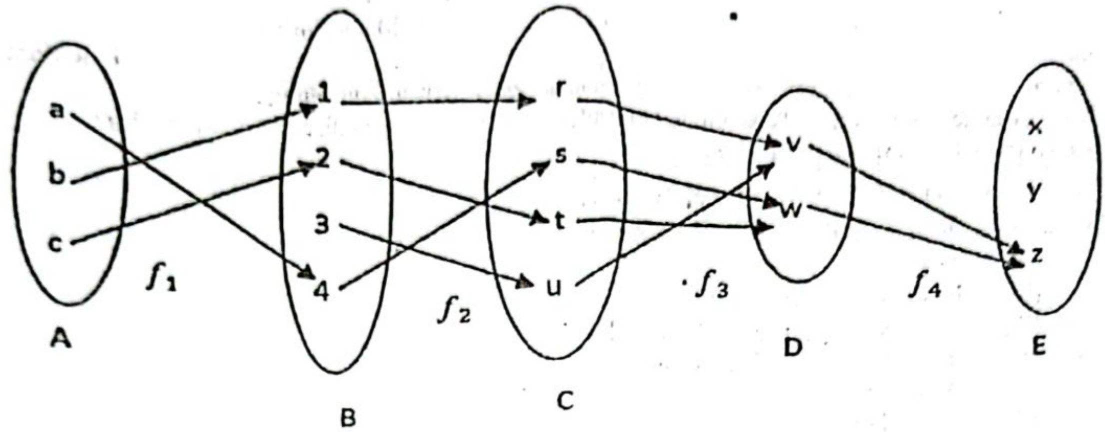


Figure: 2-1

(d) Find the number of elements in each finite set: 3

5 (i) A={2,4,6,8,10} (ii) B={x: x^2=4} 2

(iii) C={x: x > x+2} ∘ (iv) D={x: x is a positive integer, x is a divisor of 15} – 4

(v) E={Letters in the alphabet preceding the letter *m* }

(vi) F={x: x is a solution to x^3 =27} 1

(e) Given A = {1, 2}, B = {a, b, c}, and C = {c, d}. Find: (i) $(A \times B) \cap (A \times C)$ *and* (*ii*) $A \times (B \cap C)$. 2

4. (a) Define proposition. Show that $\neg(p \rightarrow q)$ and $(p \wedge \neg q)$ are logically equivalent. To model the 8-queens problems as a satisfiability problem. Solve the problem where one queen in each row, no column contains more than one queen, and no diagonal contains two queens. 5

(b) Let P(x) denote the statement "$x > 3$." What is the truth value of the quantification $\exists x\, P(x)$, where the domain consists of all real numbers? 2

(c) Define rules of inference, modus ponens, and resolution. Show that the premises $(p \wedge q) \vee r$ and $r \rightarrow s$ imply the conclusion $p \vee s$. 4

(d) Find the truth table for $(p \rightarrow q) \vee \sim(p \leftrightarrow \sim q)$. 3

5. (a) What is the limitation of the binary search algorithm? Use the bubble sort algorithm to put 3, 2, 4, 1, and 5 into increasing order. 3

(b) Define the complexity of an algorithm. Show that $f(x) = x^2 + 2x + 1$ is $O(x^2)$. How many additions of integers and multiplications of integers are used by the matrix multiplication algorithm to multiply two $n \times n$ matrices with integer entries? 6

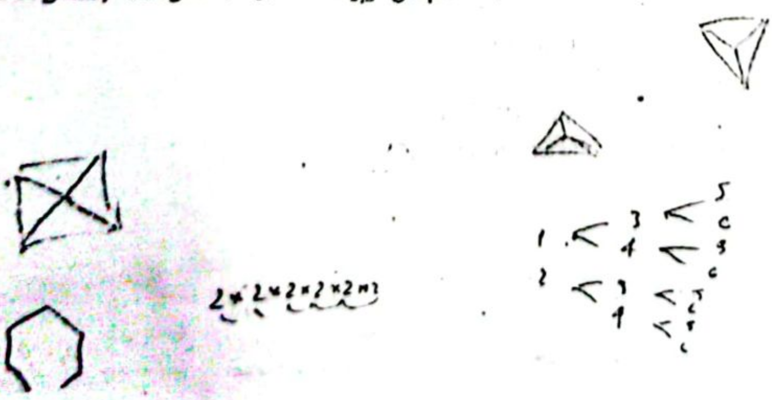
(c) Write the formal definition of modular arithmetic. State the Euclidean algorithm for estimating the greatest common divisor, GCD. Find the GCD of 414 and 662 using Euclidean algorithm. 5

6. (a) Define graph, multigraph and subgraph with figure. 3

(b) Distinguish between Hamiltonian graph and Eulerian graph. 3

(c) Draw a graph with six vertices which is Eulerian but not Hamiltonian. 3

(d) Draw 0-regular, 4-regular, k_5, and $k_{5,3}$ graph 5



Patuakhali Science and Technology University

2nd Semester (Level-1, Semester-II), Final Examination of B.Sc. Engg.in (CSE)

July-December: 2019, Session: 2018-19

Course Code: CIT-121 Course Title: Discrete Mathematics

Credit Hour: 3.00 Full Marks: 70 Duration: 03Hours

[Figures in the right margin indicate full marks. Split answering of any question is not recommended]

Answer any 7 of the following questions.

