Jaypee Institute of Information Technology, Noida
Test – 1 Examination (Odd 2021)
Course Name: Theoretical Foundation of Computer Science
Course Code: 15B11CI212
Maximum Marks: 20
Maximum Time: 1Hour

Q1.[CO1, 1 Marks] If n(A) = 20 and n(B) = 30 and n(A U B) = 40 then n(A ∩ B) is?

Answer: 10

Explanation: By using the formula we can calculate n(A ∩ B),

n(A U B) = n(A) + n(B) - n(A ∩ B).

n(A ∩ B) = n(A) + n(B) - n(A U B)

n(A ∩ B) = 20 + 30 - 40

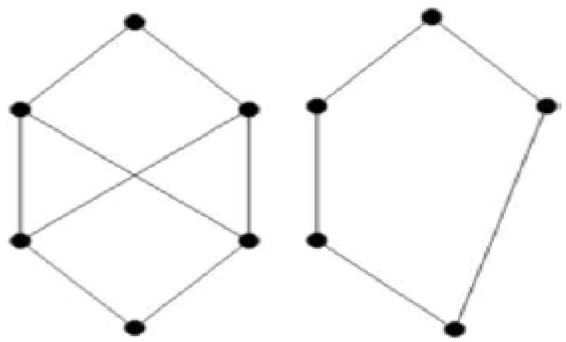
So, n(A ∩ B) = 10

Q2.**[CO1, 1 Marks]**The number of transitive closure exists in the relation R = {(0,1), (1,2), (2,2), (3,4), (5,3), (5,4)} where {1, 2, 3, 4, 5} ∈ A is_________.

Answer: {(0,1), (0,2), (1,2), (2,2), (3,4), (5,3), (5,4)}

Need to write set to get full marks

Q3.**[CO1, 1 Marks]**Which of the following represent a lattice?



I II

Solution: II Only

Q4.[CO1, 1 Marks]If A, B, C, D are sets such that $|A| = |B|$ and $|C| = |D|$,then following statements are true or false?

I: $|P(A)| = |P(B)|$

II: $|A \times C| = |B \times D|$

Answer: Both correct

Q5.**[CO1, 1 Marks]**Let the players who play cricket be 12, the ones who play football 10, those who play only cricket are 6, then the number of players who play only football are ____________, assuming there is a total of 16 players.

Answer: 4

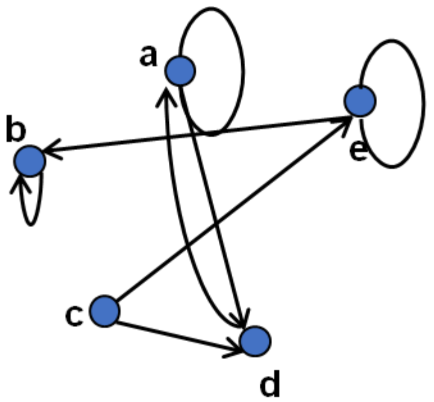
Q6. **[CO1, 1 Marks]**The cardinality of the power set of {0, 1, 2 . . ., 9} is __________.

Answer: 1024

Q7. **[CO1, 1 Marks]**Let $f(x) = x^2 + 2$, $g(x) = (fof)(x)$, $h(x) = (f + f)(x)$ then $g(2)$ and $h(2)$are equal to

Answer: 38, 12

Q8. **[CO1, 1 Marks]**For the given relation R shown below, symmetric closure is



Answer: **{(a, a), (a, d), (b, b) , (c, d) , (c, e) , (d, a), (e, b), (e, e), (b,e), (e,c), (d,c)}**

Need to write the edge pairs to get full marks

Q9. **[CO1, 1 Marks]**Pick the correct statements

I. If a relation R is both symmetric and transitive, then R is reflexive.
II. If a relation R is asymmetric, then R is both anti-symmetric and irreflexive.

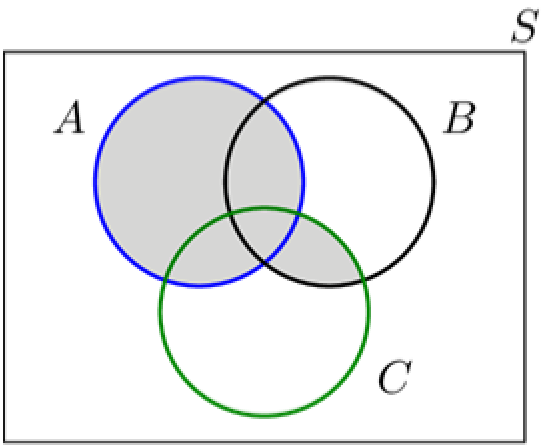
Answer: Only II correct

Q10.[CO1, 1 Marks] Consider this function $f(x) = x^2 + 1$ from R to R, then identify that this function is bijective or not:

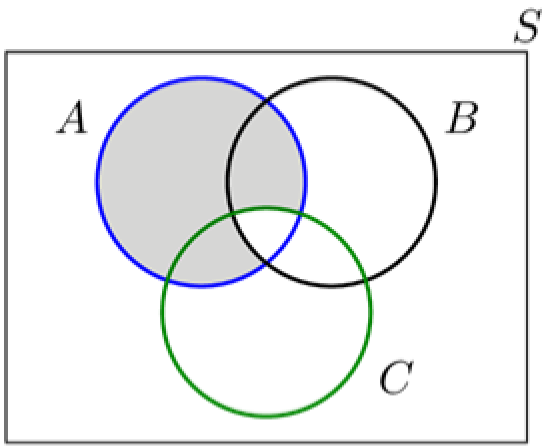
Answer: Yes function is not bijective. (need to show how it is not bijective)

Q11. **[CO1, 3 Marks]** Let A, B, C be three sets, draw Venn diagram for each of the following sets and shade the area representing the given set.

