Solutions

1. Ans. B.
The man who is now Municipal Commissioner worked as a security guard at the university.

2. Ans. A.
'cope with' means put up with

3. Ans. C.
'mock, deride and jeer' are synonyms which means mockery. Therefore, the odd one is 'praise'

4. Ans. D.
In first three options, Sequence of 5 letters are formed in the same way. 2nd position, 4th position, 1st position, 3rd position, and 5th position is sequence order of each option. But in option 'D' N and M are present instead of M and N so, option 'D' is odd one from the group.

5. Ans. B.
Given $\alpha\beta = 4$

$$\frac{\alpha^n + \beta^n}{\alpha^{-n} + \beta^{-n}} = \frac{\alpha^n + \beta^n}{\frac{1}{\alpha^n} + \frac{1}{\beta^n}}$$

$$= \frac{\left(\alpha^n + \beta^n\right)\alpha^n\beta^n}{\left(\alpha^n + \beta^n\right)} = (\alpha\beta)^n = 4^n$$

6. Ans. A.
$F \rightarrow$ Facebook, $W \rightarrow$ WhatsApp, $E \rightarrow$ Total faculties given

$n(E) = 150, n(\overline{F \cup W}) = 30$

$n(F \cup W) = n(E) - N(\overline{F \cup W}) = 150 - 30$

$n(F \cup W) = 120$

$n(f \cup w) = n(f) + [n(w) - n(F \cap w)]$

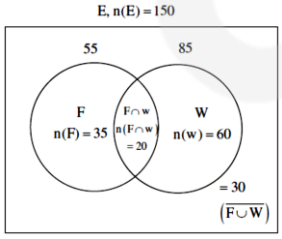
$120 = n(F) + 85$

$n(F) = 120 - 85 = 35$

$55 = n(F) + n(F \cap W)$

$n(F \cap w) = 55 - n(F) = 55 - 35 = 20$

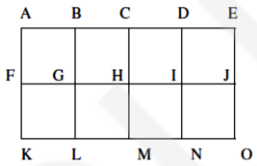
$n(w) = 85 - 20 = 65$



7. Ans. D.
"Many believes that the internet itself is unintended consequence of the original invention. So statement (ii) does not follow from the passage."
The author has no where said that the computers are bad, authoring is talking about the way computers are being used today and the author questions this way. So, statement (i) does not follow.

8. Ans. D.
Statement (i) is not true because Ooty is a hill station due Ooty has two lakes statement (ii) is also not true, because in given statements, for hill station one lake is compulsory but not mentioned about number of lakes.

9. Ans. C.
1: (AEOK)
2: (AEJF), (FJOK)
4: (ABLK), (BCML), (CDNM), (DEON)
2: ACMK, ADNK 2:ECMD,EBLO 2:ACHF,ADIF
2: ECHJ, EBGJ 2: FHMK,FINK 2: JHMD, JGLO
1: BDNL 2: BDIG,GINL
8: ABGF, BCHJ, CDIH, EDI, FGLK, GHML, HINM
Total=1+2+4+2+2+2+2+2+2+1+2+8=30



10. Ans. C.
Substituting the coordinates of the straight lines and checking all the four options given, we get the correct option as C which is $f(x) = 2 - |x - 1|$

$f(x) = 2 - |x - 1|$
Put $x = 3$, $f(x) = 2 - |3 - 1| = 2 - 2 = 0$

11. Ans. D.
(P->Q), P will infer the following:
1) It implies Q.
2) NOW Q implies P OR Q
3) P IS TRUE so it implies P OR ~Q
4) P->Q is true, Q is true and it implies TRUE.

12. Ans. B.
If $f(x)$ is polynomial of degree n,

then $g(x) = f'(x)$ is polynomial of degree n,

$\Rightarrow f(x) + f(-x)$ is polynomial of degree n,

But given $f(x) + f(-x)$ is polynomial of degree 10.