1. a) Rewrite the following statements using set notation:
(i) The element 1 is not a member of A.
(ii) The element 5 is a member of B.
(iii) A is a subset of C.
(iv) A is not a subset of D.
(v) F contains all the elements of G.
(vi) E and F contain the same elements.

b) List the elements of the following sets; here $z = (integers)$. 3
(i) $A = \{x : x \in Z, 3 < x < 9\}$
(ii) $B = \{x : x \in Z, x^2 + 1 = 10\}$
(iii) $C = \{x : x \in Z, x \text{ is odd}, -5 < x < 5\}$

c) Given that $U = N =$ (positive integers), identify which of the following sets are identical to $\{2,4\}$: 2
$A = \{even\ numbers\ less\ than\ 6\}, B = \{x : x < 5\}, C = \{x : (x-2)(x-4)(x+2) = 0\}$

d) Define the set operations of: 2
(i) absolute complement or, simply, complement of a set, (ii) the relative complement or difference of two sets.

e) Describe a situation where the universal set U may be empty. 1

2. a) Find the number of elements in each finite set: 3

(i) $A = \{2, 4, 6, 8, 10\}$
(ii) $B = \{x : x^2 = 4\}$
(iii) $C = \{x : x > x + 2\}$
(iv) $D = \{x : x \text{ is a positive integer}, x \text{ is a divisor of } 15\}$
(v) $E = \{letters\ in\ the\ alphabet\ preceding\ the\ letter\ m\}$
(vi) $F = \{x : x \text{ is a solution to } x^3 = 27\}$

b) In a survey of 60 people, it was found that 25 read Newsweek magazine, 26 read Time, and 26 read Fortune. Also 9 read both Newsweek and Fortune, 11 read both Newsweek and Time, 8 read both Time and Fortune, and 8 read no magazine at all. 7
(i) Find the number of people who read all three magazines.
(ii) Fill in the correct number of people in each of the eight regions of the Venn diagram of Fig. 1-1(x). Here N, T, and F denote the set of people who read Newsweek, Time and Fortune respectively.
(iii) Determine the number of people who read exactly one magazine.

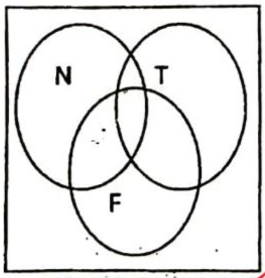


Fig. 1-1(x).

60

1(a)

3. a) Prove Theorem $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$ 2

b) One hundred students were asked whether they had taken courses in any of the three areas, sociology, anthropology, and history. The results were: 8

45 had taken sociology
38 had taken anthropology
21 had taken history
18 had taken sociology and anthropology
9 had taken sociology and history
4 had taken history and anthropology

And 23 had taken no courses in any of the areas.
(i) Draw a Venn diagram that will show the results of survey.
(ii) Determine the number k of students who had taken classes in exactly (1) one of the areas, and (2) two of the areas

P.T.O.

A∩C

A − B

4. a) Find the power set $P(A) of\ A = \{1, 2, 3, 4, 5\}$. 2

b) Prove the following propositions: $P(n): \frac{1}{1(3)} + \frac{1}{3(5)} + \frac{1}{5(7)} + \cdots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1}$ 3

c) Determine the validity of the argument: 2

$$S_1: All\ red\ meat\ contains\ cholesterol.$$
$$S_2: No\ expensive\ food\ contains\ cholesterol.$$
$$\overline{\hspace{10em}}$$
$$S: Read\ meat\ is\ not\ expensive.$$

8−1

7(9)

d) Given $A = \{1, 2\}, B = \{x, y, z\}, and\ C = \{3, 4\}. Find\ A \times B \times C\ and\ n(A \times B \times C)$. (tree diagram) 3

2:3:2

5. a) Let $A = \{1, 2, 3\}\ and\ R = \{(1,1), (2,1), (3,2), (1,3)\}\ be\ a\ relation\ on\ A\ (i.e., a\ relation\ from\ A\ to\ A)$. 3
Determine whether each of the following is true or false:
$(i) 1R1, (ii)\ 1 \not R 2, (iii)\ 2R3, (iv)\ 2 \not R 1, (v)\ 3R2, (vi)\ 3 \not R 1.$

b) Let S be the relation on $X = \{a, b, c, d, e, f\}\ defined\ by$ 2
$S = \{(a, b), (b, b), (b, c), (c, f), (d, b), (e, a), (e, b), (e, f)\}$ Draw the directed graph of S

c) Let R and S be the relations on $X = \{a, b, c\}\ defined\ by$ 3
$R = \{(a, b), (a, c), (b, a)\}\ and\ S = \{(a, c), (b, a), (b, b), (c, a)\}$
Find the matrices $M_R\ and\ M_S\ representing\ R\ and\ S\ respectively.$

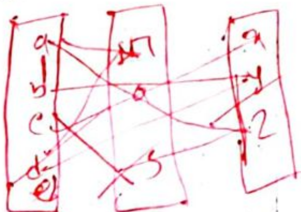
d) Consider functions $f: A \to B\ and\ g: B \to C;$ 2
$that\ is, where\ the\ codomain\ of\ f\ is\ the\ domain\ of\ g. Define\ the\ composition\ function\ of\ f\ and\ g.$

