Premier University
Dept. of CSE
2nd Semester Final Examination
Course: Discrete Mathematics (CSE 103)
Time: 3 Hours, Full Marks: 50

[N.B.: All questions are of equal value. Answer any five (5)(questions.]

1 a Verify that the proposition $(p \wedge q) \wedge \neg(p \vee q)$ is a contradiction. 5

b What are the negations of the statements $\forall x(x^2 > x)$ *and* $\exists x(x^2 = 2)$? 5

2 a (a) What are the values of the following products? 3

$(i)\prod_{i=0}^{10} i \quad ;(ii)\prod_{i=5}^{8} i \quad ;(iii)\prod_{i=1}^{100}(-1)^i$

b Encrypt the message "MATHEMATICS IS THE MOTHER OF SCIENCE", applying the encryption function: $f(p) = (p + 11) \bmod 26$. 7

3 a Determine whether the sequence $\{a_n\}$ is a solution of the recurrence relation $a_n = 2a_{n-1} - a_{n-2}$ for $n = 2, 3, 4,$ -----------, where $a_n = 3n$ for every nonnegative integer n. 6

b Express gcd(36, 48) as a linear combination of 36 and 48. 4

4 a Determine whether the posets $(\{1,2,3,4,5\}, |)$ and $(\{1,2,4,8,16\}, |)$ are lattices. 6

b Evaluate: (i) $\lceil \lfloor 1/2 \rfloor + \lceil 1/2 \rceil + 1/2 \rceil$; (ii) $\lfloor 1/2 + \lceil 3/2 \rceil \rfloor$; (iii) $\sum_{i=0}^{2}\sum_{j=0}^{2} i^2 j^3$ 4

5 a Determine whether the relation R on the set of all integers is reflexive, symmetric, antisymmetric, and/or transitive, where $(x,y) \in R$ if and only if: 10

$$(a)\ x \neq y;\ (b)\ x \text{ is a muliple of } y;\ \text{and } (c)\ x \geq y^2$$

6 a State Handshaking Theorem and prove it by an example. 5

b State Euler's Formula regarding Planar graph and prove it by an example. 5

7 a Draw an undirected graph represented by the adjacency matrix: $\begin{pmatrix} 1 & 2 & 0 & 1 \\ 2 & 0 & 3 & 0 \\ 0 & 3 & 1 & 1 \\ 1 & 0 & 1 & 0 \end{pmatrix}$ 5

b Prove that a full *m-ary* tree with n vertices has $i = (n-1)/m$ internal vertices and $L = [(m-1)n + 1]/m$ leaves. 5

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Exercises

1. List the ordered pairs in the relation R from $A = \{0, 1, 2, 3, 4\}$ to $B = \{0, 1, 2, 3\}$, where $(a, b) \in R$ if and only if
   a) $a = b$.
   b) $a + b = 4$.
   c) $a > b$.
   d) $a \mid b$.
   e) $\gcd(a, b) = 1$.
   f) $\operatorname{lcm}(a, b) = 2$.
2. a) List all the ordered pairs in the relation $R = \{(a, b) \mid a \text{ divides } b\}$ on the set $\{1, 2, 3, 4, 5, 6\}$.
   b) Display this relation graphically, as was done in Example 4.
   c) Display this relation in tabular form, as was done in Example 4.
3. For each of these relations on the set $\{1, 2, 3, 4\}$, decide whether it is reflexive, whether it is symmetric, whether it is antisymmetric, and whether it is transitive.
   a) $\{(2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3, 4)\}$
   b) $\{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$
   c) $\{(2, 4), (4, 2)\}$
   d) $\{(1, 2), (2, 3), (3, 4)\}$
   e) $\{(1, 1), (2, 2), (3, 3), (4, 4)\}$
   f) $\{(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)\}$
4. Determine whether the relation R on the set of all people is reflexive, symmetric, antisymmetric, and/or transitive, where $(a, b) \in R$ if and only if
   a) a is taller than b.
   b) a and b were born on the same day.
   c) a has the same first name as b.
   d) a and b have a common grandparent.
5. Determine whether the relation R on the set of all Web pages is reflexive, symmetric, antisymmetric, and/or transitive, where $(a, b) \in R$ if and only if
   a) everyone who has visited Web page a has also visited Web page b.
   b) there are no common links found on both Web page a and Web page b.
   c) there is at least one common link on Web page a and Web page b.
   d) there is a Web page that includes links to both Web page a and Web page b.
6. Determine whether the relation R on the set of all real numbers is reflexive, symmetric, antisymmetric, and/or transitive, where $(x, y) \in R$ if and only if

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Premier University, Chittagong

Department of Computer Science and Engineering
2nd Semester Mid-term Examination, March 2017
Course Code: CSE 103, Course Title: Discrete Mathematics
Time: 40 mins, Full Marks: 20

1) Let U={1,...,10},A={0,2,4,6,8,10}, B={0,1,2,3,4,5,6},C={4,5,6,7,8,9,10}. Find truth table 10
a)(B-A) $\cup (C-A) = (B \cup C) - A$.
b)(A) $(A \cap B) \cup (A \cap C)$
c) A $\oplus (B \oplus C) = (A \oplus B) \oplus C$

2) ((q) show the Tree. $((\sim(p \wedge q)) \wedge (\sim(q \wedge r))) \wedge (\sim(p \vee (\sim q (\sim s))))$ 3

3) Let p,q and r be the propositions 3
p:gizzly bears have been seen in the area
q:hiking is safe on the trail
r:Berries are ripe along the trail
a)Barries are along the trail, but gizzly bears have not been seen in the area
b)Gizzly bears have not been seen in the area and hiking on the trail is safe, but barriers are ripe along the trail
c)If barriers are ripe along the trail, hiking is safe if and only if gizzly bears have not been seen in the area
d)It is not safe to hike on the trail,but gizzly bearshave not been seen in the area and the barriers along the trail are ripe.
e)For hiking on the trai to be safe if and only if barriers are not ripe along the trail and for gizzly bears not been seen in the area.

