# Branch: Computer Science and Information Technology MOCK-E- SOLUTIONS

**01. Ans: (d)**

**Sol:** The given statement can be written as,

$\exists_x \{R(x) \wedge \sim S(x)\}$

Now, $\sim[\exists_x \{R(x) \wedge \sim S(x)\}]$

$\Leftrightarrow \forall_x \{\sim R(x) \vee S(x)\}$

$\Leftrightarrow \forall_x \{R(x) \rightarrow S(x)\}$

$\therefore$ Option (d) is correct.

**02. Ans: (d)**

**Sol:** The grammar is Ambiguous and no ambiguous grammar is LR(K).

**03. Ans: (d)**

**Sol:** Both $A \rightarrow B$ and $B \rightarrow A$ implied on $R_1$(AB) and $BC \rightarrow D$ implied on $R_2$ (BCD).

**04. Ans: (d)**

**Sol:**

| | |
|---|---|
| Merge | O(n log n) |
| Insertion | $O(n^2)$ |
| Bubble | $O(n^2)$ |
| Heap | O(n log n) |
| Quick | $O(n^2)$ |
| Selection | $O(n^2)$ |

**05. Ans: (a)**

**Sol:** R = {(1, 1), (2, 2), (2, 3), (2, 4), (3, 2), (3, 3), (3, 4), (4, 2), (4, 3), (4, 4)}

R is an equivalence relation

[1] = {1}

[2] = {2, 3, 4}

[3] = {2, 3, 4}

[4] = {2, 3, 4}

**06. Ans: (a)**

**Sol:** ACK is the **next byte expected**. So, upon receiving 999 bytes, it gives 1000.

**07. Ans: (c)**

**Sol:** Max file size = (Total number of blocks) * Disk block size

= (10 + 32 + 2*1024) * 64 B

= 2090 * 64 Bytes

**08. Ans: (c)**

**Sol:** int(*p)(int*) ;

Syntax pointer to function is for declaration of

return_type (*ptr variable)

(List of arguments);

**09. Ans: (d)**

**Sol:** $Y = \bar{A}\bar{B}\bar{C}(0) + \bar{A}\bar{B}C(D) + \bar{A}B\bar{C}(1) + \bar{A}BC(0) + A\bar{B}\bar{C}(D) + A\bar{B}C(D) + AB\bar{C}(1) + ABC(0)$

$Y = \Sigma m(3, 4, 5, 9, 11, 12, 13)$

**10. Ans: (d)**

**Sol:** we have f(1) = f(2) = 50

$\Rightarrow$ f is not one-to-one

In the co-domain, the integers 1, 2, 3...... 49 are not mapped by any integers of the domain.

$\Rightarrow$ f is not on-to

**11. Ans: (d)**

**Sol:** Every LL(1) grammar is LR(1) but every LR(1) need not be LL(1)

**12. Ans: 7**

**Sol:** Length of string w = 4 = |w|

No. of steps = 2× |w| – 1 = 2× 4 – 1 = 7

**13. Ans: 8.8**

**Sol:** $T_{seg}$ = 4ns

$$\text{Total time} = (0.7\times1\times4\text{ns}) + \underbrace{(0.3\times(1+4)\times4\text{ns})}_{\text{stall delay}}$$

$$= 2.8\text{ns} + 6\text{ns} = 8.8\text{ns}$$

**14. Ans: (b)**

**Sol:** In the outer for loop, the variable 'i' keeps halving so it goes round $\log_2 n$ times.

For each 'i', next for loop goes round also $\log_2 n$ times because of doubling the variable 'j'.

The innermost loop by k goes round $\frac{n}{2}$ times. Loops are nested, so the bounds may be multiplied to given that the algorithm is $O(n(\log n)^2)$.

**15. Ans: (a)**

**Sol:**
$$\begin{array}{r} [2 \quad 6 \quad 7]_8 \\ [Y \quad X \quad 6]_8 \\ \hline [Z \quad Y \quad X]_8 \end{array}$$

i) $7_8 + 6_8 = (13)_8 = (8 + 5)_8 = (5)_8$

with carry = 1, hence X = 5

ii) 6 + X + 1 = 6 + 5 + 1 = 12 = 8 + 4 = 4

with carry 1, hence Y = 4

iii) 2 + Y + 1 = 2 + 4 + 1 = 7

$\Rightarrow$ Hence Z = 7

**16. Ans: (c)**

**Sol:** The characteristic equation is $| A - \lambda I | = 0$

$\Leftrightarrow \lambda = 4, 4$

The eigen vectors for $\lambda = 4$ are given by

$[A - 4I]\, X = 0$

$\Rightarrow x - y = 0$

$\Rightarrow X = k\begin{bmatrix} 1 \\ +1 \end{bmatrix}$ where k is non zero arbitrary constant.

