PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST 1

Winter Semester: 2021-22

Course Code: CSE 2017

Course Name: Graph Theory and Combinatorics

Program & Sem: B.Tech & IV Sem.

Date:

Time:

Max Marks: 30

Weightage: 15%

Instructions:
(i) Read the all questions carefully and answer accordingly.
(ii) Scientific and non-programmable calculators are permitted

Part A [Memory Recall Questions]

Answer all the questions. Each question carries 3 marks. **(3Q x 3M = 9M)**

1. A large software development company employs 100 computer programmers. Of them, 45 are proficient in Java, 30 in C#, 20 in Python, six in C# and Java, one in Java and Python, five in C# and Python, and just one programmer is proficient in all three languages above. Determine the number of computer programmers that are not proficient in any of these three languages. (C.O.No.1) [Knowledge]

2. How many ways are there to assign 7 seven different positions to 4 different persons if every person is assigned at least one position? (C.O.No.1) [Knowledge]

3. Ram, the postman, is very lazy. He has received 10 parcels for 10 different people. However, because he is lazy, he doesn't bother reading the address and delivers them off randomly. In how many ways can Ram deliver the parcels such that no one gets the right parcel? (C.O.No.1) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the questions. Each question carries 6 marks. **(2Q x 6M = 12M)**

4. Find the rook polynomial for 3×3 chess board by using expansion formula. (C.O.NO.1) [Comprehension]

5. In how many ways can the 26 letters of the English alphabet be permuted so that none of the pattern VAN, DOG, SIZE or GUN occurs? (C.O.NO.1) [Comprehension]

Part C [Problem Solving Questions]

Answer the following question. The question carries 9 marks. **(1Q x 9M = 9M)**

6. Find the number of solutions of the equation $x_1 + x_2 + x_3 = 11$, where x_1, x_2 and x_3 are non-negative integers with $x_1 \le 3, x_2 \le 4$ and $x_3 \le 6$. (C.O.NO.1) [Comprehension]

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TEST 1

Winter Semester: 2021-22
Course Code: CSE2017
Course Name: Graph Theory and Combinatorics
Program & Sem: B.Tech & IV Sem.

Date: 10/05/2022
Time: 2.00 pm - 3.00 pm
Max Marks: 30
Weightage: 15 %

Instructions:

(i)   *Read the all questions carefully and answer accordingly.*

(ii)   *Scientific and non-programmable calculators are permitted.*

Part A [Memory Recall Questions]

Answer all the questions. Each question carries 3 marks.   **(3Q x 3M = 9M)**

1. A total of 1876 students have taken a course in Java, 999 have taken a course in Linux, and 345 have taken a course in C. Further, 876 have taken courses in both Java and Linux, 231 have taken courses in both Linux and C, and 290 have taken courses in both Java and C.   If 2504 students have taken at least one of Linux, Java, and C, how many students have taken a course in all three programming languages?   (C.O.No.1) [Comprehension]

2. How many onto functions are there from a set with five elements to a set with three elements?
(C.O.No.1) [Comprehension]

3. There are seven letters to seven different people to be placed in seven different addressed envelopes. Find the number of ways of doing it so that at least one letter gets to the right person. (C.O.No.1) [Comprehension]

Part B [Thought Provoking Questions]

Answer all the questions. Each question carries 6 marks.   **(2Q x 6M = 12M)**

4. An apple, a banana, a mango, and an orange are to be distributed to 4 boys B_1, B_2, B_3, and B_4. The boys B_1 and B_2 do not wish to have apple, B_3 does not want either banana or mango and B_4 does not like orange. In how many ways the distribution can be made so that no boy is displeased?   (C.O.No.1) [Comprehension]

5. How many integers between 1 and 300 (inclusive) are (i) divisible by at least one of 3, 5 and 7? (ii) divisible by none of 3, 5 and 7?   (C.O.No.1) [Comprehension]

Part C [Problem Solving Questions]

Answer the following question. The question carries 9 marks.   **(1Q x 9M = 9M)**

6. How many solutions does the equation $x_1 + x_2 + x_3 + x_4 = 18$ have, where x_1, x_2, x_3 and x_4 are non-negative integers with $x_i \leq 7$ for $i = 1, 2, 3, 4$.   (C.O.No.1) [Comprehension]

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TEST 2

Winter Semester: 2021-22

Course Code: CSE 2017

Course Name: Graph Theory and Combinatorics

Program & Sem: B.Tech and IV Sem

Date: 1st June 2022

Time: 03.00 PM to 04.00 PM

Max. Marks: 30

Weightage: 15%

Instructions:

(i)   Read the questions properly and answer accordingly.