6. a) Sketch the graph of the function $g(x) = x^2 + x - 6$. 3

b) Define an one –to-one (or injective) function and an onto (or surjective) function. 4

c) Let $A = \{a, b, c, d, e\}, and\ let\ B\ be\ the\ set\ of\ letters\ in\ the\ alphabet. Let\ the\ function$ f, g and h from A into B be defined as follows: 3

(i)	(ii)	(iii)
$a \xrightarrow{f} r$	$a \xrightarrow{g} z$	$a \xrightarrow{h} a$
$b \to a$	$b \to y$	$b \to c$
$c \to s$	$c \to x$	$c \to e$
$d \to r$	$d \to y$	$d \to r$
$e \to e$	$e \to z$	$e \to s$



7. a) Define a graph and a multigraph. 2

b) Draw the complete graphs K_5, K_6 and also draw the complete bipartite graphs $K_{2,3}$, $K_{3,3}$ and $K_{2,4}$. 5

c) Define a Hamiltonian graph and draw a graph with six vertices which is Hamiltonian but not eulerian. 3

8. a) What does logically equivalent of two compound propositions mean? 2

b) Verify that the proposition $(p \wedge q) \wedge \sim (p \vee q)$ is a contradiction. 2

c) Prove that disjunction distributes over conjunction: that is, prove the distributive law 4
$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$.

d) Prove the theorem "If n is a composite integer, then n has a prime divisor less than or equal to √n". 2

F

9. a) Define the terminologies with example: (i) Rooted tree (ii) Ancestors of vertices (iii) Full m-ary tree. 6

b) Prove that a full m-ary tree with i internal vertices contain $n=mi + 1$ vertices. 2

c) What is the postfix form of the expression $((x + y) \uparrow 2) + ((x - 4)/ 3)$? 2

+ x y ↑ 2 + − x 9 / 3

x y ↑ 2

Patuakhali Science and Technology University
...of B.Sc. Engg. (CSE) Level: 1 Semester: II
...Title: Object Oriented Programming
...tion: 03 Hours

Patuakhali Science and Technology University

2nd Semester (Level-I, Semester-II) Final Examination of B.Sc. Engg..(CSE) July-Dec.: 2017, Session 2016-17

Course Code: CIT-121 Course Title: Discrete Mathematics

Credit Hour: 3.0 Full Marks: 70 Duration: 3 Hours

[Figures in the right margin indicate full marks. **Split answering of any question is prohibited**]

Answer any 5 of the following questions.

1. (a) List the elements of each set where N = {1, 2, 3, ...}. 2
   (i) A = {x ∈ N | 2 < x < 7} (ii) B = {x ∈ N | x is odd, x < 11}
   (iii) C = {x ∈ N | 5 + x = 4} (iv) D= {x ∈ N | x is even, 2 + x = 4}.

   (b) Explain the partitioning of a set. 2

   (c) In a survey of 120 people, it was found that: 65 read Newsweek magazine, 20 read both Newsweek and Time, 45 read Time, 25 read both Newsweek and Fortune, 42 read Fortune, 15 read both Time and Fortune, 8 read all three magazines. 4
   (i) Draw a Venn diagram and fill in the correct number of people in each region.
   (ii) Find the number of people who read at least one of the three magazines. P(A∪B∪C)
   (iii) Find the number of people who read exactly one magazine.

   (d) Briefly describe various types of set. 6

2. (a) Let A = {a, b, c}, B = {x, y, z}, C = {r, s, t}. Let f: A → B and g: B → C be defined by: f = {(a, z)(b, x), (c, y)} and g = {(x, s), (y, t), (z, r)}. Find composition function gof: A → C. 2

   (b) Given A = {1, 2, 3, 4} and B = {x, y, z}. Let R be the following relation from A to B: 2
   R = {(1, y), (1, z), (3, y), (4, x), (4, z)}.
   (i) Find the inverse relation R^{-1} of R. (ii) Determine the domain and range of R.

   (c) Given: A = {1, 2}, B = {x, y, z}, and C = {3, 4}. Find: A × B × C. 4

   (d) Distinguish between function and relation. Explain One-to-one function, Onto function and Inverse of a Function with example. 6

3. (a) Let p be "It is cold" and let q be "It is raining". For each of the following statements make simple verbal sentence: (a) ¬p; (b) p ∧ q; (c) p ∨ q; (d) q ∨ ¬p. 2

   (b) Verify that the proposition (A ∨ B) ∧ [(¬A) ∧ (¬B)] is a contradiction. 2

   (c) Briefly describe Normal Forms. DNF CNF 4

   (d) State and explain the following rules of inference with example: 6
   (i) Modus ponens, (ii) Hypothetical Syllogism, (iii) Destructive Dilemma and (iv) Conjunction.