4) Let A = {n N: n > 2 and n = 4j - 5 for some j N} and 4
B = {n N:n > 0 and n = 2k + 1 for some k N}Prove that ACB

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Premier University
Department of Computer Science & Engineering
2nd Semester Mid-Term Exam,2017
Course Title: Discrete Mathematics
Course Code: CSE 103

Total Marks: 20

Answer all questions **Time: 40 mins**

1. a) Determine whether $(p \vee q) \wedge (\sim p \vee r) \rightarrow (q \vee r)$ is a tautology. 3

   b) If $U = \{1, \text{-------}, 10\}$, $A = \{1,3,4,8\}$, $B = \{2,3,4,5,9,8\}$ and $C = \{3,5,7,9,8\}$ 7

   (i) Find Truth Table of the following

   $A \cap (B \oplus C) = (A \cap B) \oplus (A \cap C)$

   (ii) Find Bit representation of the following:

   (1) $(A - B) \cup (A - C) \cup (B - C)$

   (2) $(A \cap B) \cup (A \cap C)$

2. a) (i) Let $A = \{n \in N$ and $n = 3k+2$ for some $k \in N\}$ and

   $B = \{n \in N$ and $n = 5k-1$ for some $k \in N\}$

   $C = \{m \in N$ and $m = 6k-4$ for some $k \in N$ and $k \geq 1\}$ 7

   Prove that (1) B [illegible] C

   (2) [illegible]

   b) If p: Grizzly bears have seen in the area

   q: Hiking is safe on the trail 3

   r: Berries are ripe along the trail

   Write these proposition using p, q and r and logical connectives.

   i) If barriers are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area. $r \rightarrow (q \leftrightarrow \neg p)$

   ii) It is not safe to hike on the trail, but grizzly bears have not been seen in the area and the barriers along the trail are ripe. $\neg q \rightarrow (\neg p \wedge r)$ [illegible] $\neg q \wedge p \vee r$

   iii) For hiking on the trail to be safe, it is necessary but not sufficient that barriers not be ripe along the trail and for grizzly bears not to have been seen in the area. $q \leftrightarrow (\neg r \wedge \neg p$

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Exercises

1. List the ordered pairs in the relation R from $A = \{0, 1, 2, 3, 4\}$ to $B = \{0, 1, 2, 3\}$, where $(a, b) \in R$ if and only if
   a) $a = b$.
   b) $a + b = 4$.
   c) $a > b$.
   d) $a \mid b$.
   e) $\gcd(a, b) = 1$.
   f) $\operatorname{lcm}(a, b) = 2$.
2. a) List all the ordered pairs in the relation $R = \{(a, b) \mid a \text{ divides } b\}$ on the set $\{1, 2, 3, 4, 5, 6\}$.
   b) Display this relation graphically, as was done in Example 4.
   c) Display this relation in tabular form, as was done in Example 4.
3. For each of these relations on the set $\{1, 2, 3, 4\}$, decide whether it is reflexive, whether it is symmetric, whether it is antisymmetric, and whether it is transitive.
   a) $\{(2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3, 4)\}$
   b) $\{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$
   c) $\{(2, 4), (4, 2)\}$
   d) $\{(1, 2), (2, 3), (3, 4)\}$
   e) $\{(1, 1), (2, 2), (3, 3), (4, 4)\}$
   f) $\{(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)\}$
4. Determine whether the relation R on the set of all people is reflexive, symmetric, antisymmetric, and/or transitive, where $(a, b) \in R$ if and only if
   a) a is taller than b.
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   d) a and b have a common grandparent.
5. Determine whether the relation R on the set of all Web pages is reflexive, symmetric, antisymmetric, and/or transitive, where $(a, b) \in R$ if and only if
   a) everyone who has visited Web page a has also visited Web page b.
   b) there are no common links found on both Web page a and Web page b.
   c) there is at least one common link on Web page a and Web page b.
   d) there is a Web page that includes links to both Web page a and Web page b.
6. Determine whether the relation R on the set of all real numbers is reflexive, symmetric, antisymmetric, and/or transitive, where $(x, y) \in R$ if and only if

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Premier University, Chittagong

Department of Computer Science and Engineering

2nd Semester Mid-term Examination, March 2017

Course Code: CSE 103, Course Title: Discrete Mathematics

Time: 40 mins, Full Marks: 20

1) Let U={1,...,10},A={0,2,4,6,8,10}, B={0,1,2,3,4,5,6},C={4,5,6,7,8,9,10}. Find truth table 10

a)(B-A) ∪ (C-A) = (B∪C) − A .

b)(A) (A∩B) ∪ (A∩C)

c) A ⊕ (B⊕C) = (A⊕B)⊕C

2) ((q) show the Tree. ((~(p∧q)) ∧(~(q∧r)) ∧(~(p∨(~q(~s)))

3) Let p,q and r be the propositions 3

p:gizzly bears have been seen in the area

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e)For hiking on the trai to be safe if and only if barriers are not ripe along the trail and for gizzly bears not been seen in the area.

