Branch: Computer Science and Information Technology MOCK-A- SOLUTIONS

01. Ans: (C)

Sol: Required probability

$= P(\overline{A} \cap \overline{B})$

$= P(\overline{A \cup B})$

$= 1 - P(A \cup B)$

$= 1 - \{P(A) + P(B) - P(A \cap B)\}$

$= 1 - \{0.25 + 0.5 - 0.14\}$

$= 0.39$

02. Ans: (B)

Sol: $r = \phi$

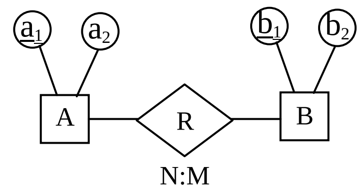
$r^* = [\phi]^* = \varepsilon$

03. Ans: (D)

Sol: Operator precedence parser is an efficient S-R parser to delimit the handles.

04. Ans: (C)

Sol:



The above ER model is represented as the following relations

A($\underline{\text{a1}}$, a2)

B ($\underline{\text{b1}}$, b2)

R($\underline{a_1 b_1}$) where a_1, b_1 are foreign keys of A and B.

05. Ans: 1010

Sol:

```
                      1 0 0 1 0 1 0
            ______________________
  1 1 0 0 1 | 1 1 0 1 0 1 1 0 0 0 0
              1 1 0 0 1
              ---------
                0 0 1 1 1
                0 0 0 0 0
                ---------
                  0 1 1 1 1
                  0 0 0 0 0
                  ---------
                    1 1 1 1 0
                    1 1 0 0 1
                    ---------
                      0 1 1 1 0
                      0 0 0 0 0
                      ---------
                        1 1 1 0 0
                        1 1 0 0 1
                        ---------
                          0 1 0 1 0
                          0 0 0 0 0
                          ---------
                            1 0 1 0  remainder
```

∴ Frame Checksum is 1 0 1 0.

06. Ans: 2525

Sol: Given that, E(X) = 50 and $\sigma = 5$

$\sigma^2 = E(X^2) - \{E(X)\}^2$

$E(X^2) = \{E(X)\}^2 + \sigma^2$

$= 2500 + 25 = 2525$

07. Ans: (D)

Sol: Along with all 3, message passing is also a mean of inter-process communication

08. Ans: (A)

Sol: Each edge = (v_i, v_j)

Each edge = $(e_{ij}) = (v_i, v_j)$

For degree of v_i

e_{ij} is counted once

For degree of v_j

e_{ij} is counted again

⇒ For counting degree of a vertex, each edge is counted twice across two vertices.

⇒ $\sum$ degree of vertices

= 2 (number of edges)

09. Ans: 10

10. Ans: (D)

Sol: If A = 0, B = 0, C = 1 then output = F = 1

11. Ans: 256

Sol: MAR size = 36 bits

MDR size = 32 bits

Hence number of addressable words = 2^{36}

and word size = 32 bits

$\therefore$ size of the RAM = $2^{36} \times 32$ bits

$= 2^{36} \times 4$ bytes = 64 G × 4 Bytes

= 256 G bytes.

12. Ans: (B)

Sol: The LALR(1) parsers for a grammar G can have SR conflict if and only if the LR(1) Parser for G has SR conflict

13. Ans: (C)

Sol: R_1 is not a function, because the element d of A has no image in B

R_2 is not a surjection, because the element 3 in B is not mapped by any element of A.

R_3 is a surjection, because each element of B is mapped by atleast one element of A.

R_4 is not a function, because the element a in A is mapped with two elements in B.

14. Ans: 64

Sol: Transmission delay = 2 × Propagation delay

$$\frac{L}{B} = RTT$$

$L = RTT \times B = 51.2\times10^{-6}\times 10^{6}$

$= 512 \text{ bits} = \frac{512}{8} = 64 \text{ bytes}$

15. Ans: (B)

Sol: Minimum page faults occur when the number of frames allocated to process is at least the number of unique pages.

16. Ans: (D)

Sol: Value is a local variable. The fun value will not effect the value in main.