4. (a) In how ways can the letters of the word 'ORANGE' be arranged so that the Consonants occupy only the even positions? 2

   (b) A box contains 8 blue socks and 6 red socks. Find the number of ways two socks can be drawn from the box if: (a) They can be any color. (b) They must be the same color. 2

   (c) In a certain college town, 25% of the students failed mathematics (M), 15% failed chemistry (C), and 10% failed both mathematics and chemistry. A student is selected at random. 4
   (i) If he failed chemistry, find the probability that he also failed mathematics.
   (ii) If he failed mathematics, find the probability that he also failed chemistry.
   (iii) Find the probability that he failed mathematics or chemistry. M∪C
   (iv) Find the probability that he failed neither mathematics nor chemistry. $(M\cup C)^c$

   (d) State and prove Pascal's Identity. 3

   (e) A history class contains 8 male students and 6 female students. Find the number n of ways that the class can elect: (a) 1 class representative; (b) 2 class representatives, 1 male and 1 female; (c) 1 president and 1 vice president. 3

5. (a) Explain BFS algorithm for graph traversal with example. 4

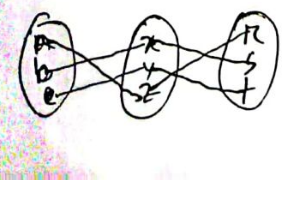
   (b) Consider three pen-stands. The first pen-stand contains 2 red pens and 3 blue pens; the second one has 3 red pens and 2 blue pens; and the third one has 4 red pens and 1 blue pen. There is equal probability of each pen-stand to be selected. If one pen is drawn at random, what is the probability that it is a red pen? 4

   (c) Minimize the following Boolean expression using Boolean identities: 6
   F (A, B, C) = A'B+ BC'+ BC+ AB'C'

6. (a) Explain Euler graph. 2

   (b) Discuss representation of graphs. 4

   (c) What is minimum spanning tree? State and explain Kruskal's algorithm with example. 8



gof(a) = g(f(a))
= g(f(z))
= g(r)

Patuakhali Science and Technology University

B.Sc. Engg. (CSE) Level-1, Semester-II, Final Examination Jul-Dec/16, Session: 2015-16

Course code: CIT-121 Course Title: Discrete Mathematics

Credit hours: 3.00 Full marks: 70 Duration: 3 hours

[Figures in the right margin indicate full marks.]

Answer any 7 of the following questions. Split answering is not recommended.

1. a. Define finite set and infinite set with examples. 2
   b. Compare ϕ and $\{\phi\}$ with an example from a computer. 2
   c. Determine whether the following functions are one-to-one or onto or both or none. 1+1
      i. To each person on the earth assign the number corresponding his/her age
      ii. To each country of the world assign the latitude and longitude of its capital
      Justify your answer with some sample/hypothetical values.
   d. Consider the following number of students of a class taking different languages. 2

      65 study French | 20 study French and German
      45 study German | 25 study French and Russian
      42 study Russian | 15 study German and Russian
      8 study all three languages.

      1.17

      Now find out the number of students taking at least one the above languages.
   e. Draw the Venn Diagram for the question 1.d. showing the numbers of student inside the diagram. 2

2. a. Find out the Cartesian product of A x B x C where A = {1,2,3}, B = {a,b,c}, C = {ক, খ} 2
   b. Consider the following SQL command for students of a university taking Computer Science and Mathematics major. 2

```
select * from csMajor, mathMajor
        where csMajor.studentID = mathMajor.studentID
```

   hint: ***select **** means selecting all students, ***csMajor*** is the table of students who takes Computer Science as their major and ***mathMajor*** is the table of students who takes Mathematics as their major.
   Now, interpret this using set theory.
   c. Let A = {2,3,4} and B = {3,2,4,3,2,3,2,4,2} are two sets. Are they equal? Justify your answer. 2
   d. Determine which of the following declarative sentences are proposition. 0.5x8
      i. x=2 is the solution of $x^2=4$ ii. 1+1 = 2 iii. 2+2 = 3 iv. London is in Denmark
      v. Where are you going? vi. 9 < 6 vii. Do your Homework. viii. Paris is in France

3. a. Consider the propositions ***p*** such that "Roses are red" and ***q*** such that "violets are blue". What will be the declarative sentence for $\neg(p \wedge q)$? 1
   b. Prove that $\neg(p \wedge q) \equiv \neg p \vee \neg q$ using a truth table. What will be the declarative sentence for $\neg p \vee \neg q$ where ***p*** and ***q*** mean the same as stated in 3.a. 2+1
   c. Write the following sentences in propositional symbolic form 1x6
      i. If I am not in a good mood or I am busy, do not disturb me.
      ii. A program is readable only if it is well structured.
      iii. There will be no exam tomorrow if the professor is out of the town or there is a strike.
      iv. If the user enters a wrong password, his access is not granted even though he has paid his fees.
      v. Driving over 65 miles per hour is sufficient for getting a speeding ticket.
      vi. If berries are ripe in the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

$q \to (\neg p \leftrightarrow q)$

4. a. There are two signboards in front of a shoppin mall. One says, "Good items are not cheap". The other one says, "Cheap items are not good". Do the signboards say the same proposition? Justify your answer using truth tables. 3
   b. Use De Morgan's law to find the negation of the statement "Kim study well and obtained good grades". 2
   c. Which rules of inference is used in each argument below? 5
      i. Alice is a Math major. Therefore, Alice is either a Math major or a CSE major.
      ii. Jerry is a Math major and a CSI major. Therefore, Jerry is a Math major.
      iii. If it is rainy, then the pool will be closed. It is rainy. Therefore, the pool is closed.
      iv. If it snows today, the university will close. The university is not closed today. Therefore, it did not snow today.