4) Let A = {n N: n > 2 and n = 4j − 5 for some j N} and 4

B = {n N:n > 0 and n = 2k + 1 for some k N}Prove that A⊂B

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D-3

Q5 a) Prove that 'A simple connected graph is a tree if between any two vertices there exists a unique path' 5

b) If U={1,--------,10}, A={0,2,4,6,8,10}, B={0,1,2,3,4,5,6} and C={4,5,6,7,8,9,10} 5

Find Truth Table of the following

(i) $(A \cap \bar{B}) \cup \underline{(A \cap C)}$

(ii) $((C \cap A) - \overline{(B - A)}) \cap C$

(iii) $(B - \bar{C}) \cup ((B - A) \cap (C \cup B))$

Q6 a) Let $A = \{n : n \in \mathbb{N}$ and $n = 3k + 2$ for some $k \in \mathbb{N}\}$, $B = \{n : n \in \mathbb{N}$ and $n = 5k - 1$ for some $k \in \mathbb{N}$ such that $k \geq 5\}$. Prove that $A \neq B$ 4

b) If $P = \{s \to (p \wedge (\sim r))\} \wedge ((p \to (r \vee q)) \wedge s)$, $Q = (p \vee s)$ 4

Then determine whether they are equal or not?

c) Show that $(p \vee q) \wedge (\sim p \vee r) \to (q \vee r)$ is tautology. 2

Q7 a) If R={(1,2),(1,4),(1,6),(1,8),(1,10),(3,5),(3,7),(4,6),(6,8),(7,10)} and 4

S={(2,4),(3,6),(5,7),(7,9),(8,10),(8,9),(8,8),(9,9),(3,8),(4,9)}

T={(1,10),(3,5),(3,7),(7,8),(6,7),(6,8)}

Find: (i) $S \circ T$

(ii) $R \circ S$

b) State and prove Hand shaking theorem. 3

c) Decide whether the followings are Symmetric, Antisymmetric, Reflexive and Transitive 3

{(2,2),(2,3),(2,4),(3,2),(3,3),(3,4)}

{(1,1),(1,2),(2,1),(2,2),(3,3),(4,4)}

{(2,4),(4,2)}

{(1,2),(2,3),(3,4)}

{(1,1),(2,2),(3,3),(4,4)}

{(1,3),(1,4),(2,3),(2,4),(3,1),(3,4)}

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D-1

Premier University, Chittagong

Department of Computer Science and Engineering
2nd Semester Final Examination, May 2017
Course Title: Discrete Mathematics
Course No.: CSE 103

Time: 3 Hours **Marks: 50**

Answer any five (5) from following seven (7) questions.

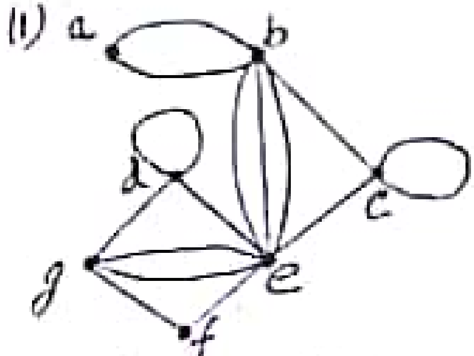
(1) a) Determine whether each of these sequence is graphic. For those that are, draw the graph. — 3
5,4,3,2,1,0
3,3,3,2,2,2
4,4,3,3,3

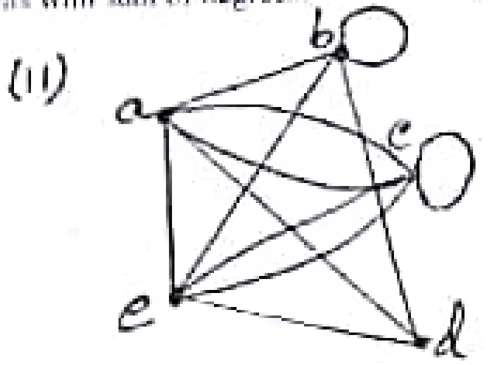
b) Draw the following graphs: — 2
$K_{1,4}$ (ii) $K_{2,3}$

c) Draw the truth table of the following: — 2
$(q \to \neg p) \oplus (\neg p \leftrightarrow \neg r)$

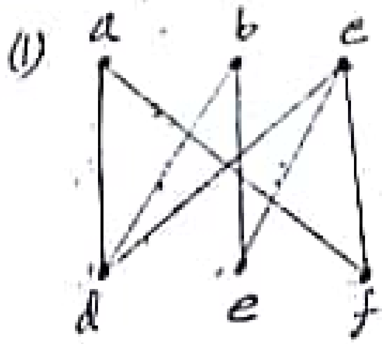
d) A simple graph has an even number of odd degree. Prove it. — 3

