

Discrete Structures

Assignment 1 for Teacher Assessment (TA)

Submission Date: 29th March – 10th April. (Submit to class CR)

1. Write the expansion of $(x+y)^6$ using binomial theorem.
2. What is the row of the pascal's triangle containing binomial coefficients $\binom{9}{k}$ where $0 \leq k \leq 9$.
3.
 - A) Find the number of ways to paint 12 offices so that 3 will be green, 2 will be pink, 2 will be yellow and the remaining will be white.
 - B) In how many ways can a set of 5 letters be selected from the English alphabet.
4. How many students must be in a class to guarantee that at least two students receive the same score on the final exam, if the exam is graded on a scale from 0 to 100.
5. Construct a truth table for each of the compound propositions.
 - a) $(p \rightarrow q) \rightarrow r \rightarrow s$
 - b) $(\neg p \leftrightarrow \neg q) \leftrightarrow (p \leftrightarrow r)$
 - c) $\neg p \rightarrow (p \rightarrow r)$
6. Express each of the statements using quantifiers. Then form the negation of the statement so that no negation is to the left of the quantifier. Also express the negation in simple English.
 - a) Some old dogs can learn new tricks
 - b) No rabbits know calculus.
 - c) every bird can fly.
 - d) There is no dog that can talk.
7. Prove that if n is an integer and $3n+2$ is even then n is even using.
 - a) proof of contraposition
 - b) proof of contradiction
8. What is the universal and existential quantifications of predicate $P(x)$? What are their negations.

9. Let $P(x)$ be the statement “ student x knows calculus” and let $Q(y)$ be the statement “ class Y contains a student who knows calculus”. Express each of these quantifications of $P(x)$ and $Q(x)$.
- a) Some students know calculus.
 - b) Not every student knows calculus.
 - c) Every class has a student in it who knows calculus.
 - d) Every student in every class knows calculus.
10. A) Explain steps to solve a problem using mathematical induction.
B) Prove by mathematical induction $n^3 - n$ is divisible by 3 ,where n belongs to the set of integers
11. A university has 20 students who need to be placed in 6 research labs for a group project. The university ensures that each lab receives at least one student. What is the minimum number of students that must be assigned to at least one lab.
12. Write the quantifiers and rules of inference used in sentence given below
“Everyone in Mumbai lives 50km of the ocean. Someone in Mumbai has never seen the ocean. Therefore, someone who lives within 50km of the ocean has never seen the ocean”.