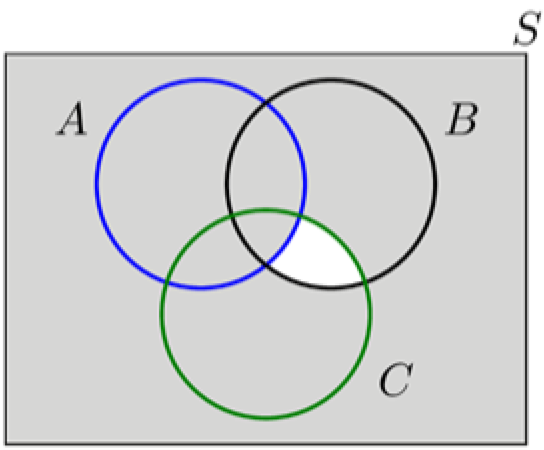
a. A∪(B∩C)
b. A−(B∩C)
c. A∪(B∩C)’



$A \cup (B \cap C)$



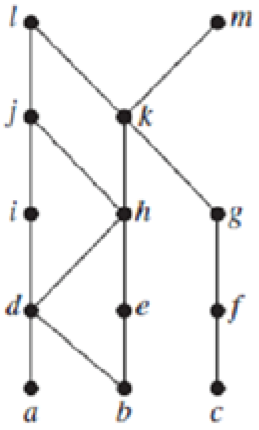
$A - (B \cap C)$



$A \cup (B \cap C)^C$

Q12. **[CO1, 3 Marks]**For the given Hasse diagram, Find the maximal, minimal, greatest, least, LB, glb, UB and lub for the following subsets

(i) {d, k, f} (ii) {b, h, f} (iii) {a, b, c}



Solution

Set	Greatest	Least	Maximum	Minimum	UB	LB	LUB	GLB
$\{d, k, f\}$	$\{k\}$	NIL	$\{k\}$	$\{d, f\}$	$\{k, l, m\}$	NIL	$\{k\}$	NIL
$\{b, h, f\}$	NIL	NIL	$\{h, f\}$	$\{b, f\}$	$\{l, m\}$	NIL	$\{k\}$	NIL
$\{d\}$	$\{d\}$	$\{d\}$	$\{d\}$	$\{d\}$	$\{d, h, i, j, k, l, m\}$	$\{d, a, b\}$	$\{d\}$	$\{d\}$
$\{a, b, c\}$	NIL	NIL	$\{a, b, c\}$	$\{a, b, c\}$	$\{k, l, m\}$	NIL	$\{k\}$	NIL
$\{l, m\}$	NIL	NIL	$\{l, m\}$	$\{l, m\}$	NIL	$\{a, b, c, d, e, f, g, h, k\}$	NIL	$\{k\}$

Q13.[CO1, 4 Marks]Consider the following recurrence relation:

$$a_n = 9a_{n-1} - 27a_{n-2} + 27a_{n-3}$$

a. Find General Solution
b. Find solution with initial conditions: $a_0 = 3, a_1 = 6, a_2 = 27$

Solution:

$$a_n = 9a_{n-1} - 27a_{n-2} + 27a_{n-3}$$

a) characteristic Equation

$$x^3 = 9x^2 - 27x + 27$$

$$\Rightarrow x^3 - 9x^2 + 27x - 27 = 0$$

$$\Rightarrow (x-3)^3 = 0$$

Roots = 3, 3, 3

root = 3 with multiplicity 3

General Solution

$$\boxed{a_n = (A + Bn + Cn^2)3^n}$$ Ans.

b) $a_0 = 3$ $a_1 = 6$ $a_2 = 27$

$n = 0$

$$(A + B\times 0 + C\times 0)3^0 = 3$$

$$\boxed{A = 3}$$

$n = 1$

$$(A + B\times 1 + C\times 1)3 = 6$$

$$A + B + C = 2$$

$$B + C = 2 - 3$$

$$B + C = -1 \quad \text{— (i)}$$

$n = 2$ $(A + 2B + 4C)3^2 = 27$

$$A + 2B + 4C = 3$$

$$2B + 4C = 0$$

$$B = -2C \quad \text{— (ii)}$$

Substituting $B = -2C$ in eq(i)

$$-2C + C = -1$$

$$-C = -1$$

$$\boxed{C = 1}$$

$$B = -2\times 1 = -2$$

$\therefore$ Solution

$$\boxed{a_n = (3 - 2n + n^2)3^n}$$