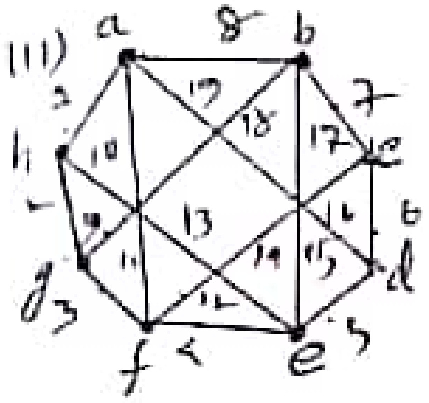
(2) a) Find the adjacency matrix of the given graphs with sum of degrees. — 4





b) Whether the given graph is planar, draw it, and then prove Euler's Formula. — 4





c) For every x and y if $x^2 < y^2$ then $x<y$ — 2

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D-2

Q3 a) Draw the graph using the following adjacency matrix: 4

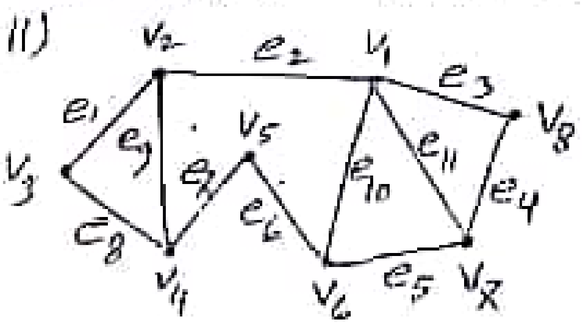
(i) $\begin{bmatrix} 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 2 & 0 & 1 & 2 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & 2 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 \end{bmatrix}$, (ii) $\begin{bmatrix} 4 & 1 & 1 & 1 & 0 & 2 \\ 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 3 \\ 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 \\ 2 & 0 & 3 & 1 & 1 & 0 \end{bmatrix}$

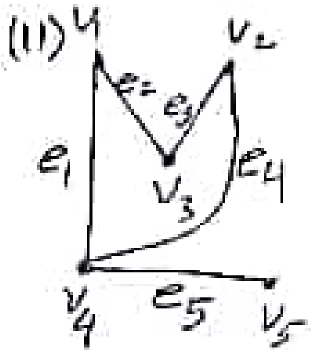
b) Draw the graph using the following incidence matrix: 4

(i) $\begin{bmatrix} 0 & 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}$ (ii) $\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 & 0 \end{bmatrix}$.

c) For every positive integer, if n is even then prove that, $n^2 + n + 19$ is prime. 2

Q4 a) Write the incidence matrix of the following graph. 4





b) Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} be a universal set. Let A, B, C ⊂ U such that A = {1, 3, 4, 8}, B = {2, 3, 4, 5, 9, 10}, and C = {3, 5, 7, 9, 10}. Use bit representations for A, B, and C together with UNION, INTER, DIFF, and COMP to find the bit representation for the following 4

$A \cap (\bar{B} - (C \cap B))$

$(A \cup B) \cup (\bar{C} - B)$

c) Determine the sequence of the series: 2

2,16,54,128,250,432,686,.....

3,6,12,24,48,96,192,.........

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Premier University
Department of Computer Science & Engineering
2nd Semester Final Exam, November 2016
Course Title: Discrete Mathematics
Course Code: CSE 103

Total Marks: 50 | Time: 3 Hours

Answer any five questions.

1. a) Draw the graph from the following adjacency matrix

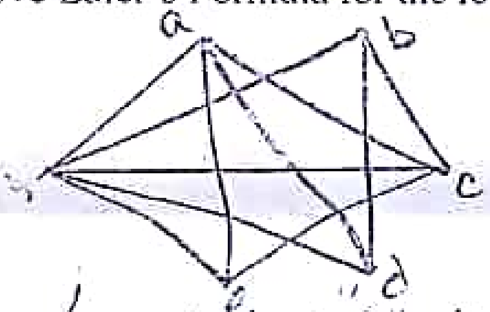
$$\begin{array}{c|ccccc} & a & b & c & d & e \\ \hline a & 0 & 1 & 3 & 0 & 4 \\ b & 1 & 2 & 1 & 3 & 0 \\ c & 3 & 1 & 1 & 0 & 1 \\ d & 0 & 3 & 0 & 0 & 2 \\ e & 4 & 0 & 1 & 2 & 3 \end{array}$$

S.S.C

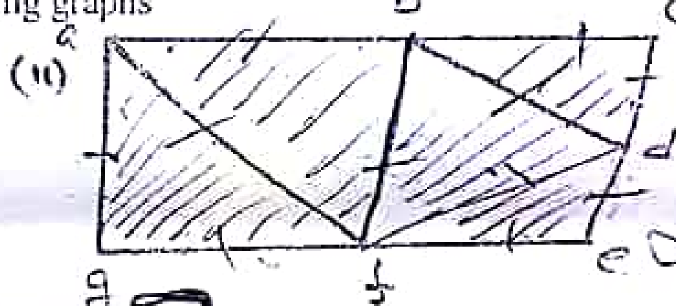
H.S.C Certificate

b) Prove Euler's Formula for the following graphs

(i)