(ii)   Question paper consists of 3 parts.

(iii)   Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]

Answer all the questions. Each question carries THRE marks.   (3Q x 3M = 9M)

1. A graph contains 21 edges, 3 vertices of degree 4 and all other vertices of degree 2.   Find the number of vertices.   (C.O.No.2) [Knowledge]

2. Write the degrees and neighbourhoods of all the vertices of the following graph.
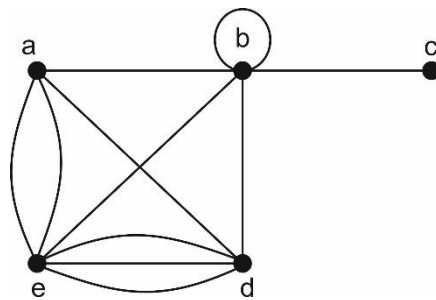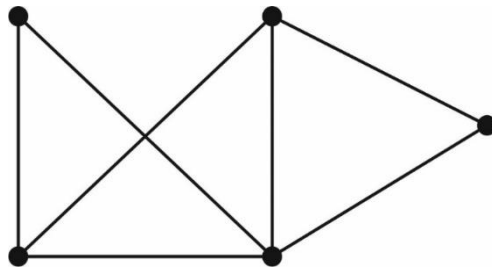

(C.O.No.2) [Knowledge]

3. Define a complete bipartite graph with an example.   (C.O.No.3) [Knowledge]

Part B [Thought Provoking Questions]

Answer both the questions. Each question carries SIX marks.   (2Q x 6M = 12M)

4. Write the adjacency and incidence matrix of the following graph.

(C.O. No.2) [Comprehension]

5. (a) For the degree sequence {3, 3, 3, 2, 2, 2, 1}, check whether graph is existing.   If it exists, draw the graph. If not, justify the answer.

   (b) Draw the graph of K_5 and hence verify the handshaking theorem.
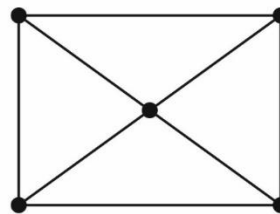
(C.O.No.2) [Comprehension]

Part C [Problem Solving Questions]

Answer the following question. The question carries NINE marks. (1Q x 9M = 9M)

6. Define the term "isomorphism of two graphs" and hence check whether the following graphs are isomorphic.   (C.O.No.2) [Comprehension]

G   H

Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

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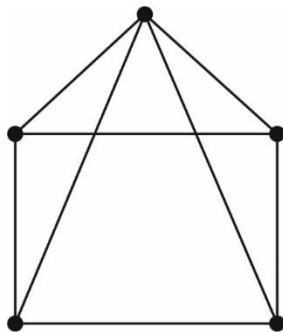
END TERM EXAMINATION

Winter Semester: 2021-22   **Date**: 29th June 2022

Course Code: CSE 2017   **Time**: 09.30 AM To 12.30 PM

Course Name: Graph Theory and Combinatorics   **Max Marks**: 100

Program & Sem: B.Tech & IV Sem   **Weightage**: 50%

Instructions:

(iii)   Read the questions properly and answer accordingly.
(iv)   Scientific and Non-programmable calculators are permitted.

Part A [Memory Recall Questions]
**Answer all the questions. Each question carries THREE marks.   (6Q x 3M = 18M)**

1. There are exactly three types of students in a school: the geeks, the wannabees, and the athletes. The total number of students in the school is 1000. The total number of geeks is 310, wannabees is 650, athletes is 440, both geeks and wannabees are 170, both geeks and athletes are 150 and both wannabees and athletes is 180. What is the total number of students who fit into all 3 categories?
                                      (C.O.No.1) [Knowledge]
2. Define pseudo graph. Give an example.   (C.O.No.2) [Knowledge]
3. Can there be a graph consisting of the vertices A, B, C and D with deg(A) = 2, deg (B) = 3, deg(C) = 3 and deg(D) = 3 ?   (C.O.No.2) [Knowledge]
4. Draw a cubic graph and K1, 6 graph.   (C.O.No.3) [Knowledge]
5. Define Hamiltonian graph with an example.   (C.O.No.3) [Knowledge]
6. Define binary tree with an example.   (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]
**Answer all the questions. Each question carries TEN marks.   (5Q x 10M = 50M)**