17. Ans: (C)

Sol: we have, $a = a^1$

$\Rightarrow a \; R \; a \;\; \forall \; a \in N$

$\Rightarrow$ R is reflexive on N

Let $a \; R \; b$ and $b \; R \; a$

$\Rightarrow a = b^{K_1}$ and $b = a^{K_2}$ .... (1)

$\Rightarrow b = \left(b^{K_1}\right)^{K_2} = b^{K_1 K_2}$ (from (1))

$\Rightarrow k_1 k_2 = 1$

$\Rightarrow k_1 = 1$ and $k_2 = 1$

$\Rightarrow a = b$ from (1)

$\therefore$ R is antisymmetric.

Let $a \; R \; b$ and $b \; R \; c$

$\Rightarrow a = b^{K_1}$ and $b = c^{K_2}$ .... (2)

$\Rightarrow a = \left(c^{K_2}\right)^{K_1} = c^{K_1 K_2}$

$\Rightarrow a = c^{K_3}$ where $k_3 = k_1 . k_2$

$\Rightarrow a \; R \; c$

$\therefore$ R is transitive

R is not symmetric. For example $8 \; R \; 2$ but $2 \not R \; 8$

R is not a total order. For example $2 \not R \; 3$ and $3 \not R \; 2$

$\therefore$ Only option (C) is correct.

18. Ans: (D)

Sol: $(45)_{16} = (69)_{10}$

So $(45)_{10} - (45)_{16} = (45)_{10} - (69)_{10}$

$= (-24)_{10}$

Now $(24)_{10} = 1\ 1\ 0\ 0\ 0$

$+(24)_{10} = 0\ 1\ 1\ 0\ 0\ 0$

$+(24)_{10}$ in 8 bits = 0 0 0 1 1 0 0 0

↓ 2's complement

$(-24)_{10}$ in 8 bits = 1 1 1 0 1 0 0 0.

19. Ans: (A)

Sol: $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 3 \\ -3 & -10 & 2 \end{bmatrix}$

Applying $R_2 \to (-2R_1 + R_2)$,

$R_3 \to (3R_1 + R_3)$

$A \sim \begin{bmatrix} 1 & 2 & 1 \\ 0 & -1 & 1 \\ 0 & -4 & 5 \end{bmatrix}$

Applying $R_3 \to (-4R_2 + R_3)$

$A \sim \begin{bmatrix} 1 & 2 & 1 \\ 0 & -1 & 1 \\ 0 & 0 & 1 \end{bmatrix} = U$

and $L = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ -3 & 4 & 1 \end{bmatrix}$

The entries 2, –3, 4 in L are the negatives of the multipliers –2, 3, –4 respectively in the above row operation.

20. Ans: (D)

Sol: AB, CB, F.

B→D is a partial delay. The 2NF decompose relations are R_1(ABCF), R_2(BDE).

21. Ans: (C)

Sol: Let number of columns = x

Number of Rows = 2x

Memory space = Number of Rows × Number of columns

2x × x = 2048 bits

$x^2 = 1024$, $x = 32$

Hence number of Rows = 64

size of the Row Address Decoder is 8 × 64

22. Ans: (B)

Sol: L_1 is DCFL

L_2 is CSL

L_3 is REL but not Recursive

$(L_1 - L_2) \cap L_3 = (L_1 \cap L_2^1) \cap L_3$

= (DCFL ∩ CSL) ∩ REL

↓

= (CSL ∩ CSL) ∩ REL

↓

= REL ∩ REL

= REL

23. Ans: (A)

Sol: $\left(X.X + Y.\overline{Y}\right) + \left(\overline{\overline{X} + X\overline{Y}}\right)$

$= \left(X + 0\right) + \left(\overline{\overline{X} + \overline{Y}}\right)$

$\left[\because A + \overline{A}B = A + B\right]$

$= X + \overline{\overline{X}}.\overline{\overline{Y}} = X + XY = X\left[1 + Y\right] = X$

24. Ans: (C)

Sol: Kruskal's algorithm considers edges and builds minimum cost forests. It needs to maintain a min-heap. Since each edge is examined and min-heap maintenance is performed. The complexity is $O(|E| \log |E|)$, where $\log |E|$ term denotes cost of operating the min-heap.