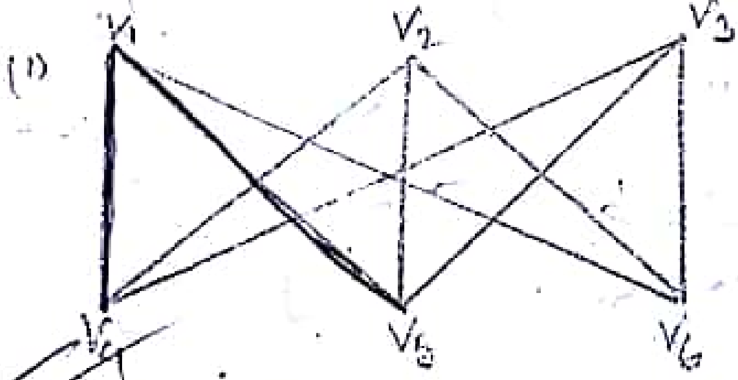


(ii)

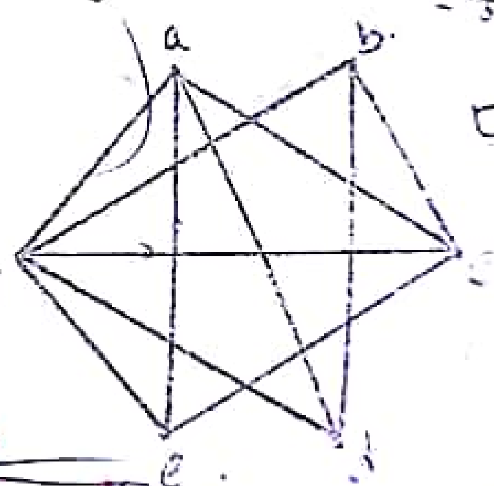


c) Determine whether the following graphs are planar.

(i)



(ii)



find each each

2. a)

Mary=John

Peter=Elaine　　Maude=Harold

George　　Elizabeth

Using the above family tree find each of the following Relations.

(i) Is Married to^{-1}

(ii) Is Cousin of

(iii) Is Siblings of ∩ Is Parent of

(iv) Is Same Generation

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b) If R={(1,2),(1,4),(1,6),(1,8),(1,10),(3,5),(3,7),(4,6),(6,8)(7,10)} and S={(2,4),(3,6),(5,7),(7,9),(8,10),(8,9),(8,8),(9,9),(3,8),(4,9)}
T={(1,10),(3,5),(3,7),(7,8),(6,7),(6,8)}
Find: (i) $S \circ T$
(ii) $R \circ S$

3 a) Decide whether the followings are Symmetric, Antisymmetric, Reflexive and Transitive

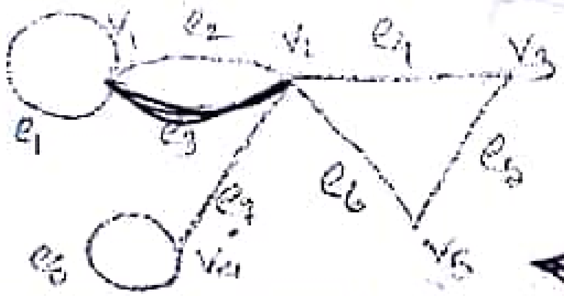
(i) {(2,2),(2,3),(2,4),(3,2),(3,3),(3,4)} IR/T/S
(ii) {(1,1),(1,2),(2,1),(2,2),(3,3),(4,4)} Re
(iii) {(2,4),(4,2)} Sy
(iv) {(1,2),(2,3),(3,4)} T
(v) {(1,1),(2,2),(3,3),(4,4)} Re
(vi) {(1,3),(1,4),(2,3),(2,4),(3,1),(3,4)} S.y

b) Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} be a universal set. Let A, B, C ⊂ U such that A = {1, 3, 4, 8}, B = {2, 3, 4, 5, 9, 10}, and C = {3, 5, 7, 9, 10}. Use bit representations for A, B, and C together with UNION, INTER, DIFF, and COMP to find the bit representation for the following:

(i) $A \cap (B - (C \cap B))$
(ii) $(A \cup B) \cup (C - B)$
(iii) $\bar{A} \times \bar{B} \times \bar{C}$

4 a) *Prove that a simple connected graph is a tree if between any two vertices there exists a unique path.*

b) Find incidence matrix and the sum of degrees of the following graph.



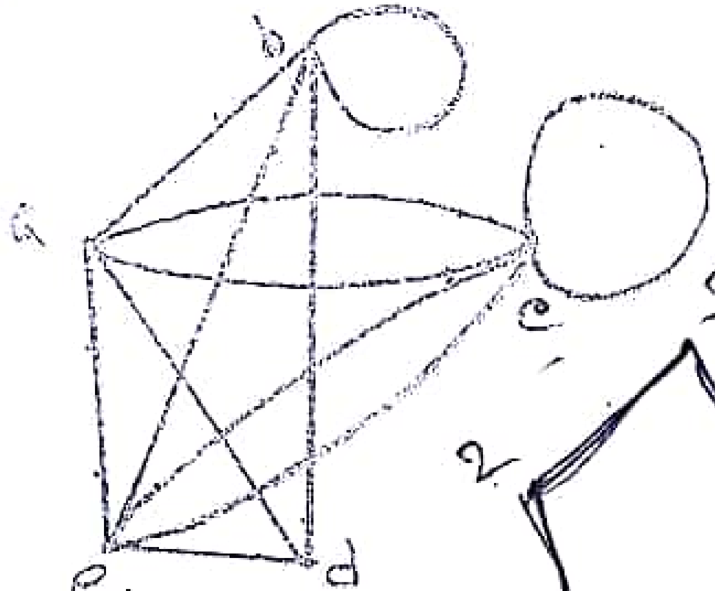
c) Draw the following graphs
(i) $K_{1,8}$
(ii) 3,2,2,1,0

