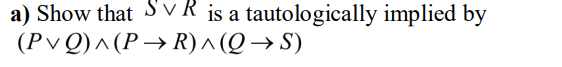
Question Bank For DSGT

Unit 1.1

1. 
2. 
3. Prove that : ¬(𝑝˅𝑞) ≡ (¬𝑝˄¬𝑞). (De Morgan’s Law)
4. Prove that : 𝑝˅(𝑞˄𝑟) ≡ (𝑝˅𝑞)˄(𝑝˅𝑟). (Distributive Law)
5. Prove that 𝐴 × (𝐵 ∩ 𝐶) = (𝐴 × 𝐵) ∩ (𝐴 × 𝐶).
6. 

Unit 1.2

1. How can this sentence be translated into a logical expression ? “you can access the internet from campus only if you are a computer science major or are not a freshman.
2. If R ={ (a, a³): a is a prime number less than 5 } be a relation. Find the range of R.
3. If 𝑅 = {(𝑥, 𝑦): 𝑥 + 2𝑦 = 8} is a relation on N, then write the range of R.
4. If 𝐴 = {1,2},𝐵 = {2,3,4}, 𝐶 = {4,5}, then find: 𝐴 × (𝐵 ∩ 𝐶)
5. Prove that 𝑛^3 + 2𝑛 is divisible by 3 using principle of mathematical induction, where n is natural number.
6. Show that √3 is not a rational number.
7. Let p and q be the propositions p : It is below freezing. q : It is snowing. Write these propositions using p and q and logical connectives (including negations).

a) It is below freezing and snowing.

b) It is below freezing but not snowing.

c) It is not below freezing and it is not snowing.

d) It is either snowing or below freezing (or both).

e) If it is below freezing, it is also snowing.

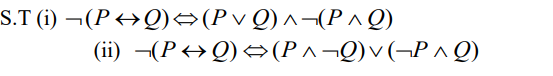
f ) Either it is below freezing or it is snowing, but it is not snowing if it is below freezing

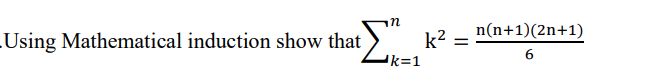
9. Show that the following statement is tautology : (( 𝑝 ˅ 𝑞) ˄ (𝑝 → 𝑟) ˄(𝑞 → 𝑟)) → 𝑟.

10. Prove that ∀𝑥(𝑃(𝑥) → 𝑄(𝑥)), ∀𝑥(𝑅(𝑥) → ℸ𝑄(𝑥)) ⟹ ∀𝑥(𝑅(𝑥) → ℸ𝑃(𝑥))

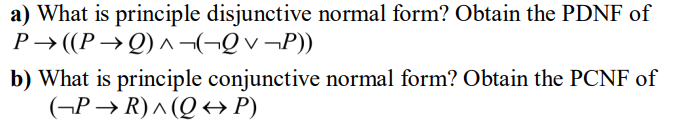
11. Show that (P→ 𝑄) Ʌ(R→ 𝑆), (𝑄 ɅM) Ʌ(S →N), ℸ(𝑀ɅN) and (P → 𝑅) ⟹ ℸP.

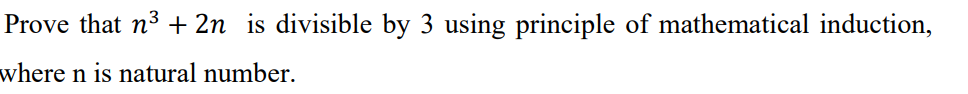
12. 

13. 

14. 

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16. 

17. 

18. **Prove that if n is a positive integer, then n is even if and only if 7n + 4 is even.**

Unit 2.1

1. Show that the relation R in the set {1, 2, 3} given by R= {(1, 1), (2, 2), (3, 3), (1, 2), (2, 3)} is reflexive but neither symmetric nor transitive.
2. Let X = {1, 2, 3,....., 7} and R = {(x, y)|(x – y) is divisible by 3}. Is R equivalence relation. Draw the digraph of R.
3. Let R ={ (1,2), (2,3), (3,1) } and A = { 1,2,3 } , find the reflexive , symmetric and transitive closure of R ,using (i) Composition of relation R. (ii) Composition of matrix relation R. (iii) Graphical representation of R.
4. Given a non empty set X, consider P(X) which is the set of all subsets of X. Define the relation R in P(X) as follows: For subsets A, B in P(X), A R B if and only if A⊂B. Is R an equivalence relation on P(X)?
5. Let A = { 1,2,3,4,5,6 } and let R be the relation defined by x divides y written as x/y : (a) Write R as a set of ordered pairs. (b) Draw its directed graph. (c) Find 𝑅 ^-1 .
6. If f : A B, g : B C are invertible functions, then show that gof : A C is invertible and (𝑔𝑜𝑓) ^-1= 𝑓 ^-1𝑜 𝑔 ^-1 .
7. Let R be a relation on the set of natural numbers N, as R = {(x, y) : x, y N, 3x + y = 19}. Find the domain and range of R. Verify whether R is reflexive.
8. Let 𝐴 = {𝑎, 𝑏, 𝑐} and the relation R be defined on A as follows: 𝑅 = { (𝑎, 𝑎), (𝑏, 𝑐), (𝑎, 𝑏) }. Then, write the minimum number of ordered pairs to be added in R to make R reflexive and transitive.
9. Draw Hasse diagram for ({3, 4, 12, 24, 48, 72}, /)
10. Draw Hasse diagram for (D12 , /)
11. Consider the set A = {4, 5, 6, 7}. Let R be the relation ≤ on A. Draw the directed graph and the Hasse diagram of R.
12. In a poset P({v, x, y, z}, ⊆) which of the following is the greatest element?

Unit 2.2

1. A coin tossed 6 times .In how many ways can we obtain 4 heads and 2 tails?
2. A bag contains 10 red marbles, 10 white marbles, and 10 blue marbles. What is the minimum no. of marbles you have to choose randomly from the bag to ensure that we get 4 marbles of the same color?
3. If 11 people each shake hands with 12 others, at least one person must have shaken hands with at least 2 others, because 12 handshakes among 11 people means some people must have more than one handshake.
4. If you have 10 pairs of black socks and 10 pairs of white socks randomly distributed in a drawer, pulling out 3 socks guarantees that at least one pair is of the same color (assuming pairs are distinguishable).
5. In a group of 13 people, at least two people must share the same birth month, since there are only 12 months in a year.
6. Assume there is a standard deck of 52 cards.

a) How many cards must be selected to guarantee that at least three cards of the same suit are chosen?

b) How many cards must be selected to guarantee that at least three hearts are selected?

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1. What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades, A, B, C, D and F.
2. Assume that telephone numbers are of the form NXX-NXX-XXXX where N is a digit from 2 to 9 and X can be any digit. What is the least number of area codes needed to guarantee that 25 million phone numbers can be assigned.