$\therefore n = 10.$

$\Rightarrow g(x)$ is polynomial of 9.

$\therefore g(x) - g(-x)$ is polynomial of degree 9.

13. Ans. D.
Any planar graph is four-colourable.

14. Ans. C.
I is not correct
$x + y + z = 1$
$x + y + z = 0$
Has no solution, when no of equations is less than no of variables.
II is not correct
Eg:

$x - 2y = 2$
$2x + 8y = 16$
$x + y = 5$
Has a solution $(x = 4, y = 1)$.
III is correct
Eg: x + y = 4,
x + 2y = 0
Has solutions $(x = 6, y = -2)$

15. Ans. C.
E_1 –event of selecting type-I bulb
E_2-event of selecting type-II bulb
A-Event of selecting a bulb lasts more than 100 hours
Given $P(E_1) = 0.5, P(E_2) = 0.5$
$P(A/E_1) = 0.7, P(A/E_2) = 0.4$
Required probability,
$P(A) = P(E_1)P(A/E_1) + P(E_2)P(A/E_2)$
$= 0.5 \times 0.7 + 0.5 \times 0.4$
$= 0.55$

16. Ans. A.
Given that 1,2,4 are eigen values of A>
$\Rightarrow |A| = 8$ and $|A^{-1}| = \frac{1}{|A|} = \frac{1}{8}$
Now, $\left|(A^{-1})^{+}\right| = |A^{-1}|^{T} = |A^{-1}| = \frac{1}{8} = 0.125$

17. Ans. A.
Maximum delay we could get when input at B will be -1, i.e. add "00000001" with "11111111" and would get Maximum delay.

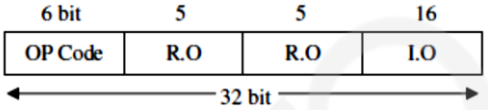
18. Ans. C.

x1	x2	x3	x4	x1⊕x2⊕x3⊕x4
0	0	0	0	0 (*)
0	0	0	1	1
0	0	1	0	1
0	0	1	1	0 (*)
0	1	0	0	1
0	1	0	1	0 (*)
0	1	1	0	0 (*)
0	1	1	1	1
1	0	0	0	1
1	0	0	1	0 (*)
1	0	1	0	0 (*)
1	0	1	1	1
1	1	0	0	0 (*)
1	1	0	1	1
1	1	1	0	1
1	1	1	1	0 (*)

Consider the values for x_1, x_2, x_3, x_4 only the last column is 0. Now this can satisfy only $\bar{x}_1 \oplus \bar{x}_3 = \bar{x}_2 \oplus \bar{x}_4$.

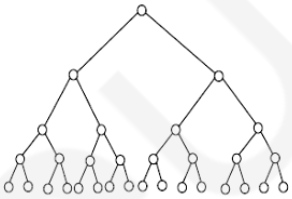
19. Ans. A.
$X = 2^{16-1}$ to $+2^{16-1} - 1$
$Y = -2^{16-1}$ to $+2^{16-1} - 1$
So $[X - Y = 1]$

20. Ans. D.



So 16 bit for immediate operand field

21. Ans. C.



Maximum value of n, when vertex t is at a distance 4 is: 31 (last leaf node in the above tree).

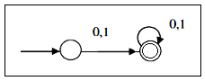
22. Ans. C.
I's address and j's value are passed to the function of f. f modifies i value to 20. j value remains same (as its value is passed not the reference).
$\therefore i + j = 30$ will be printed

23. Ans. D.
As input is already sorted quick sort runs in $\theta(n^2)$ & insertion sort runs in $\theta(n)$.

24. Ans. C.
Floyd - warshall algorithm follows dynamic programming paradigm.

25. Ans. C.
Delete: θ(1) time as pointer is directly given.
Insert: O(N) time, we may need to insert at the end of the sorted list.
Find: θ(N) time. List we need to search sequentially.
Decrease key: θ(N) time, pointer is directly given, delete then insert.
All operations when put together:
θ(N) * θ(1) + O(log N) * O(N) + O(log N) * θ(N) + θ(N) * θ(N)
This is $O(N^2)$.