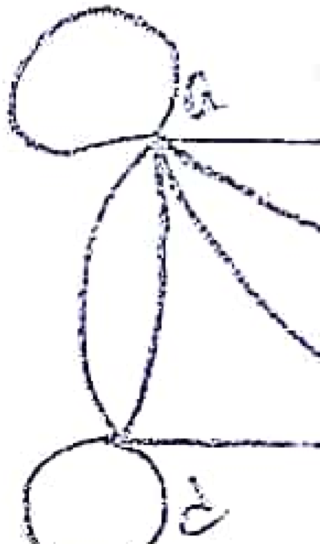
5 a) Let U={0,1,........,10}, A={0,2,4,6,8,10}, B={0,1,2,3,4,5,6} and C={4,5,6,7,8,9,10}
Show that (i) $\bar{A} \cap \bar{B} \cap \bar{C}$ (ii) $(A - B) \cup (A - C) \cup (B - C)$ using truth table.

b) List the ordered pairs in the relation R from A={0,1,2,3,4} to B={0,1,2,3} where $(a, b) \in R$ if and only if (i) a+b=4, (ii) a/b (iii) a>b

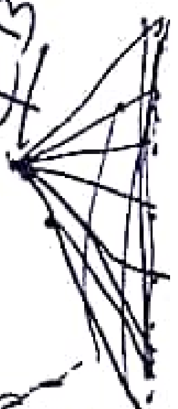
c) Prove that a simple graph has an even number of vertices of odd degree.

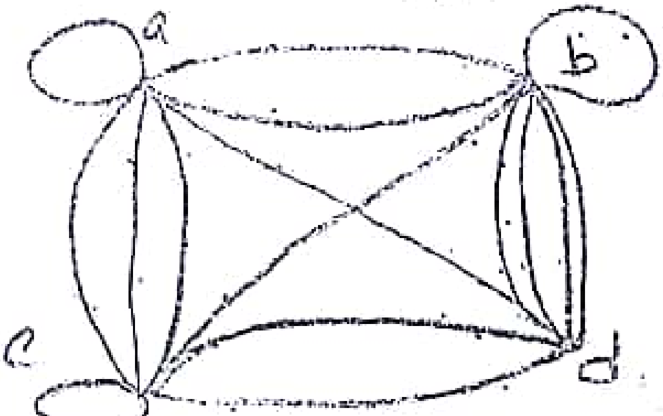
6 a) Find the adjacency matrix and sum of degrees of the following graphs





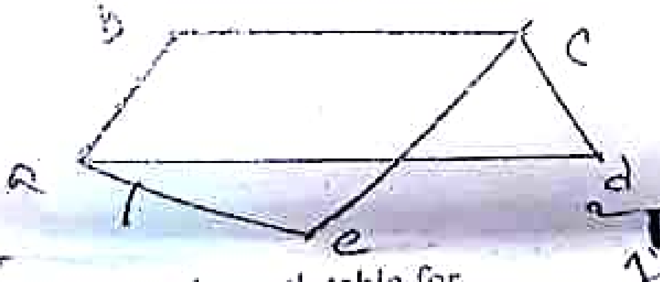
b) Determine the sum of degrees of the following graph.



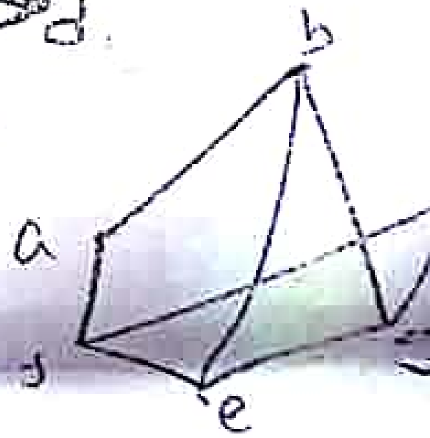


c) Determine whether the following graphs are bipartite.

(i)



(ii)



a) Construct the truth table for

(i) $(q \vee p \vee \sim s \vee \sim r) \oplus (p \oplus q \wedge \sim s)$

(ii) $(p \oplus q) \rightarrow (r \wedge s)$

b) Let $A = \{n : n \in \mathbb{N} \text{ and } n = 2k + 1 \text{ for some } k \in \mathbb{N}\}$, $B = \{n : n \in \mathbb{N} \text{ and } n = 4K + 1 \text{ for some } k \in \mathbb{N}\}$ Prove the following

(i) $35 \notin A$

(ii) $B \subseteq A$

A⊂B
A⊆B
A⊄B

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Premier University

Department of Computer Science & Engineering

2nd Semester Final Exam, December 2017

Course Title: Discrete Mathematics

Course Code: CSE 103

Total Marks: 50

Answer any five questions. **Time: 3 Hours**

1 a) Let $A = \{n : n \in N \text{ and } n = 3k + 2 \text{ for some } k \in N\}$, $B = \{n : n \in N \text{ and } n = 5k - 1 \text{ for some } k \geq 5\}$, and $C = \{m \in N : m = 6k - 4 \text{ and } k \in N \text{ and } k \geq 1\}$. Prove the following: 6