$= g(f(z))$

$= g(x)$

v. I go swimming or eat an ice cream. I did not go swimming. Therefore, I eat an ice cream

5 a. Use rules of inference to prove the conclusion from the premises below. 3
If I go swimming, then I will stay in the sun too long. If I stay in the sun too long, then I will sunburn. Therefore, if I go swimming, then I will sunburn.

b. Test the validity of the following argument using rules of inference. 3
If two sides of a triangle are equal, then the opposite angles are equal. Two sides of a triangle are not equal. Therefore, the opposite angles are not equal.

c. Consider the statement: "If two angles are congruent, then they have the same measure." Write the propositional symbolic for for this statement. Find the converse, contrapositive and inverse for this statement both in symbolic form and English statement. 4

6 a. Find the value of F(A,B,C) where A = 101101, B = 100101, C = 111000 for the following 2x3
i. F(A,B,C) = ABC ii. F(A,B,C) = A+B+C iii. F(A,B,C) = A(B+C)

b. What values of A,B,C,D satisfy the following simultaneous Boolean equations? 2
$\bar{A} + AB = 0, \quad AB = AC, \quad A\bar{C} + AB + CD = \overline{CD}$

c. What do sum-of-product and product-of-sum mean? Explain with example. 2

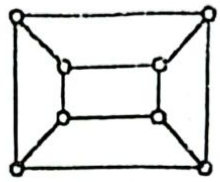
7 a. Define simple graph, multigraph and pseudo-graph with realistic examples. 1x3

b. Relate directed graphs with computer networks between different cities. 2

c. What is Handshaking theorem? Explain with an example. 2

d. Is it possible to construct a graph with 102 vertices such that exactly 49 vertices have degree 5 and the remaining 53 vertices have degree 6? Justify your answer. 3

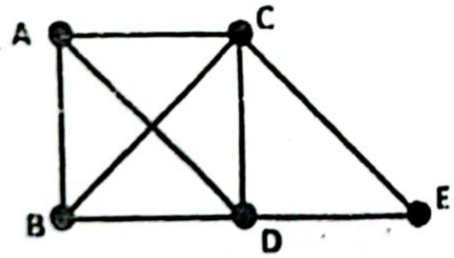
8 a. Determine if the graph on the right hand side is bipartite or not using graph coloring. 4
Label the nodes with numbers starting from the top left node.



b. Represent the graph of 8.a using adjacency list, adjacency matrix and incedence matrix 2x3

9 a. Discuss the trade-offs between adjacency lists and adjacency matrices. 2

b. Show step by step whether the two graphs shown in the following figure are isomorphic or not using adjacency matrices. 5



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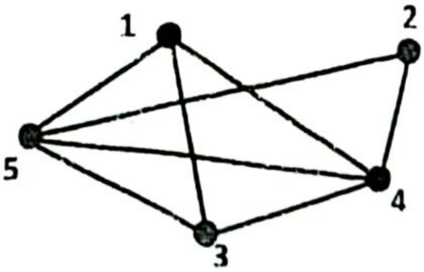

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c. Compare BFS and DFS using example. 3

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Patuakhali Science and Technology University

Faculty of Computer Science and Engineering

2nd Semester (Level-1, Semester-II) Final Examination of B.Sc.Engg.(CSE) July-December- 2015

Session: 2014-2015, Course Code: CIT-121, Course Title: Discrete Mathematics

Credit Hour: 03 Full Marks: 70 Duration: 3 Hours

[Figure in the right margin indicates full marks. Split answering of any questions is not recommended.] Answer any 7 of the following question.

1. (a) Re-write the following statements using set notation: 3
   - (i) The element 2 is not a member of G.
   - (ii) The element 7 is a member of F.
   - (iii) B is a subset of C.
   - (iv) D is not a subset of C.
   - (v) A contains all the elements of H.
   - (vi) J and F contain the same elements.

   (b) List the elements of the following sets; 3
   - (i) $A=\{x: x \in N, 3< x <9\}$
   - (ii) $B=\{x: x \in N, x^2+1=10\}$
   - (iii) $C=\{x: x \in N, x \text{ is odd}, -5< x <5\}$

   (c) Define the set operation of : (i) Union and (ii) intersection 2

   (d) $U= \{1, 2, 3,....,8, 9\}$, $A= \{1, 2, 3, 4\}$, $B= \{2, 4, 6, 8\}$, $C=\{3, 4, 5, 6\}$.
   Find: (i) $(A \cap B)\backslash C$ and (ii) $(A\backslash B)^c$ 2

2. (a) Find the number of elements in each finite set: 4
   - (i) $A= \{2,4,6,8,10,12,14\}$
   - (ii) $B= \{x: x^2=16\}$
   - (iii) $C= \{x: x > x+2\}$
   - (iv) $D= \{x: x$ is a positive integer, x is a divisor of $16\}$
   - (v) $E=$ {Letters in the alphabet preceding the letter n} / (vi) $F= \{x: x$ is a solution to $x^3 =27\}$

   (b) Prove $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(A \cap C) - n(B \cap C) + n(A \cap B \cap C)$ 2

   (c) Shade the set $(A \cup B) \cap (A \cup C)$. 4

3. (a) Consider the following assumptions: 2

   S_1: All dictionaries are useful.

