

**Answer Keys**

1	0.07	2	C	3	C	4	3	5	D	6	C	7	D
8	D	9	C	10	C	11	A	12	A	13	D	14	C
15	C	16	C	17	C	18	B	19	D	20	C	21	B
22	D	23	C	24	C	25	B	26	C	27	C	28	2.5
29	B	30	C	31	2	32	255	33	C	34	B	35	D
36	D	37	A	38	A	39	C	40	B	41	15	42	A
43	B	44	B	45	C	46	A	47	D	48	B	49	C
50	D	51	D	52	D	53	B	54	C	55	A	56	D
57	D	58	A	59	A	60	B	61	B	62	D	63	B
64	B	65	B										

**Explanations:-**

1.  $P(x + y = 2) = P(x = 0, y = 2) + P(x = 1, y = 1) + P(x = 2, y = 0) [\because x \text{ and } y \text{ are independent}]$   
 $= {}^4C_0 \left(\frac{1}{2}\right)^4 \cdot {}^5C_2 \left(\frac{1}{2}\right)^5 + {}^4C_1 \left(\frac{1}{2}\right)^4 \cdot {}^5C_1 \left(\frac{1}{2}\right)^5 + {}^4C_2 \left(\frac{1}{2}\right)^4 \cdot {}^5C_0 \left(\frac{1}{2}\right)^5 = 0.07$

2. Given:  $f(x) = \log_7 x$ ; let  $\log_7 x = y \Rightarrow x = 7^y$ ;  $\therefore f^{-1}(x) = 7^x$   
 Also we know that  $f \circ f^{-1}(x) = f^{-1} \circ f(x) = I(x) = x$

3. (c) is false because if all  $x$ 's are related to some  $y$ , it does not necessarily mean it's always the same  $y$ .

4. Field in header gives number of chars in frame.

5 4 3 2 5

Frame 1

6 7 8 9 3 2

Frame 2

4 1 2 3

Frame 3

6. No rows are selected by outer query because inner query returns empty relation due to false where condition, as 'any' returns false on empty relation for all the rows.

7. The given Schedule is Not Serializable, since it is NOT Conflict Serializable, NOT View Serializable

8. Because "T2" read the modified data of "T1" and committed without waiting for "T1" to commit.

9. Contention period is time period in which we deal with collision i.e. equivalent to round trip time.

$$RTT = 2 * \text{end to end propagation delay} = 2 * 125 \mu \text{sec} = 250 \mu \text{sec}$$

11. 1<sup>st</sup> printf will increment A [0] and print 68.  
2<sup>nd</sup> printf will increment pointer to point to A[1] and print 43.  
3<sup>rd</sup> printf will print 43 and then pointer will be incremented
12. Static variable is initialized only once and it will retain the value in between the function calls. On the last iteration n & i will become 340 and 550 respectively and so it will return  $340+550 = 890$ .
13. By using circular doubly linked list, last element of string can be accessed in constant ( $\theta(1)$ ) time.
14. According to Watson-Felix model of cost estimation  
Effort =  $5.2 \times (\text{KLOC})^{0.91}$  person-months.  
 $= 5.2 \times (1000)^{0.91} = 2792$  person months
16. (A) & (B) are not context free languages.  
(C) In  $L_1$  number of b's = number of c's, in  $L_2$  number of a's = number of b's  
Hence in  $L_1 \cap L_2$ , number of a's = number of b's = number of c's, which is not context free.
17. (A) When b ends in string, one a should always come because of production  $S \rightarrow bS / aA$  But it is not present in the given string  
(B) d never comes after b immediately  
(D) 'baba' can never be a substring  
(C)  $S \rightarrow bS$   

$S \rightarrow bbS$	$S \rightarrow bS$
$\rightarrow bbbS$	$S \rightarrow bS$
$\rightarrow bbbbS$	$S \rightarrow bS$
$\rightarrow bbbbaA$	$S \rightarrow aA$
$\rightarrow bbbbaccA$	$A \rightarrow cccA$
$\rightarrow bbbbaccccA$	$A \rightarrow ccA$
$\rightarrow bbbbaccccd$	$A \rightarrow d$
18. prefix expression is  $+ - + \underline{ab} * c de$
19. With  $f_2 = \Sigma(6, 7, 2)$ , f will become  $\Sigma(6, 7, 2)$  which is contradiction to the data given in question.
20.  $T_{PDF} \leq T_{CLK}$   
 $\therefore \frac{1}{40n \text{ sec}} \leq T_{CLK}$   
 $\therefore \frac{1}{40n \text{ sec}} \geq F_{CLK}$   
 $\therefore F_{CLK} \leq 25\text{MHz}$   
 So 25MHz is the maximum usable frequency.
21. It causes infinite recursion, so stack overflows.