(i) $C \subseteq A$

(ii) $A \neq B$

(iii) $50 \in C$

b) Find the expression tree of the following formulas: 4

(i) $\left(\left(\left((\sim(\sim p)) \wedge (\sim q)\right) \sim\wedge r\right) \vee \left(\left((\sim(\sim q)) \wedge (\sim r)\right) \wedge s\right)\right) \leftrightarrow (s \rightarrow p)$

(ii) $(\sim q \wedge \sim r) \leftrightarrow (p \rightarrow (q \vee r))$

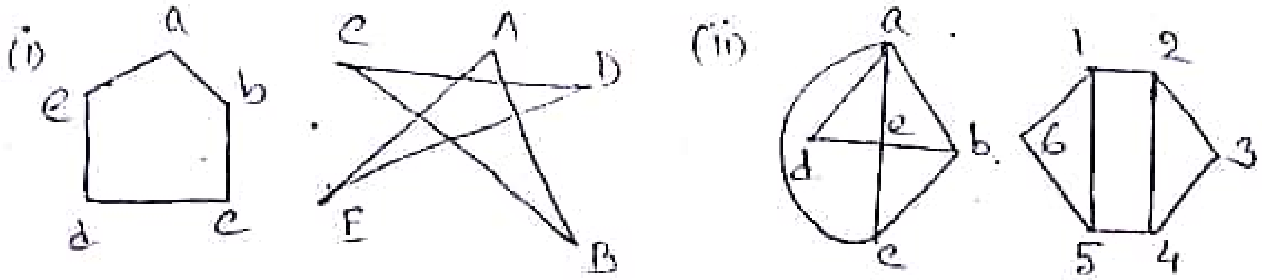
2 a) Prove that $A \oplus (B \oplus C) = (A \oplus B) \oplus C$ 5

b) Let $U = \{0,1,\ldots,9\}$; $A = \{0,1,2,3\}$; $B = \{0,2,4\}$ and $C = \{0,3,6,9\}$. Construct truth table for the following: 5

(i) $A \cap (B \oplus C) = (A \cap B) \oplus (A \cap C)$

(ii) $(A \cup B) \oplus (B \cup C)$

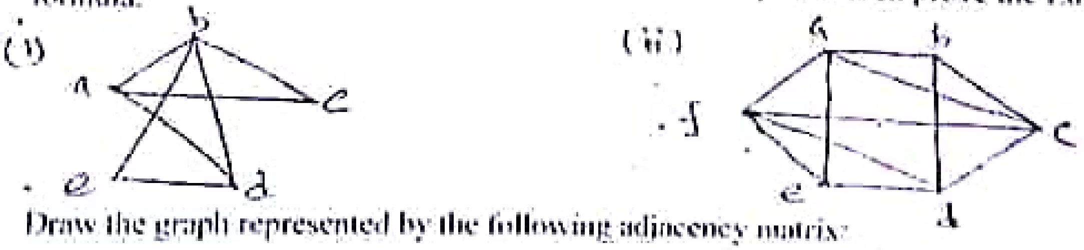
3 a) Prove that the following graphs are Isomorphic: 5



b) Prove that, "A simple connected graph is a tree if between any to vertices there exists a unique path." 5

4 a) State and prove Euler's formula for graphs. 6

b) Determine whether the following graphs are planar. If planar then prove the Euler's formula. 4



5 a) Draw the graph represented by the following adjacency matrix: 5

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Premier University
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2nd Semester Final Exam, December 2017
Course Title: Discrete Mathematics
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Total Marks: 50
Answer any five questions. **Time: 3 Hours**

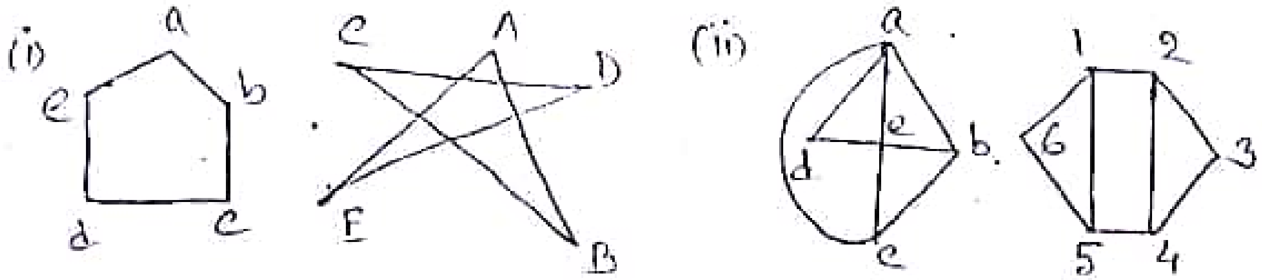
1. a) Let $A = \{n : n \in N \text{ and } n = 3k + 2 \text{ for some } k \in N\}$, $B = \{n : n \in N \text{ and } n = 5k - 1 \text{ for some } k \geq 5\}$, and $C = \{m \in N : m = 6k - 4 \text{ and } k \in N \text{ and } k \geq 1\}$. Prove the following: 6
   - (i) $C \subseteq A$
   - (ii) $A \neq B$
   - (iii) $50 \in C$

   b) Find the expression tree of the following formulas: 4
   - (i) $\left(\left(\left((\sim(\sim p)) \wedge (\sim q)\right) \sim\wedge r\right) \vee \left(\left((\sim(\sim q)) \wedge (\sim r)\right) \wedge s\right)\right) \leftrightarrow (s \rightarrow p)$
   - (ii) $(\sim q \wedge \sim r) \leftrightarrow (p \rightarrow (q \vee r))$