7. Five teachers T_1, T_2, T_3, T_4, T_5 are to be made class teachers for five classes, C_1, C_2, C_3, C_4 and C_5, one teacher for each class. T_1 and T_2 do not wish to become the class teachers for C_1 or C_2, T_3 and T_4 for C_4 or C_5, and T_5 for C_3 or C_4 or C_5. In how many ways can the teachers be assigned the work?
                                      (C.O.No.1) [Comprehension]
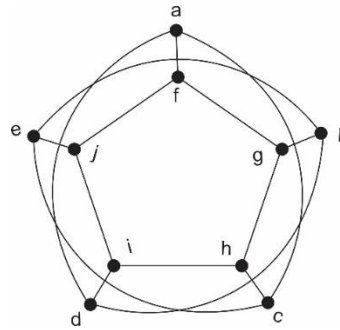8. Find the adjacency matrix and incidence matrix of the following graph 1.   (C.O.No.2) [Comprehension]
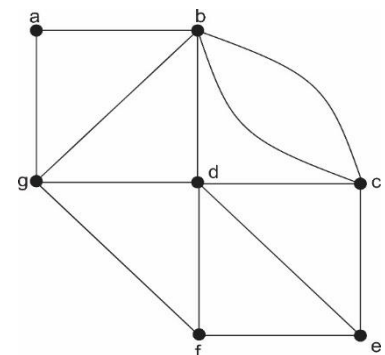
Graph 1

9. (a) Check if the following graphs 2 and 3 are isomorphic.   (C.O.No.2) [Comprehension]
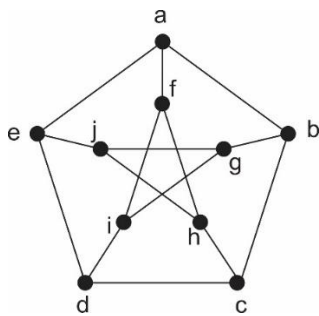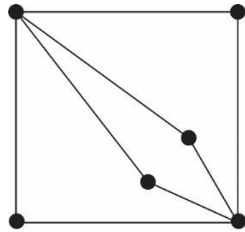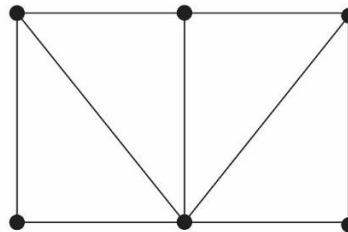
Graph 2

Graph 3

(b) Check if the following graphs G and H are Euler graph as well as Hamiltonian graph.

(C.O.No.3) [Comprehension]

G
Graph G

H
Graph H

10. (a) Prove that the complete bipartite graph $K_{3,3}$ is a non-planar graph.
    (b) Assign colors and find the chromatic number of the following graph 4.

(C.O.No.3) [Comprehension]

11. (a) Define binary search tree with an example. Form the binary search tree for the following word's: banana, peach, apple, pear, coconut, mango and papaya using the alphabetical order.
    (b) Suppose that a tree T has 3 vertices of degree 2, 4 vertices of degree 3 and 2 vertices of degree 4. Find the number of pendant vertices in T. (C.O.No.4) [Comprehension]

Part C [Problem Solving Questions]
Answer both the questions. Each question carries SIXTEEN marks.   (2Q x 16M = 32M)

12. Find the number of integer solution of the equation $x_1 + x_2 + x_3 = 20$ subject to $2 \leq x_1 \leq 5$, $4 \leq x_2 \leq 7$ and $-2 \leq x_3 \leq 9$. (C.O.No.1) [Comprehension]
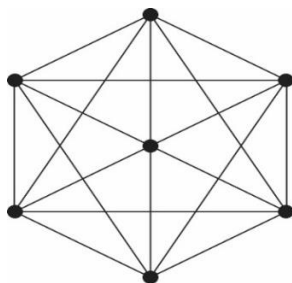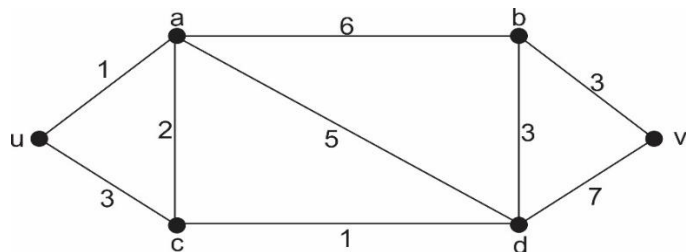
13. (a) Explain the Kruskal's algorithm. (C.O.No.5) [Comprehension]
    (b) Apply Dijkstra's algorithm to the following graph 5 to find the shortest path from u to v.

(C.O.No.5) [Application]

Graph 4

Graph 5