23. An inherited attribute is one whose value at a node is defined in terms of attributes of the parent and/or sibling of that node.

25.  $f'(x) = 2 \cdot \frac{2}{3} (x-1)^{-1/3}$

$f'(1) = \infty \Rightarrow f(x)$  is not differentiable in  $(0, 2)$

$f(x)$  is continuous  $\forall x \in [0, 2]$  and  $f(0) = f(2)$

26. As  $i$  is declared as static, by default it will be initialized to 0 and  $++**q$  will print 1.

27. 

00000000	xxxxxxxxxxxx	xxxxxxxxxxxx
11101111	xxxxxxxxxxxx	xxxxxxxxxxxx

 } 240, 2 – address instructions
- |          |              |              |
|----------|--------------|--------------|
| 11110000 | 000000000000 | xxxxxxxxxxxx |
| 11110000 | 111111111111 | xxxxxxxxxxxx |
| 11110001 | 000000000000 | xxxxxxxxxxxx |
| 11110001 | 111111111111 | xxxxxxxxxxxx |
| :        |              |              |
| 11111111 | 000000000000 | xxxxxxxxxxxx |
| 11111111 | 111111111111 | xxxxxxxxxxxx |

 }  $2^{12}$  }  $16 * 2^{12}$ , 1 – address instructions

28. 

A	D	C	B
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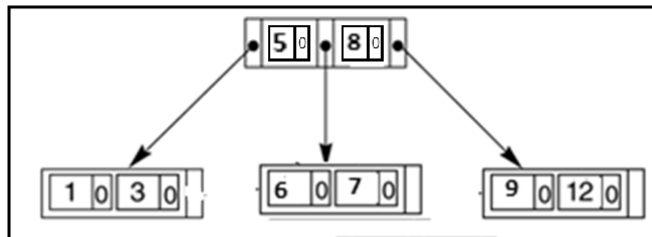
  

0	4	5	7	10
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$$\frac{0+6+3+1}{4} = \frac{10}{4} = 2.5 \text{ ms.}$$

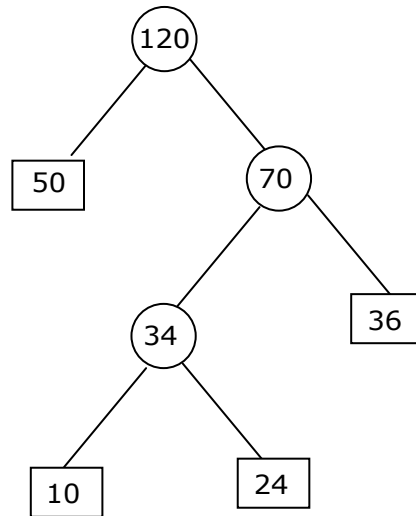
30. AC will be the only candidate key. So  $A \rightarrow BD, C \rightarrow E$  are partial dependencies and will violate 2NF property. Hence those should be taken as separate relations. Hence the 2NF decomposition will be  $R_1(A, B, D)$   $R_2(C, E)$   $R_3(A, C)$ .

- 31.



32.  $\text{loc}(A[7][15]) = 100 + [7*20+15]*1 = 255$

33. Total size =  $120 \times 2 = 240$  million bits



Using Huffman total size =  $50(1) + 36(2) + 10(3) + 24(3)$   
= 224 million bits

So it is 6.66% improvement

34.     for ( $i = 1; i \leq n; i++$ )                   runs  $(n+1)$  times  
          for ( $j = i; j < i^2; j++$ )               runs  $n \times n^2$  times  
          do – something();               runs  $n \times n^2$  times

total time taken is  $(n+1) + (n \times n^2) + (n \times n^2) = \Theta(n^3)$

35.     2 4 1 5 3 is wrong because after popping 4, 1 can't be popped as top of stack is pointing to 3.

36.      $\frac{8 \times 2^{30}}{8}$  byte is transmitted in 1 sec

$\therefore$  In 4 seconds,  $2^{30} \times 4 = 2^{32}$  bytes will be transmitted

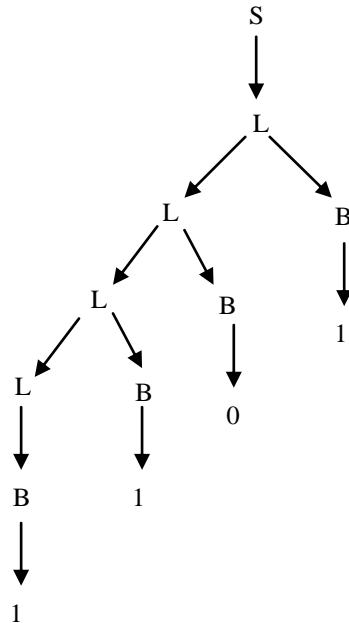
So, sequence number requires 32 bits.