2. a) Prove that $A \oplus (B \oplus C) = (A \oplus B) \oplus C$ 5

   b) Let $U = \{0,1,\ldots,9\}$; $A = \{0,1,2,3\}$; $B = \{0,2,4\}$ *and* $C = \{0,3,6,9\}$. Construct truth table for the following: 5
   - (i) $A \cap (B \oplus C) = (A \cap B) \oplus (A \cap C)$
   - (ii) $(A \cup B) \oplus (B \cup C)$

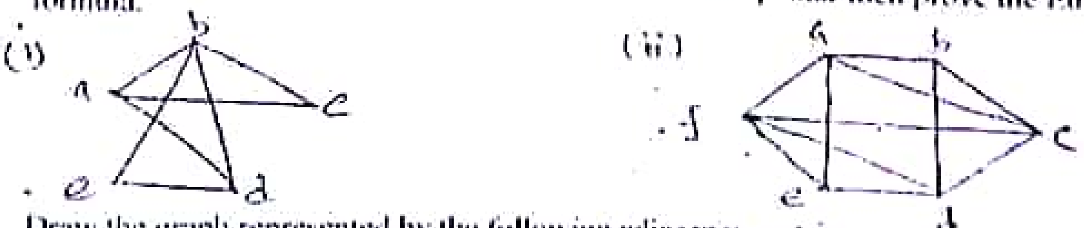
3. a) Prove that the following graphs are Isomorphic: 5



   b) Prove that, "A simple connected graph is a tree if between any to vertices there exists a unique path." 5

4. a) State and prove Euler's formula for graphs. 6

   b) Determine whether the following graphs are planar. If planar then prove the Euler's formula. 4



5. a) Draw the graph represented by the following adjacency matrix: 5

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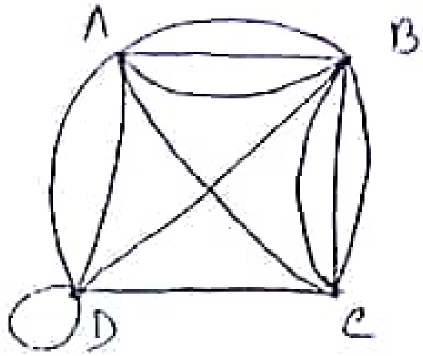
(i) $\begin{bmatrix} 4 & 1 & 1 & 1 & 0 & 2 \\ 1 & 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 0 & 1 & 1 & 3 \\ 1 & 1 & 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 & 1 \\ 2 & 0 & 3 & 1 & 1 & 0 \end{bmatrix}$ (ii)

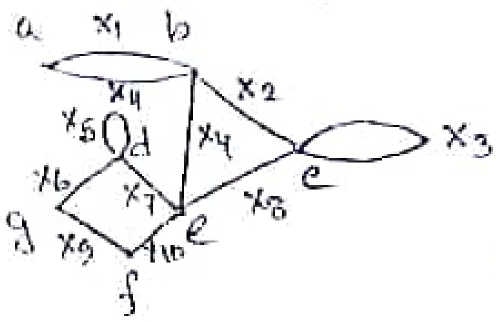


b) Draw the following:

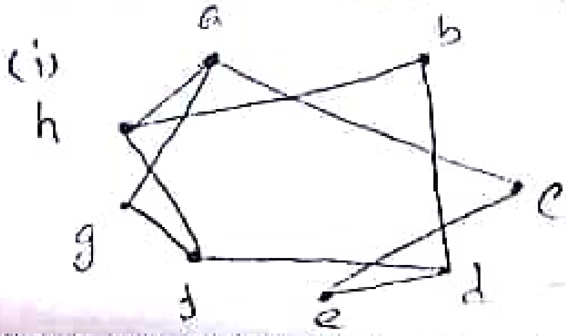
(i) $K_{1,8}$ (ii) $K_{2,3}$ (iii) K_7 (iv) $K_{4,4}$ (v) 6,5,4,3,2,1

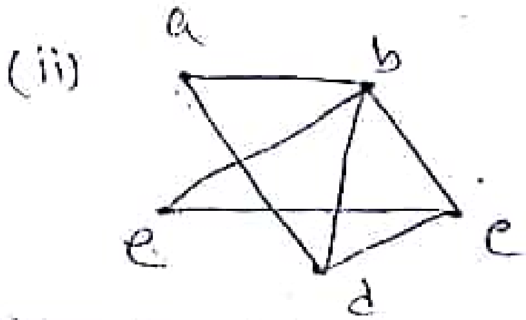
a) Draw the graph represented by the following incidence matrix:

(i) $\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$ (ii)



b) Show that the following graphs are bipartite:





a) Let A={0,1,2,3,4} to B={0,1,2,3}, where $(a,b) \in R$. Determine whether relation R o the following sets of all people is reflexive, antisymmetric symmetric, and/or transitiv if and only if

(i) a is taller than b

(ii) a and b are same age

(iii) a+b=4

(iv) a/b

b)

$$R_1 = \{(1,2),(1,6),2,4),(3,4),3,6),(3,8)\}$$
$$R_2 = \{(2,u),(4,s),(4,t),(6,t),(8,u)\}$$

Find (i) $R_1 0 R_2$ (ii) $R_2 0 R_1$

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