25. Ans: (A)

Sol: The given formula is equivalent to the following argument

1. p	premise
2. $p \rightarrow q$	premise
3. $s \vee r$	premise
4. $r \rightarrow \sim q$	premise
$\therefore (s \vee t)$	conclusion
5. q	(1), (2), modus ponens
6. $\sim r$	(4), (5), modus tollens
7. s	(3), (6), Disjunctive syllogism
8. $(s \vee t)$	(7), Addition

$\therefore$ The argument is valid

Hence, the given formula is a tautology.

26. Ans: (C)

Sol:

18. 250. 31 . 14

AND 255. 240. 0 . 0

18. 240. 0 . 0

250 → 1111 1010

240 → 1111 0000

1111 0000

27. Ans: (A)

Sol: The macro call square(3) will be substituted by 3*3, so the expression becomes i = 81/3*3. Since / and * has equal priority the expression will be evaluated as (81/3)*3 i.e. 27*3 = 81.

28. Ans: 32

Sol: Number of leaf nodes = Number of internal nodes with 2 children + 1

= 12 + 1 = 13

Total number of nodes = Number of internal nodes + Number of leaf nodes

= 12 + 7 + 13 = 32

29. Ans: 5

Sol: $27 > 5 *(3 - 1) + n*(4 - 1)$

$27 > 10 + 3n$

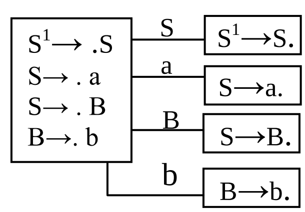
$17 > 3n$

$5.67 > n$

$n = 5$

30. Ans: (A)

Sol:



31. Ans: 14

Sol: The corresponding generating function is $g(x) = (x^4 + x^5 + x^6 + x^7 + x^8)(x^2 + x^3 + x^4 + x^5 + x^6)(x^2 + x^3 + x^4 + x^5)$

The required number is the coefficient of x^{12} which is 14.

32. Ans: (D)

Sol:

T_1	T_2	T_3	T_4
R(A)			
			R(B)
		W(A)	
	W(B)		
			W(C)
			Commit
		W(C)	
W(A)			
Commit			
	R(D)		
		W(D)	
		Rollback	

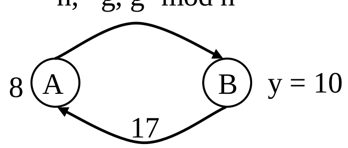
The schedule is both recoverable and cascade-less.

33. Ans: 4

Sol:

47, 3, 17

n, g, g^x mod n



3^{10} mod 47 = 17

Session key = 17^8 mod 47 = 4

34. Ans: (B)

Sol: The number of serial schedules are 2

The number of concurrent schedules are $= \frac{(5+3)!}{5!*3!} = 56$

Then, the total number of non serial schedules are

= (number of concurrent schedules – number of serial schedules)

= 56 – 2 = 54

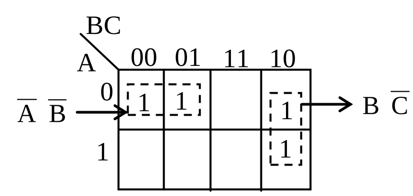
35. Ans : (D)

Sol: The brute-force approach will generate every possible sub-set of the N integer set and finds the sub-set with the largest sum. Since the number of possible sub-sets of N integers is 2^N , the complexity of this algorithm is $O(2^N)$.

36. Ans: (C)

Sol: $Y = \sum m(0, 1, 2, 6)$

simplify using K-map



$Y = \overline{A}\,\overline{B} + B\overline{C}$

Output = Z = $\overline{C} + Y$

$Z = \overline{\overline{C} + \overline{A}\,\overline{B} + B\overline{C}}$

$Z = \overline{C}[1+B] + \overline{A}\,\overline{B}$

$Z = \overline{C} + \overline{A}\,\overline{B} \rightarrow$ Option (C).