37.     Between B and C, S is half close and at the label D,  $X=4001, Y=9501$ .

38.     Here we have 3 minimal elements 2, 3 and 5 for any two of which, greater lower bound does not exist; hence the given poset is not a meet semi lattice.

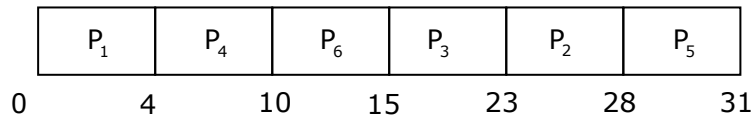
However for every pair of elements in the poset least upper bound exists, hence the given poset is join semi lattice.

39. The parse tree for the input string 1101 is as follows



40. Strings of length 3    001  
 Strings of length 4    0011, 1101  
 Strings of length 5    00011

41. Gantt Chart



∴ Completion Time of P<sub>6</sub> = 15.

42. The sum of the degrees of the regions is equal to twice the number of edges. But each region must have degree  $\geq 4$  because all cycles have length  $\geq 4$ . So we have  $2e \geq 4r$ .

By Euler's formula:  $v - e + r = 2$ , so combining these

$$e - v + 2 \leq \frac{1}{2}e \Rightarrow \boxed{e \leq 2v - 4}$$

43.  $F = A \bar{B} \bar{C} + A B \bar{C} + \bar{A} B \bar{C} + \bar{A} B C$   
           100    110    010    011  
 $F = \sum m(4, 6, 2, 3) = \sum m(2, 3, 4, 6)$

44. 1 and 3 are isomorphic.

45. We have  $AP = PD$  where  $P$  is modal matrix and  $D$  is spectral matrix

$$\Rightarrow D = P^{-1}AP \Rightarrow D^n = P^{-1}A^nP$$

$$\therefore P^{-1}A^2P = D^2$$

$$\text{Here } D = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix} \quad (\because 1, 2, 3 \text{ are eigen values of } A)$$

$$\Rightarrow D^2 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 9 \end{bmatrix}$$

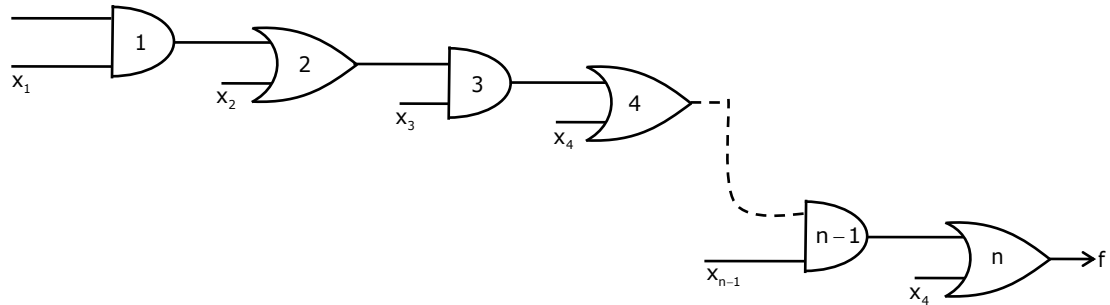
46.  $f(x) = x + \sin x$   
 $f'(x) = 1 + \cos x$

$$\text{Formula in } x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$$

$$x_{n+1} = x_n - \frac{x_n + \sin x_n}{1 + \cos x_n} = \frac{x_n + x_n \cos x_n - x_n - \sin x_n}{1 + \cos x_n} = x_n \cos x_n - \sin x_n$$

$$x_{n+1} = \frac{x_n \cos x_n - \sin x_n}{1 + \cos x_n}$$

47. In terms of Boolean expressions,



$$\% \text{ of } 1 \text{ is } x_0x_1 \Rightarrow \% \text{ of } 2 \text{ is } (x_0x_1 + x_2) \Rightarrow \% \text{ of } 3 \text{ is } (x_0x_1 + x_2)x_3 = x_0x_1x_3 + x_2x_3$$

$$\% \text{ of } 4 \text{ is } x_0x_1x_3 + x_2x_3 + x_4 \Rightarrow \% \text{ of } 5 \text{ is } x_0x_1x_3x_5 = x_2x_3x_5 + x_4x_5$$

$$\% \text{ of } 6 \text{ is } x_0x_1x_3x_5 + x_2x_3x_5 + x_4x_5x_6 \Rightarrow \text{for } n \text{ gates connected as shown, } \% \text{ is}$$

$$x_0x_1x_3 \dots x_{n-1} + x_2x_3x_5 \dots x_{n-1} + x_4x_5x_7 \dots x_{n-1} \dots + x_{n-2}x_{n-1} + x_n$$