   S_2: Mary owns only romance novels.

   S_3: No romance novel is useful.

   Determine the validity of each of the following conclusions:
   - (x) Romance novels are not dictionaries.
   - (y) Mary does not own a dictionary.
   - (z) All useful books are dictionaries.

   (b) One hundred students were asked whether they had taken courses in any of the three areas, Sociology, Anthropology, and History. The results were: 8

45 had taken sociology	18 had taken sociology and anthropology
38 had taken anthropology	9 had taken sociology and history
21 had taken history	4 had taken history and anthropology

   and 23 had taken no courses in any of the areas.
   - (x) Draw a Venn diagram that will show the results of the survey.
   - (y) Determine the number k of students who had taken classes in exactly (1) one of the areas, and (2) two of the areas.

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CIT—121
2015

4. (a) Define the composition of relations and give examples with diagram.
(b) Let A={a, b, c, d, e}, and let B be the set of letters in the alphabet . Let the functions f, g and h from A into B be defined as follows:

(i) f	(ii) g	(iii) h
$a \to r$	$a \to z$	$a \to a$
$b \to a$	$b \to y$	$b \to c$
$c \to s$	$c \to x$	$c \to e$
$d \to r$	$d \to y$	$d \to r$
$e \to e$	$e \to z$	$e \to s$

Are any of these functions one-to-one?

r
a
s

5. (a) What is meant by a recursively defined function? Calculate 8! Using the recursive definition.
(b) Let a and b denote positive integers. Suppose a function Q is defined recursively as follows:

$$Q(a,b) = \begin{cases} 0 & if\ a < b \\ Q(a-b,b)+1 & if\ b \le a \end{cases}$$

(i) Find the value of $Q(2,3)$ and $Q(14,3)$.
(ii) What does this function do? Find $Q(5861,7)$.

6. (a) Give two methods to fine the truth table of the proposition $\sim(p \wedge \sim q)$.
(b) Prove that disjunction distributes over conjunction; that is, prove the distributive law

$$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$$

7. (a) Define the truth table of the biconditional $p \leftrightarrow q$, that is "p if and only if q" and also define the truth value of the compound statement $p \to q$, that is "if p then q".
(b) Prove that the conditional operation distributes over conjunction; that is,

$$p \to (q \wedge r) \equiv (p \to q) \wedge (p \to r)$$

8. (a) Define a Hamiltonian graph. Draw a graph with six vertices which is Hamiltonian but not Eulerian.
(b) What is a complete graph and regular graph? Draw the complete bipartite graph $K_{2,3}$, $K_{3,3}$, $K_{2,4}$, $K_{2,5}$ and Draw all trees with six vertices.

T-T=T
F-F=T
F-F

Patuakhali Science and Technology University

2nd Semester (Level-1, Semester-II) Final Examination of B.Sc.Engg.(CSE) July-December- 2014

(Session: 2013-2014)

Course Code: CIT-121, Course Title: Discrete Mathematics

Credit Hour: 03 Full Marks: 70 Duration: 3 Hours

[Figure in the right margin indicates full marks. Split answering of any questions is not recommended.] Answer any 7 of the following question.

1. (a) Define a compound statement, and give examples. 2
   (b) Find the truth table for $(p \rightarrow q) \vee \sim(p \leftrightarrow \sim q)$. 4
   (c) Prove the associative law: $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$. 4

2. (a) Calculate 4!, using recursive definitions and with proper steps. 3
   (b) Find the number of elements in each finite set: 4
   - (i) $A=\{2,4,6,8,10\}$
   - (ii) $B=\{x: x^2=4\}$
   - (iii) $C=\{x: x>x+2\}$
   - (iv) $D=\{x: x$ is a positive integer, x is a divisor of 15$\}$
   - (v) $E=\{$letters in the alphabet preceding the letter m$\}$
   - (vi) $F=\{x: x$ is a solution to $x^3=27\}$

   (c) Describe in words how you would prove each of the followings: 3
   - (i) A is equal to B
   - (ii) A is subset of B
   - (iii) A is a proper subset of B
   - (iv) A is not a subset of B

3. (a) (i) Find the power set $P(A)$ of $A=[\{a,b\},\{c\},\{d,e,f\}]$ (ii) Let $B_1=\{1,2\}$, $B_2=\{3,4\}$, $B_3=\{5,6\}$ Find $\prod B_i$ 3
   (b) Given $A=\{1,2\}$, $B=\{x,y,z\}$, and $C=\{3,4\}$. Find $A \times B \times C$ and $n(A \times B \times C)$ with draw tree diagram. 3
   (c) Show that the following argument is not valid by constructing a Venn diagram in which the promises hold but the conclusion does not hold: 4

   S_1 : Some students are lazy.
   S_2 : All males are lazy.

   S : Some students are males.

