DSGT Practice Questions

Set Theory:

1. Let the universal set be $U = \{1,2,3, \dots .10\}$ and let A= {2,4,7,9}, B= {1,4,6,7,10} and C= {3,5,7,9}

   Find A∪B, A∩B $A \oplus B$ where ⊕ is symmetric difference

2. For A = {1, 2, 3, 4, 5}, which is correct partition on A.

   i) $\pi_1 = \{\emptyset, \{1,2\}, \{3,4,5\}\}$

   ii) $\pi_2 = \{\{1,2\}, \{3,4,5\}\}$

   iii) $\pi_3 = \{\{1\}, \{2,3\}, \{3,4,5\}\}$

3. Let A = {a, b, c, d, e, f, g, h}. Consider the following subsets of A

   A1 = {a, b, c, d}, A2= {a, c, e, g, h}, A3={a, c, e, g}, A4= {b, d}, A5= {f, h}

   Determine whether the following is partition of A or not. Justify your answer.

   i) {A1, A2} ii) {A3, A4, A5}

4. Let A, B and C be non-empty sets and let X = (A−B)−C and Y = (A−C)−(B−C). Is X = Y ?

5. Let E, F and G be finite sets. Let $X = (E \cap F) - (F \cap G)$ and $Y = (E - (E \cap G)) - (E - F)$

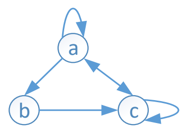
   Prove that X=Y.

Relation:

1. Let R = { (x, y) | x ≤ y } on set A = {1, 2, 3}. Represent R in the form of Adjacency matrix and diagraph.

2. Determine whether the relation R = {(1, 2), (1, 3), (1, 4), (2, 3), (2, 4), (3, 4)} on set A = {1, 2, 3, 4} is reflexive, symmetric, asymmetric, antisymmetric, or transitive or not ?

3. Determine whether R is reflexive, symmetric, asymmetric, antisymmetric, and transitive or not.



4. Prove that R = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (3, 4), (4, 3), (4, 4), (5, 5)} is equivalence relation on set A = {1, 2, 3, 4, 5}. find the quotient set A/R.

5. Let R be a relation on the set of integers Z defined by $R = \{(x, y) \mid x - y \text{ is divisible by } 3\}$. Show that R is an equivalence relation. Find Z/R

6. Let R be a relation on the set of integers Z defined by a R b, iff $a \equiv m(mod 5)$. Prove that R is an equivalence relation. Find A/R.

7. If A = {1, 2, 3, 4,} and R = {(1, 1), (1, 2), (1, 4), (2, 4), (3, 1), (3, 2), (4, 2), (4, 3), (4, 4)}. Find reflexive and symmetric closure of R.

8. Using Warshall's algorithm find transitive closure of R= {(1,1), (1,4), (2,2), (2,3), (3,1), (4,3), (4,4)} on set A= {1,2,3,4}.

9. Consider the set S = {1, 2, 3, 4} and relation R on S given by R= {(4, 3), (2, 2), (2, 1), (3, 1), (1, 2)}.

   i) Show that R is not transitive.

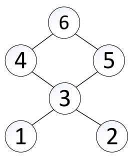
   ii) Find transitive closure of R using Warshall's Algorithm.

Function:

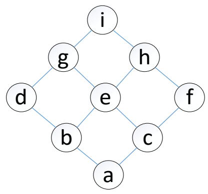
1. Prove that the function $f: R \to R,\ \ f(x) = x^2 - 4x$ is neither injective nor surjective.
2. Prove that the function $f: R - \{2\} \to R,\ f(x) = \frac{1}{x-2}$ is injective but not surjective.
3. A function $f: R - \left\{\frac{2}{5}\right\} \to R - \left\{\frac{4}{5}\right\}$ defined as $f(x) = \frac{4x+3}{5x-2}$. Prove that *f(x) is* bijective and find f^{-1}.
4. Let A = {1, 2, 3} and f, g be the functions from A to A given by $f = \{(1,2),(2,3),(3,1)\}$ and $g = \{(1,2),(2,1),(3,3)\}$. Find gof and fog
5. If $f: R \to R,\ f(x) = x^3$; $g: R \to R,\ g(x) = 4x^2 + 1$; $h: R \to R,\ h(x) = 7x - 2$
   Find fog and $(goh)of$
6. Functions f and g are defined as follows: $f: R \to R,\ f(x) = 2x + 3$; $g: R \to R,\ g(x) = 3x - 4$
   Verify that $(fog)^{-1} = g^{-1}of^{-1}$

Poset & Latiice

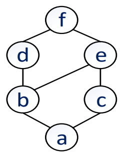
7. Let Z+ is a set of positive integers and a relation R defined on Z+ by a R b iff a | b then prove that R is a partial order relation.
8. Prove that $(\boldsymbol{P}(\boldsymbol{S}), \subseteq)$ is POSET on subset relation, where P(S) is power set of S = {a, b, c}. Draw Hasse diagram for poset $(\boldsymbol{P}(\boldsymbol{S}), \subseteq)$
9. Draw Hasse diagram POSET $(\mathbf{A}, \ |)$ where A = {1, 2, 3, 4, 6, 8, 12, 15}.
10. Consider the Hasse diagram. Find LUB (1, 2, 3) and GLB (1, 2, 3)



11. Draw Hasse diagram of D30. Determine whether it is lattice of not.
12. Determine whether the Hasse diagrams represents a lattice.



13. Find complement of each element of given POSET and check it is compliment lattice or not



14. Consider the Hasse diagram. Find complement of 'a' and 'c'