IT223 Discrete Mathematics Total Marks: 30 Time: 2 hours

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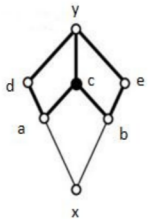
1. Suppose a list A contains the 30 students in a mathematics class, and a list B contains the 35 students in an English class, and suppose there are 20 names on both lists. Find the number of students:
(a) only on list A, (b) only on list B, (c) on list A or B (or both), (d) on exactly one list. (2)

2. The following defines a relation on the positive integers **N**: *x* is greater than *y*
Check if the relation is (a) reflexive; (b) symmetric; (c) transitive. (2)

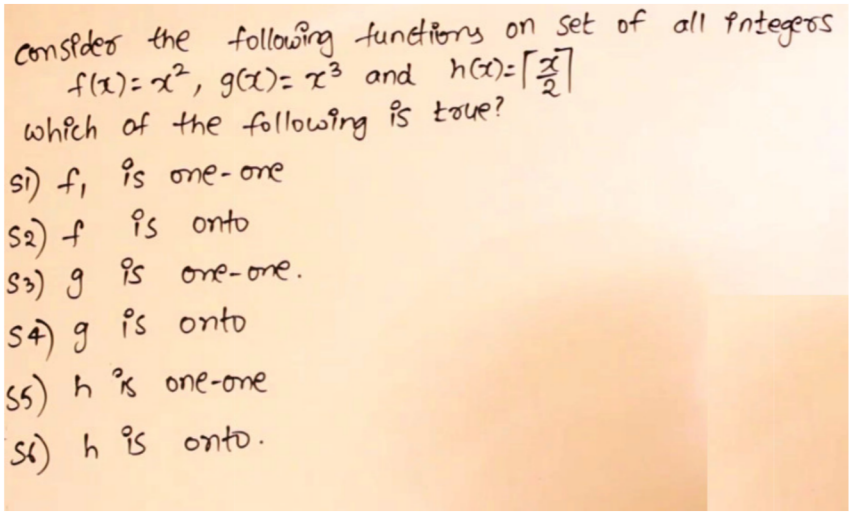
3. Let S = {Φ, {a},{b},{a,b}} then is [S, ⊆] TOS? Give proper justification (2)

4. The hasse diagram of a lattice L = { x,a,b,c,d,e,y} is shown below. Which of the following subsets of 'L' are sublattices of L? (3)

   a. {x,a,b,y}
   b. {x,a,c,y}
   c. {x,a,e,y}
   d. {x,d,e,y}



5. Solve the following: (3)



6. Which of the following is not equivalent to p<->q (3)

(A) $(\neg p \vee q) \wedge (p \vee \neg q)$
(B) $(\neg p \vee q) \wedge (q \rightarrow p)$
(C) $(\neg p \wedge q) \vee (p \wedge \neg q)$
(D) $(\neg p \wedge \neg q) \vee (p \wedge q)$

7. Consider the statement (3)

"Not all that glitters is gold"

Predicate $glitters(x)$ is true if x glitters and predicate $gold(x)$ is true if x is gold. Which one of the following logical formulae represents the above statement?

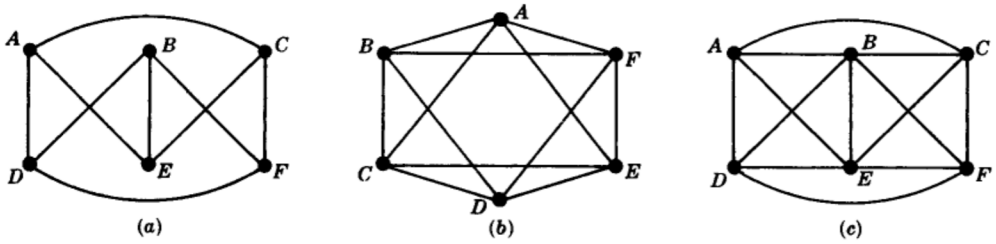
(A) $\forall x:\ glitters\ (x) \Rightarrow \neg gold(x)$

(B) $\forall x:\ gold\ (x) \Rightarrow glitters(x)$

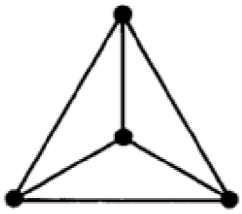
(C) $\exists x:\ gold\ (x) \wedge \neg\ glitters\ (x)$

(D) $\exists x:\ glitters\ (x) \wedge \neg\ gold\ (x)$

8. Draw the planar representation of the following graphs: (3)



9. Count the number V of vertices, the number E of edges, and the number R of regions of the Figure below and verify Euler's formula. Also find the degree d of the outside region. (3)



10. A binary operation on a set of integers is defined as $x \oplus y = x^2 + y^2$.
Which one of the following statements is TRUE about ? (3)

(A) Commutative but not associative

(B) Both commutative and associative

(C) Associative but not commutative

(D) Neither commutative nor associative

11. On a set A = {a,b,c,d} a binary operation * is defined as (3)

*	a	b	c	d
a	a	c	b	d
b	c	b	d	a
c	b	d	a	c
d	d	a	c	b

The relation is

A. Commutative but not associative

B. Neither commutative nor associative

C. Both commutative and associative

D. Associative but not commutative