4. (a) Define the set operation of : (i) Union and (ii) Intersection 2
   (b) Find: (i) $(A \cup B)^c$ and (ii) $A^c \cap B^c$ 3
   (c) Shade the set $A \cap B \cap C^c$ 5

$x^4 - 9x^2 - x^2 + 9$
$x^2(x^2-9) - 1(x^2-9)$
$(x^2-9)(x^2-1)$

5. (a) Define the graph of function $f: A \rightarrow B$ 2
   (b) Sketch the graph of the function $g(x) = x^4 - 10x^2 + 9$ 5
   (c) Which of the function in fig: 1-1 are one-to-one and onto? 3

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Patuakhali Science and Technology University
...ation of B.Sc. Engg. (CSE) Level: 1 Semester: II
Course Title: Object Oriented Programming
Duration: 03 Hours

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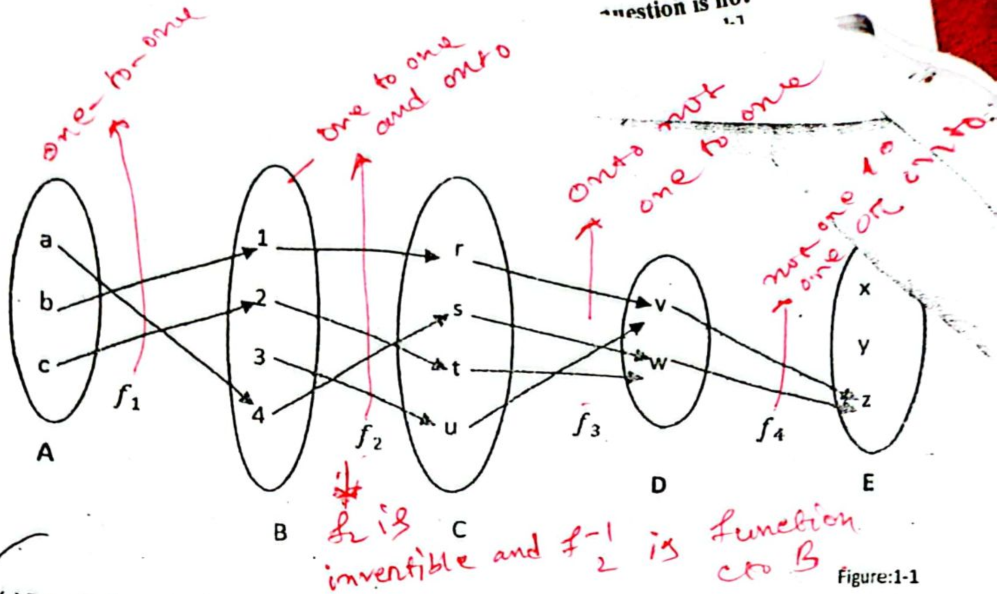

Figure:1-1

6. (a) Determine the number m of nonequivalent propositions P(p, q) in two variables p and q. 3

(b) Suppose that 100 of the 120 mathematics students at a college take at least one of the languages French, German, and Russian. Also suppose 7

65 study French	20 study French and German
45 study German	25 study French and Russian
42 study Russian	15 study German and Russian

(i) Find the number of students who study all three languages.

(ii) Fill in the correct number of students in each of the eight regions of the Venn diagram of Fig. 1-2. Here F,G and R denote the sets of students studying French, German, and Russian respectively.

(iii) Determine the number K of students who study (x) exactly one language, and (y) exactly two languages

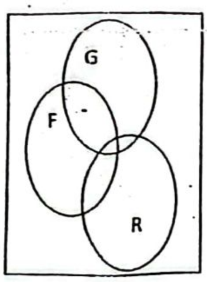

Figure1-2

7 (a) Distinguish between Hamiltonian graph and Eulerian graph. 3

(b) Draw a graph with six vertices which is Eulerian but not Hamiltonian. 2

(c) Draw 0-regular, 4-regular, $k_{2,3}$, $k_{3,3}$ and $k_{5,6}$ graph. 5

8 (a) Define Graph, Multigraphs and Subgraphs with figure. 4

(b) Which connected graphs can be both regular and bipartite? 3

(c) Explain the meaning of a labeled graph with an example. 3

Patuakhali Science and Technology University

B.Sc. Engg. (CSE) Level-1 Semester-II Final Examininatioh-2012 (July-December)

Course Code: CIT-121 Course Title: Discrete Mathematics

Credit Hour: 3.00 Full Marks: 70 Duration: 3 Hours

[Figures in the right margin indicate full marks. Split answering of any question is not recommended.]

Answer any 5 (Five) of the following questions

1.a) One hundred students were asked whether they had taken courses in any of the three areas, sociology, anthropology, and history. The results were: 8

45 had taken Sociology, 18 had taken Sociology and Anthropology
38 had taken Anthropology, 9 had taken Sociology and History
21 had taken History, 4 had taken History and Anthropology

and 23 had taken no courses in any of the areas.

(i) Draw a Venn diagram that will show the results of the survey.

(ii) Determine the number k of students who had taken classes in exactly (x) one of the areas, and (y) two of the areas.

b) Consider the set $A = \{\{1, 2, 3\}, \{4, 5\}, \{6, 7, 8\}\}$. 6

(i) What are the elements of A?