26. Ans. B.



27. Ans. C.
$L_1 = \{a^n b^n / n \geq 1\}$ CFL but not regular
$L_2 = (ab)^{+}$ regular

28. Ans. D.
$L_1 \cup \bar{L}_2$ is recursive but not CFL as CFL's are not closed under complementation.

29. Ans. A.
(P) Lexical analysis - Regular expressions
(Q) Top down parsing - Leftmost derivation
(R) Semantic analysis - Type checking
(S) Runtime environments - Activation records

30. Ans. D.
If page fault rate increases even when the number of allocated frames increases, then that situation is called "Belady's Anamoly". It was happening with only FIFO among the given options.

31. Ans. A.
In both B& B+ trees all the leaf nodes will be at same level will be at same level.

32. Ans. A.
Topological order guarantees all transactions are present in the non-conflict order that can guaranteed to yield a serial schedule.

33. Ans. A.
In digital signature generation process using senders private key we can encrypt the
message and in verification process using senders public key we can decrypt the message.

34. Ans. D.
The concept of binary exponential backoff algorithm The exponential backoff mechanism reduces the probability of collision on retransmissions.

35. Ans. C.
When a browser requests a webpage from a remote server then that requests (URL address) will be mapped to IP address using DNS, then TCP synchronization takes place after that HTTP verify whether it is existed in the web server or not.

36. Ans. B.
It is reflexive as every ordered pair is related to itself (a,b) R (a,b) since $a \le a$ or $b \le b$
It is not transitive as (2,4)R(3,2) & (3,2) R(1,3) but (2,4) R (1,3)

37. Ans. D.
For every x , p or q is true. It can not imply that Either for every x, p is true OR for every x, q is true. So last option is wrong.

38. Ans. B.
We can solve the given problems by taking an undirected graph with 23 vertices and 9 of these with degree 3. Assume that if two compounds react with each other, then there exists an edge between the vertices. Given that 9 vertices of degree 3 (odd).
By degree theorem atleast one of the remaining vertices must have odd degree
($\because$ No. of vertices of odd degree is always even).

39. Ans. D.
By Fermat's theorem, If p is a prime number and p is not a divisor of a, then $a^{p-1} = 1 \pmod p$ Here, 17 is a prime number and 17 is not a divisor of 13.
$\therefore 13^{16} = 1 \pmod p$
$13^{99} = (13)^{96}.(13)^3 = (13^{16})^6 .2197 = 1^6 .2197 \pmod{17}$
$\therefore 13^{99} \pmod{17} = 2197 \pmod{17} = 4$
(The remainder obtained by dividing 2197 with 17)

40. Ans. B.
Two unit says we have to pipelines with same functionality. we can start both of them at same time. Lets distribute i's values 1 to 5 for pipeline1, and 6 to 10 for pipeline2.
Total Time required = (3+5)+(4*5)=28

41. Ans. C.
Number of register = 64

Number of bits to address register = $\lceil log_2 64 \rceil$ = 6 bits

Number of Instruction = 12

Opcode size = $\lceil log_2 12 \rceil$ = 4

Opcode 4	reg1 6	reg2 6	reg2 6	Immediate 12

Total bits per instruction = 34

Total bytes per instruction= 4.25

Due to byte alignment , Total bytes per instruction = 5

Total instruction = 100

Total size = Number of instruction × Size of instruction
= 100× 5= 500 bytes

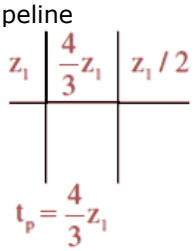
42. Ans. B.