37. Ans: (B)

Sol: L is accepted by DFA without any dead state. If we make all the states as final, then we get DFA in which all the states are final that accepts Σ^*

$\therefore \Sigma^* = (0+1)^* = (0+1^*)^*$

38. Ans: 3

Sol: The characteristic equation is

$|A - \lambda I| = 0$

$$\Rightarrow \begin{vmatrix} 1-\lambda & 1 & 1 \\ 1 & 1-\lambda & 1 \\ 1 & 1 & 1-\lambda \end{vmatrix} = 0$$

$C_1 \rightarrow C_1 + C_2 + C_3$

$$\Rightarrow \begin{vmatrix} 3-\lambda & 1 & 1 \\ 3-\lambda & 1-\lambda & 1 \\ 3-\lambda & 1 & 1-\lambda \end{vmatrix} = 0$$

$R_2 - R_1, R_3 - R_1$

$$\Rightarrow \begin{vmatrix} 3-\lambda & 1 & 1 \\ 0 & -\lambda & 0 \\ 0 & 0 & -\lambda \end{vmatrix} = 0$$

$\Rightarrow \lambda = 0, 0, 3$

The eigen vector for $\lambda = 0$ are given by

$[A - I]\, X = 0$

$\Rightarrow x + y + z = 0$

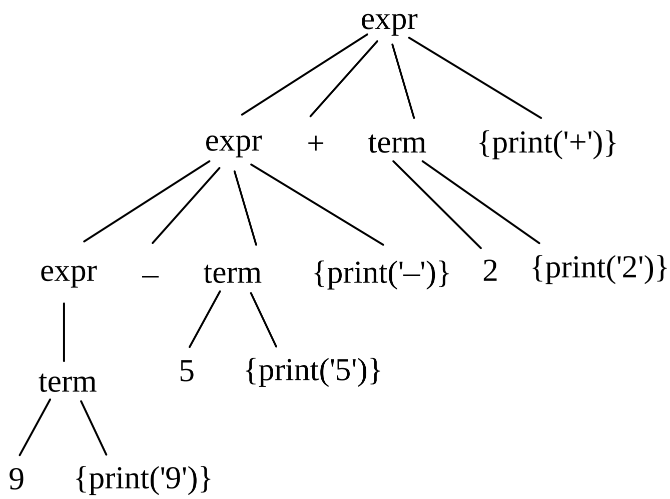
$\Rightarrow$ There are two linearly independent solutions for $\lambda = 0$

For $\lambda = 3$, there exists only one independent eigen vector

$\therefore$ Number of linearly independent eigen vectors of a = 3.

39. Ans: (B)

Sol: Example: 9 – 5 + 2



$\therefore$ 95 – 2 +

$\therefore$ It is postfix notation.

40. Ans: (D)

Sol:

S_1		
Name	**Age**	**Rank**
A	16	4
B	17	3
C	15	1
D	21	6
E	22	7

S_2		
Name	**Age**	**Rank**
A	16	4
B	17	3
C	15	1
D	21	6
E	22	7

When the query executes on the above table of data returns A,D,E in the output, those are students with higher rank than all students with age <18.

41. Ans: (A)

42. Ans: (B)

Sol: P_1 executes 'while' and P_2 executes 'while'. Then by executing assignment statement, both P_1 and P_2 can enter into critical section.

43. **Ans: (B)**

Sol: x = 20

fun(6, &x) ⇒ fun(n, *fp)

fun(5, &x) ⇒ f = t + *fp, *fp = t

t = fun(4, fp), f = t + *fp, *fp =t

fun(4,fp) ⇒ t = fun(3, fp),

f = t + *fp, *fp = t

fun(3, fp) ⇒ t = fun(2, fp),

f = t + *fp, *fp = t

fun(2, fp) ⇒ t = fun(1, fp),

f = t + *fp, *fp = t

fun(1, fp) ⇒ *fp = 1

⇒ x =1 return 1 ⇒ t =1

fun(2, fp) ⇒ t =1,

f = 1 + * fp = 1 + 1 = 2,

*fp =1 return f(2)

