18U126　　　　　　　　(Pages: 2)　　　　　Name: ………….…………….

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FIRST SEMESTER B.C.A. DEGREE EXAMINATION, NOVEMBER 2018
(Regular/Supplementary/Improvement)
(CUCBCSS-UG)
CC15U BCA1 C02 / CC17U BCA1 C02 - DISCRETE MATHEMATICS
(Mathematics - Complementary Course)
(2015 Admission onwards)

Time: Three Hours　　　　　　　　　　　　　　　　　Maximum: 80 Marks

PART A

Answer *all* questions. Each question carries 1 mark.

1. Let $A = \{1,2,3,4,6\}$ and R be the relation on A defined by 'x divides y'. Write R as a set of ordered pairs.

2. Show that $\rightarrow (\rightarrow p)$ and p are logically equivalent.

3. Give an example of a partial order relation.

4. Give an example of a bipartite graph.

5. What does it mean for two simple graphs to be isomorphic?

6. What does it mean for a graph to be connected?

7. Give an example of a non planar graph.

8. Define the chromatic number of a graph.

9. What is a spanning tree of a simple graph?

10. Can there be two different simple paths between the vertices of a tree?

(**10 × 1 = 10 Marks**)

PART B

Answer *all* questions. Each question carries 2 marks.

11. Translate the statement "The sum of two positive integers is always positive" into a logical expression.

12. Show that $p \leftrightarrow q$ and $(p \wedge q) \vee (\rightarrow p \wedge \rightarrow q)$ are equivalent.

13. Define an Euler circuit and an Euler path in an undirected graph.

14. How can Euler's formula for planar graphs be used to show that a simple graph is non planar?

15. Use De Morgan's laws to find the negation of the statement "Ibrahim is smart and hard working".

(**5 × 2 = 10 Marks**)

PART C

Answer any *five* questions. Each question carries 4 marks.

16. Is the following argument valid?

"If you do every problem in this book, then you will learn discrete mathematics. You learned discrete mathematics. Therefore, you did every problem in this book."

17. What are the truth sets of the predicates $P(x)$ and Q(x), where the domain is the set of integers and $P(x)$ is "$|x| = 1$" and $Q(x)$ is "$x^2 = 2$"?

18. Give some properties of a simple graph that imply that it does not have a Hamilton circuit.

19. Define union of two graphs and give an example.

20. How many different Boolean functions of degree n are there?

21. Show that the identity in Boolean algebra $x(y + z) = xy + xz$ is valid.

22. What is the chromatic number of K_n? Justify your answer.

23. Find all spanning trees of K_5.

(**5 × 4 = 20 Marks**)

PART D
Answer any *five* questions. Each question carries 8 marks.

24. Show that the relation $R = \{(a, b) | a \equiv b(mod\ m)\}$, where m be a positive integer with $m > 1$, is an equivalence relation on the set of integers.

25. Show that each of the following conditional statement is a tautology without using truth tables.

    (a) $[p \wedge (p \to q)] \to q$

    (b) $[(p \to q) \wedge (q \to r)] \to (p \to r)$

26. Describe Kruskal's algorithm with an example.

27. State and prove Euler's formula.

28. Show that every tree is a planar graph.

29. Explain how an adjacency matrix can be used to represent a graph. Draw a graph having adjacency matrix

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

30. Describe Dijkstra's algorithm for finding the shortest path in a weighted graph between two vertices.

31. (a) 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?

    (b) What is the truth value of $\forall x(x^2 \geq x)$ if the domain consists of all real numbers?

(**5 × 8 = 40 Marks**)

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