Tag	Set	Offset

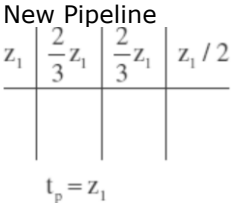
40 bit

Tag bits = $40 - (19 - 3) = 24$ bits

43. Ans. D.
Pipeline



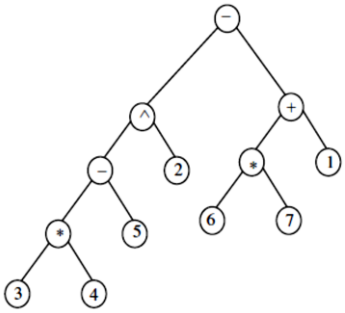
New Pipeline



44. Ans. C.
n^{th} smallest element will be present within 'n' levels of min heap

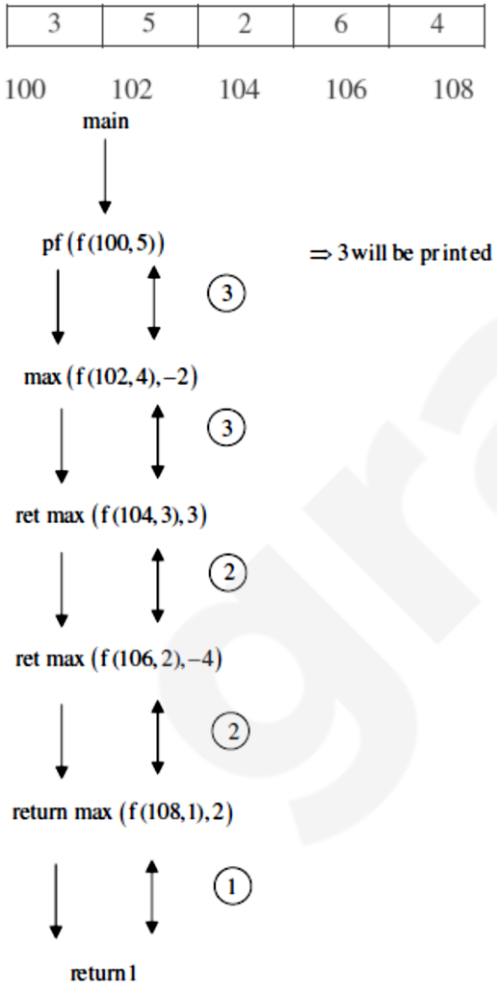
45. Ans. C.
When b=0, at the start of the loop X^Y value should be computed correctly in res. So it matches only X^Y = res $*$ a^b.

46. Ans. C.
Given is the post fix expression the expression tree given below.



New-order of above expression tree is
$-+1*76\wedge 2-5*43$

47. Ans. C.
Assume base address of array a is 100.

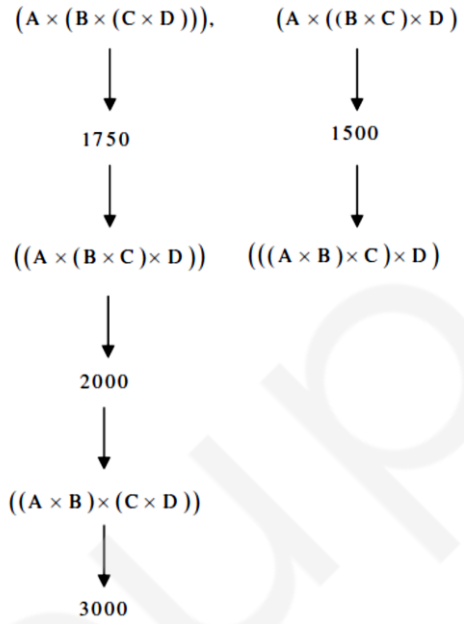


48. Ans. B.

No. of ways of multiplying the chain of matrices $= \frac{^{2m}C_m}{m+1}$

Where m = no. of multiplications (not matrices)

$\Rightarrow \frac{^6C_3}{3+1} = 5$



49. Ans. B.
A(n) = 5 A(n/2) + O(1)
Case1: a > b^k

$n^{\log_2 5}$

So, the value of α=2.32

50. Ans. D.
$2^6 = 64$

51. Ans. B.
Most efficient algorithm to set the twin pointer in each entry in each adjacency list is as follows:
Applying BFS on Undirected graph give you twin pointer. Visit every vertex level-wise for every vertex fill adjacent vertex in the adjacency list. BFS take O(m+n) time.