48. 1<sup>st</sup> at 60-> 55->42->15->11->5->4->73->90  
5+13+27+4+6+1+69+17=142

49. If the head is moving towards 0,  
60->55->42->15->11->5->4->0->73->90  
So total head movements=5+13+27+4+6+1+4+73+17=150  
If the head is moving towards 99,  
60->73->90->99->55->42->15->11->5->4  
So total head movements=13+17+9+44+13+27+4+6+1=134  
So the diff is 150-134=16

50 & 51. K-map will be

wx \ yz	00	01	11	10
00	0	0	0	1
01	d	0	d	d
11	1	0	d	1
10	1	1	d	d

One of the solutions is

wx \ yz	00	01	11	10
00	0	0	0	1
01	d	0	d	d
11	1	0	d	1
10	1	1	d	d

$$F(w, x, y, z) = wz' + wx' + yz'$$

wx \ yz	00	01	11	10
00	0	0	0	1
01	d	0	d	d
11	1	0	d	1
10	1	1	d	d

$$F(w, x, y, z) = XZ' + YZ' + WX'$$

These are two possible minimized solutions, where prime implicants are  $wz', wx', yz', xz'$  and essential prime implicants are  $wx', yz'$ .

52. Recording area = outer area - inner area

$$= \pi \left( \frac{7}{2} \right)^2 - \pi \left( \frac{4}{2} \right)^2 = 25.905 \text{ square inch}$$

Given density is  $40 \times 10^6$  bits/square inch,

So, disk capacity =  $25.905 \times 40 \times 10^6 = 1036.2 \times 10^6$  bits

Total radial spacing = outer diameter - inner diameter =  $7 - 4 = 3$  inch

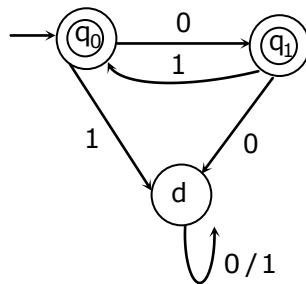
Number of tracks =  $3 \times 2000 = 6000$  tracks

$$\text{Average density/track} = \frac{1036.2 \times 10^6}{6000} = 172.7 \text{ kb / track}$$

53. Data transfer rate =  $\frac{172.7}{8} \times \frac{3600}{60} = 1.29 \text{ MBps}$

54. 010101-----; prefixes:  $\in / 0/01/010/0101.....$ ; Regular expression:  $0(10)^* + (01)^*$

55. DFA is



57. A, B, C are outdoor games  
D is Indoor game

59. Integration is a part of Mathematics  
Zoology is a part of Biology

60.  $(1 + 2 + 3 + ..... + 71 + 72 + 73 + .....100) - (1 + 2 + 3 + ....70)$   
 $= \frac{100}{2} \times (1 + 100) - \frac{70}{2} \times (1 + 70)$   
 $= (50 \times 101) - (35 \times 71) \Rightarrow (5050 - 2485) = 2565$



61. (A) Universal  
(B) Specified  
(C) Universal  
(D) Universal
62. Ratio of days taken by A and B = 1:3  
Time difference = 3-1 = 2 days  
While B takes 3 days & A takes 1 day.  
If difference of time is 2 days, B takes 3 days  
If difference of time is 60 days  $\frac{3}{2} \times 60 = 90$  days  
(A + B)'s one day's work =  $\frac{1}{30} + \frac{2}{90} = \frac{2}{45}$   
A + B together do work in  $\frac{45}{2} = 22.5$  days
63. Percentage of money spent on Tennis =  
 $\left( \frac{45}{360} \times 100 \right) \% = 12\frac{1}{2} \%$
64. Required numbers are 16, 24, 32, 40 ,....., 96  
 $a = 16, d = 8 \text{ \& } \ell = 96$   
Then  $t_n = 96$   
 $\Rightarrow a + (n-1)d = 96$   
 $16 + (n-1)8 = 96 \Rightarrow (n-1)8 = 80$   
 $n-1 = 10 \therefore n = 11$
65. When Vowels EAI are always together, they are supposed to be one Letter. Now we have to arrange LNDG (EAI)  
Now 5 Letters can be arranged in  $5! = 120$  ways  
(EAI) 3 Letters can be arranged in  $3! = 6$  ways  
Total ways =  $120 \times 6 = 720$  ways