fun(3, fp) ⇒ t = 2,

f = 2 + * fp = 2 + 1 = 3,

*fp = 2 return 3

fun(4, fp) ⇒ t = 3,

f = 3 +2 = 5, *fp = 3,

return 5

fun(5, fp) ⇒ t = 5,

f = 5 + 3 = 8, *fp = 5,

return 8

fun(6, fp) ⇒ t = 8,

f = 8 + 5 = 13, *fp = 8,

return 13

44. Ans: (B)

Sol: Given

$$D_0 = \overline{Q_0 + Q_1} = \overline{Q}_0 . \overline{Q}_1$$

$D_1 = Q_0$

D Flip-Flop Table

D	**Q_{n+1}**
0	0
1	1

Clock	**D_1**	**D_0**	**Q_1**	**Q_0**
0	-	-	0	0
1	0	1	0	1
2	1	0	1	0
3	0	0	0	0
4	0	1	0	1
5	1	0	1	0

Hence (B) is correct.

45. Ans: 410

Sol: While transferring a block from 2^{nd} level to 1^{st} level memory only 4 words transfer (equal to 1^{st} level block size) takes place, then a word is transferred to CPU.

Hence total time = (4 × 100) + 10

= 410 ns.

46. Ans: 6

Sol: G is CFG

$L = \{0^n 1^n \mid n \geq 1\}$

$W \in L$

$W = 000111, |W| = 6$

Number of steps in GNF to generate a string of length 6 is 6

47. Ans: (B)

Sol: $\underset{x \to 0}{\text{Lt}} \dfrac{x(1 - a\cos x) + b\sin x}{x^3} = \dfrac{1}{3}$

$\Rightarrow \dfrac{1}{3} = \underset{x \to 0}{\text{Lt}} \dfrac{(1 - a\cos x) + a\,x\sin x + b\cos x}{3x^2}$

(Applying L-Hospital's rule) .... (1)

$\Rightarrow (1 - a + b) = 0$ .... (2)

$(\because \text{Limiting value is finite})$

Again by applying L-Hospitals rule two times,

$\dfrac{1}{3} = \underset{x \to 0}{\text{Lt}} \dfrac{a\sin x + a(\sin x + x\cos x) - b\sin x}{6x}$

$=$

$\underset{x \to 0}{\text{Lt}} \dfrac{a\cos x + a(\cos x + x\sin x + \cos x) - b\sin x}{6}$

$= \underset{x \to 0}{\text{Lt}} \dfrac{3a\cos x - a\,x\sin x - b\cos x}{6}$

$= \dfrac{3a - b}{6}$

$\therefore (3a - b) = 2$ .... (3)

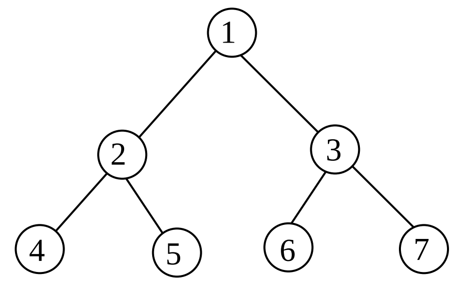
Solving (2) & (3) for a, b; we get,

$a = \dfrac{1}{2}$ & $b = \dfrac{-1}{2}$

48. Ans: (B)

Sol: Any intermediate node in the tree is an articulation point.

Example: N = 7



1, 2, 3 are articulation points

$2^h - 1 = 2^2 - 1 = 4 - 1 = 3$

49. Ans: 452

Sol: The total header length is the sum of the IP and ICMP headers:

Total header length = 20 + 8 = 28 bytes

Thus, the length of the ICMP data field is

ICMP data field = Ethernet length – IP and ICMP headers

= 480 – 28

= 452 bytes

50. Ans: 45

51. Ans: 17

Sol: Key size, k = 24B

Block size, B = 512B

Index pointer size, b = 6B

Let the number of pointers = n

$(n - 1)\,k + nb = B$

$(n - 1)\,24 + 6n = 512$

$24n - 24 + 6n = 512$

$n = \dfrac{512 + 24}{30} = 17$

52. Ans: (A)

Sol: fork() returns 0 in child process and process ID of child process in parent process.