52. Ans. B.
II is false, if all the states of DFA are accepting states then $L = \Sigma^*$
II is true because we can have regular language A = {} [Empty language] which satisfies the condition.

53. Ans. B.
$L_1 \rightarrow$ we can rush a's & b's and for each c we can pop one item from stack, one c's are over stack should be empty.
$\therefore L_1 =$ CFL
For L_2, we can't build PDA [a's & b's should be equal & C' should be double of that count]

54. Ans. C.
L1 and L2 are recursive. For both of them it is possible to construct halting TM. But L3 is not recursively enumerable hence it is also not recursive. L3 can not accepted by any TM.

55. Ans. B.
C & D are having indirect left recursion.

56. Ans. A.
Both G1 & G2 generates the string: int a[10] [3];
You may use LMD, RMD or parse tree to derive the string.

57. Ans. C.

Process	Arrival Time	Burst Time	CT	TAT
P1	0	10	20	20
P2	3	6	10	7
P3	7	1	8	1
P4	8	3	13	5

Average TAT = (20+ 7+ 1 + 5)/4 =8.25

58. Ans. C.
The given solution for two process synchronization using "Turn" variable, satisfies the only mutual exclusion and bounded waiting but progress is violated.

59. Ans. A.
$S = -20 + 12 = -8$
∴ The largest initial value of S for which atleast one P(S) operation remains blocked is 7.

60. Ans. A.
Look aside Cache Latency = 1ms
Main Memory Latency = 10ms
(1) Assume cache size is 20 MB:
Miss rate = 60% ,
Hit rate = 40%
Average =0.4 (1) +0.6 (10) = 0.4 +6 = 6.4 ms > 6 ms
(2) Assume cache size is 30 MB:
Miss rate = 40% ,
Hit rate = 60%
Average = 0.6 (1) + 0.4 (10) = 0.6 + 4 = 4.6 ms < 6ms
So Required smallest cache size is 30 MB to ensure an average read latency of less than 6ms.

61. Ans. C.
No transaction is reading the data item written by some other transaction. So the given schedule is cascadeless.

62. Ans. B.
Two names Bikaner & churu will be selected.

63. Ans. B.
$B = 2 \times 10^6$ bps
$T_p = 40\,\mu s$
$L = ?$
$L = 2 \times T_p \times B \Rightarrow L = 2 \times 40 \times 10^{-6} \times 20 \times 10^6$
$= 1600 \text{ bits} (\text{or}) 200 \text{ bytes}$
$L = 200 \text{ bytes}$

64. Ans. B.
In collision avoidance, we use RTS-CTS mechanism but not in collision detection, only statement II is false.

65. Ans. D.
$B = 128$ kbps
$T_p = 150$ ms
$L = 1$KB
$\eta = 100\% \Rightarrow 1 = \frac{w}{1+2a}$
$T_x = \frac{L}{B} = \frac{8 \times 10^3}{128 \times 10^3} = 62.5 \text{ms}$
$a = \frac{T_p}{T_x} = \frac{150 \text{ms}}{62.5 \text{ms}} = 2.4$
$\Rightarrow w = 1 + 2a \Rightarrow \frac{2^n}{2} = 1 + 2(2.4)$
$\Rightarrow \frac{2^n}{2} = 5.8 \Rightarrow 2^n = 11.65$
$\Rightarrow 2^n = 11.6 \approx 12 \approx 2^4$
$n = 4$

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