(ii) Determine whether each of the following is true or false:

(f) $1 \in A$ (h) $\{6, 7, 8\} \in A$ (j) $\emptyset \notin A$
(g) $\{1, 2, 3\} \subseteq A$ (i) $\{\{4, 5\}\} \subseteq A$ (k) $\emptyset \subseteq A$

2.a) Find the power set $\mathcal{P}(A)$ of $A = \{\{a, b\}, \{c\}, \{d, e, f\}\}$. 2

b) Given $A = \{1, 2\}$, $B = \{x, y, z\}$, and $C = \{3, 4\}$. Find $A \times B \times C$ by tree diagram and $n(A \times B \times C)$. 4

c) Let R and S be the relation on $X = \{a, b, c\}$ 4
defined by $R = \{(a, b), (a, c), (b, a)\}$ and $S = \{(a, c), (b, a), (b, b), (c, a)\}$
Find the composition $R \circ S$ for the relations R and S with matrices M_R and M_S.

d) Let R be a relation on a set A. Define the following four types of relations. (i) Reflexive, (ii) Symmetric, (iii) Antisymmetric (iv) Transitive 4

3.a) Let a and b denote positive integers. Suppose a function Q is defined recursively as follows: 8

$$Q(a, b) = \begin{cases} 0 & \text{if } a < b \\ Q(a-b, b) + 1 & \text{if } b \le a \end{cases}$$

(i) Find the value of Q(2, 3) and Q(14, 3).

(ii) What does this function do? Find Q(5861, 7).

b) Suppose there are two distinct simple paths, say P_1 and P_2, from a vertex u to a vertex v in a graph G. Prove that G contains a cycle. 4

c) Plot the graph of $f(x) = \lceil x \rceil - \lfloor x \rfloor$. 2

4.a) What is stirling number? Suppose N = {a, b, c, d}, Find S(4, 2) and S(4, 3). 4

b) Draw Pascal's triangle and write down it's property. 2

c) Define combinatorics. How many 5 digit zipcode possible? 4

d) Why do you study quantifier in discrete mathematics? Express the statement: "Every student in this class has studied calculus" as a universal quantifier. 4

5.a) What are complete graph and Hamiltonian graph? 6

b) Draw the complete graph K_5, K_6, and Hamiltonian and non-Eulerian, Eulerian and non-Hamiltonian. 8

6.a) Define a tautology and contradiction with examples. 4

b) Prove that disjunction distributes over conjunction; that is, prove the distributive law $p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ 5

c) Define the truth table of the biconditional $p \leftrightarrow q$, that is, "p if and only if q". Find the truth table for $(p \leftrightarrow \sim q) \leftrightarrow (q \rightarrow p)$. 5

4. (a) Define the graph of function $f: A \to B$ 2

(b) Sketch the graph of $h(x) = x^3 - 3x^2 - x + 3$ 3

(c) Which of the function in fig: 1-2 are one-to-one, onto and Invertible Functions? 5

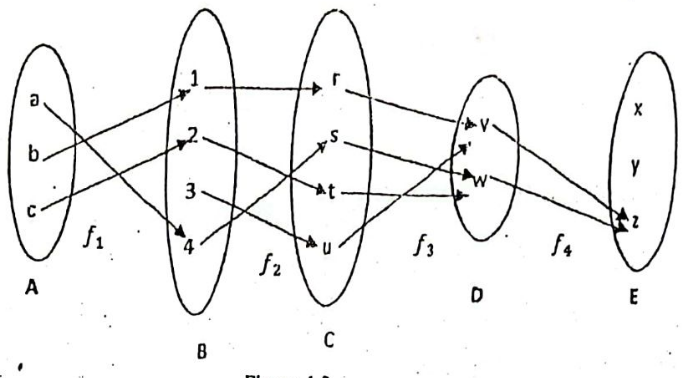

Figure: 1-2

5. (a) Define a compound statement, and give examples. 2

(b) What do you mean by equivalent propositions? 2

(c) Prove that the conditional operation distributes over conjunction; that is, 6

$$p \to (q \land r) \equiv (p \to q) \land (p \to r)$$

6. (a) What is a complete graph? Draw the complete graphs k_4, k_5 and k_6 4

(b) Distinguish between Hamiltonian graph and Eulerian graph. 3

(c) Draw a graph with six vertices which is Eulerian but not Hamiltonian. 3

7. (a) Draw the complete bipartite graphs $k_{2,3}$, $k_{3,3}$ and $k_{2,4}$ 5

(b) Let G be a graph (multigraph). Define a connected component of g. Illustrate with an example. 3

(c) Draw a diagram of each of the following multigraphs G(V, E) where $V = \{p_1, p_2, p_3, p_4, p_5\}$ and 2

(i) $E = [\{p_2, p_4\}, \{p_2, p_3\}, \{p_3, p_5\}, \{p_5, p_4\}]$

(ii) $E = [\{p_1, p_1\}, \{p_2, p_3\}, \{p_2, p_4\}, \{p_3, p_2\}, \{p_4, p_1\}, \{p_5, p_4\}]$

8. (a) Use the definition of the Ackermann function to fine A (1, 3). → Page 73 5

(b) Verify that the proposition $p \lor \sim (p \land q)$ and $(p \land q) \land \sim (p \lor q)$ are a tautology and contradiction. 5

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