In Child (x), a = a – 5

In Parent (u), a = a + 5;

Therefore u = x + 10.

The physical addresses of 'a' in parent and child must be different. But our program accesses virtual addresses (assuming we are running on an OS that uses virtual memory). The child process gets an exact copy of parent process and virtual address of 'a' doesn't change in child process. Therefore, we get same addresses in both parent and child.

53. Ans: (D)

Sol: (A) R.H.S $\Leftrightarrow (a \to c) \vee (b \to c)$

$\Leftrightarrow (\sim a \vee c) \vee (\sim b \vee c)$ Equivalence

$\Leftrightarrow (\sim a \vee \sim b) \vee (c \vee c)$

By associative and commutative laws

$\Leftrightarrow \sim(a \wedge b) \vee c$ $(\because (c \vee c) \Leftrightarrow c)$

$\Leftrightarrow (a \wedge b) \to c$ Equivalence = L. H. S

$\therefore$ The given formula is a tautology

(B) R.H.S $\Leftrightarrow (p \to q) \wedge (p \to r)$

$\Leftrightarrow (\sim p \vee q) \wedge (\sim p \vee r)$ Equivalence

$\Leftrightarrow \sim p \vee (q \wedge r)$ Distributive law

$\Leftrightarrow p \to (q \wedge r)$ Equivalence

= L. H. S

(C) R.H.S $\Leftrightarrow (p \to r) \wedge (q \to r)$

$\Leftrightarrow (\sim p \vee r) \wedge (\sim q \vee r)$ Equivalence

$\Leftrightarrow (\sim p \wedge \sim q) \vee r)$ Distributive law

$\Leftrightarrow \sim(p \vee q) \vee r$ Demorgan's law

$\Leftrightarrow (p \vee q) \to r$ Equivalence

= L.H.S

(D) When a is true, b is false and c is true; the given formula has truth value false.

$\therefore$ It is not a tautology

54. Ans: (C)

Sol: Body of for loop is optional. In this question for loop will execute until value of variable x becomes six and condition becomes false.

55. Ans: (B)

Sol: Running time of the inner, middle & outer loop is n, logn and logn respectively. The given loop is nested one so the overall complexity of the code will be $O(n(\log n)^2)$.

56. Ans: (A)

Sol: Vulgarity (n.) means offensive speech or conduct.

57. Ans: (A)

58. Ans: (B)

59. Ans: (A)

Sol: Cylinder volume = $\pi r^2 h$

$$= \frac{22}{7} \times 10 \times 10 \times 14 = 4400 \text{ m}^3$$

60. Ans: (D)

Sol: Speed = 10 kmph = $10\times\frac{5}{18}m/\sec$

$= \frac{50}{18}m/\sec$

Man walks 50 m in 18 sec.

61. Ans: (D)

Sol: Rate downstream = (24/2) kmph

= 12 kmph.

Rate upstream = (24/4) kmph = 6 kmph.

Therefore, speed in still water

= 1/2* (12 + 6) = 9 kmph.

62. Ans: (B)

Sol: Let principle be 4.

Then amount = $4\times\frac{7}{4}=7$

Interest = 7 – 4 = 3

Rate of interest $=\frac{3\times100}{4\times4}=18\frac{3}{4}\%$

63. Ans: (C)

Sol: Net part filled in 1 hour

$=\frac{1}{10}+\frac{1}{12}-\frac{1}{20}=\frac{6+5-3}{60}$

$=\frac{11-3}{60}=\frac{8}{60}=\frac{2}{15}$

The tank will be full in $\frac{15}{2}$ hrs = 7 hrs.30 min.

64. Ans: (A)

Sol: Share of wealth that C gets (in Rs lakhs)

= 20

Tax = 40%

⇒ Wealth tax (in Rs lakhs) that C has to pay = $\frac{40}{100}\times20=8$

65. Ans: (A)

Sol: Note that an assumption is like a premise in that if it is wrong the argument is invalid, and if it is right it supports the conclusion. If the statement in (A) is correct, it supports the idea that point and shoot is not an art, but if it is wrong, and choosing what to point the camera at involves art, then the argument is invalid. Hence, (A) is an assumption.