University of Sargodha

BS 2nd Term Exam 2015

Subject: Computer Science **Paper: Discrete Structure (CMP-2111)**

Time Allowed: 2:30 Hours **Maximum Marks: 80**

Objective Part Compulsory

Q.No.1: Attempt all parts and each require answer 2 – 3 lines (16*2=32)

1. Differentiate between bound and free variable with the help of an example?

When a quantifier is used on the variable x, we say that this occurrence of the variable is **bound**. An occurrence of a variable that is not bound by a quantifier or set equal to a particular value is said to be **free**. For **Example**: In the statement $\exists x(x + y = 1)$, the variable x is bound by the existential quantification $\exists x$, but the variable y is free because it is not bound by a quantifier and no value is assigned to this variable.

2. Find the negation of this statement ∀x ∀y((x > 0) ^ (y<0) → (xy < 0))

The negation of the statement $\forall x \forall y((x > 0) \wedge (y<0) \rightarrow (xy < 0))$ is

$\exists x \exists y \neg ((x > 0) \wedge (y<0) \rightarrow (xy < 0))$

3. Write the converse of this statement "If we prepare the exam, then we will get good grade."

The converse of statement "If we prepare the exam, then we will get good grade." Will be: "If we get good grade then we did prepare the exam."

4. Write the addition rule of inference?

The tautology basis on $p \rightarrow (p \vee q)$ of rule of inference is called addition rule of inference.

5. Define vacuous.

We can quickly prove that a conditional statement $p \rightarrow q$ is true when we know that p is false, because $p \rightarrow q$ must be true when p is false. Consequently, if we can show that p is false, then we have a proof, called a **vacuous proof**, of the conditional statement $p \rightarrow q$.

For Example: Show that the proposition $P(0)$ is true, where $P(n)$ is "If $n > 1$, then $n2 > n$" and the domain consists of all integers.

Solution: Note that $P(0)$ is "If $0 > 1$, then $02 > 0$." We can show $P(0)$ using a vacuous proof. Indeed, the hypothesis $0>1$ is false. This tells us that $P(0)$ is automatically true.

6. Differentiate between subset and proper set.

The set A is a *subset* of B if and only if every element of A is also an element of B. We use the notation $A \subseteq B$ to indicate that A is a subset of the set B.

Let A and B be sets. A is a proper subset of B, if and only if, every element of A is in B but there is at least one element of B that is not in A, and is denoted as $A \subset B$.

7. Is the function f(x)=x² from the set of integers to the set of integers one to one?

8. Find the formula of this sequence 1, 1/2, 1/3, 1/4…….

The formula of the sequence 1, 1/2, 1/3, 1/4……. Is $a_n = 1/n$ where $n<=1$.

9. Define the correctness of an algorithm.

The correctness of an Algorithm is that an Algorithm should produce the correct output values for each set of input values.

10. Differentiate between sum and product rule.

Sum Rule: If one event can occur in n_1 ways, a second event can occur in n_2 (different) ways, then the total number of ways in which exactly one of the events (i.e., first or second) can occur is $n_1 + n_2$.

Example: Suppose there are 7 different optional courses in Computer Science and 3 different optional courses in Mathematics. Then there are 7 + 3 = 10 choices for a student who wants to take one optional course.

Product Rule: If one event can occur in n_1 ways and if for each of these n_1 ways, a second event can occur in n_2 ways, then the total number of ways in which both events occur is $n_1 \cdot n_2$.

Example: The chairs of an auditorium are to be labeled with an uppercase English letter followed by a positive integer not exceeding 100. What is the largest number of chairs that can be labeled differently?

Solution: The procedure of labeling a chair consists of two tasks, namely, assigning to the seat one of the 26 uppercase English letters, and then assigning to it one of the 100 possible integers. The product rule shows that there are 26 · 100 = 2600 different ways that a chair can be labeled. Therefore, the largest number of chairs that can be labeled differently is 2600.

11. How many relations are there on set s={a, b, c}?

There are 3x3=9 relations in set S.

12. Differentiate between function and relation.

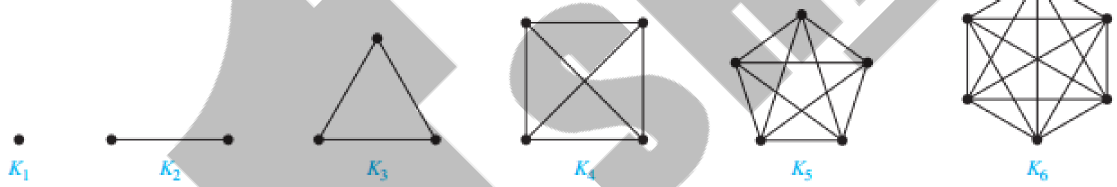
Relation: Let A and B be sets. A binary relation from A to B is a subset of A × B. Let A and B be sets. The binary relation R from A to B is a subset of A × B. When (a, b) ∈R, we say ‘a’ is related to ‘b’ by R, written aRb.

Function: A function **F** from a set X to a set Y is a relation from X to Y that satisfies the following two properties

> **1.** For every element x in X, there is an element y in Y such that (x,y) ∈F. In other words every element of X is the first element of some ordered pair of F.
>
> **2.** For all elements x in X and y and z in Y, if (x,y) ∈ F and (x,z) ∈ F, then y = z In other words no two distinct ordered pairs in F have the same first element.

13. Draw graph k4.

K_4 Graph: A complete graph on n vertices is a simple graph in which each vertex is connected to every other vertex and is denoted by K_n (K_n means that there are n vertices).



14. Compute the degree of every vertex in the graph?

The degree of a vertex is the number of edges connecting it. The degree of vertex v_1 is 2, V_2 is 2, V_3 is 2 and V_4 is also 2.

15. List the members of the following set.

a. {x|x is real number such that x^2=4}

b. {x|x is an integer such that x^2=2}

(a) The members of the set {x| x is a real number such that $x^2 = 4$} are {2}.

(b) The members of the set {*x* | *x* is an integer such that $x_2 = 2$} are Ø (√2 is not an integer).

16. Use truth table to determine whether (¬p ∧ (p → q)) → ¬ q is tautology.

(¬p ∧ (p → q)) → ¬q is Tautology

p	q	¬ p	¬q	p → q	¬p ∧ (p → q)	(¬p ∧ (p → q)) → ¬ q
F	F	T	T	T	T	T
F	T	T	F	T	T	T
T	F	F	T	F	F	T
T	T	F	F	T	F	T

Solved by Talha Shahab