**17. Ans: (d)**

**Sol:** Transaction $T_3$ performs read on A, which is updated by $T_1$ and committed before $T_1$ does.

**18. Ans: (d)**

**Sol:** Deadlock may occur under basic 2PL

**19. Ans: (d)**

**Sol:** p = &a[2][2][2] we declare only two 2D arrays, but we are trying to access the third 2D(which are not declared) it will print garbage values. *q=***a starting address of a is assigned integer pointer. Now q is pointing to starting address of a. If you print *q it will print first element of 3D array.

**20. Ans: (d)**

**Sol:** The grammar is not LL(1), LR(0), SLR (1) and LR(1) as it has Reduce-Reduce conflict.

**21. Ans: 8**

**Sol:** By sum of degrees theorem,

$(5 + 2 + 2 + 2 + 2 + 1) = 2\,|E|$

$\Rightarrow |E| = 7$

$\therefore$ Number of edges in G = 7

$|E(G)| + |E(\overline{G})| = |E(K_6)|$

$\Rightarrow 7 + |E(\overline{G})| = C(6, 2)$

$\Rightarrow |E(\overline{G})| = 8$

**22. Ans: 159**

**Sol:** /27 clearly indicates that first 3 bits (128, 64, 32) in the last octet are borrowed for subnet, 5 bits for Host ID and mask is 255.255.25.224. If you perform AND operation between IP (200.10.11.144) and Subnet mask (255.255.255.224) then we get 200.10.11.128. So subnet ID is 128 and network ID is 200.10.11.

We have 5 bits for host ID. We cannot have all 1's in host ID, therefore we will have 11110 (last 5 bits) for the last IP address. Therefore in last octet we will have 10011110, it is 158.

Last Broadcast ID we have 10011111, it is 159.

**23. Ans: 8**

**Sol:** $F(A,B,C,D) = A \oplus B \oplus C \oplus D$

XOR is an odd function. Number of 1's are odd then XOR output is 1

$F(A,B,C,D) = A \oplus B \oplus C \oplus D$

$= \sum m\,(1, 2, 4, 7, 8, 11, 13, 14)$

hence number of SSOP terms are 8

**24. Ans: (a)**

**Sol:** R.I.S.C uses Hardwired control unit (CU)

Hardwired C. U. is faster than Horizontal and vertical control word units.

Modification in Hardwired control unit is not possible.

**25. Ans: (b)**

**Sol:** n-bit magnitude comparator condition for A > B is

$$\Rightarrow \frac{2^{2\times n} - 2^n}{2} \quad \text{Here } n = 8$$

$$\Rightarrow \frac{2^{2\times 8} - 2^8}{2} = \frac{2^{16} - 2^8}{2} = \frac{2^8\left[2^8 - 1\right]}{2}$$

$= 2^7\,[256 - 1] = 255 \times 2^7$

**26. Ans: (a)**

**Sol:** Only the statement a = a–5 is part of the if statement, the statement b = b + 5 will always be executed. If we want the statement b = b + 5 to become part of if statement then we need to enclose both statements within braces.

```
if (a < 10)
{
 a = a –5;
 b = b + 5;
}
```

**27. Ans: 740**

**Sol:** Payload length = Total length – (HLEN * 5)

= 800 – (12 * 5) = 740

**28. Ans: (d)**

**Sol:** R-R conflict occurs in LR(0), LALR(1) and conflict possible in LL(1)

**29. Ans: (c)**

**30. Ans: (c)**

**Sol:** In $IPV_4$ datagram offset value is non zero and M (More Fragment) bit is one, then the position of datagram is Intermediate Fragment.

**31. Ans: (c)**

**Sol: Example:** For MOD-16 $\Rightarrow$ N = 16

(a) $N = 2^m = 16 = 2^4 \Rightarrow$ m = number of Flip-Flops = 4

(b) For BCD $\Rightarrow N = 10 \Rightarrow m \geq \log_2 N \Rightarrow$ hence m = 4

(c) MOD-16 Ring counter need 16 Flip-Flops

(d) 16-bit Johnson counter requires $= \frac{N}{2} = \frac{16}{2} = 8$ Flip-Flops

**32. Ans: (c)**

**Sol:** For each value of 'i', the loop 'j' will run "logn" time and loop 'k' will run loglogn time.

Since the outer loop 'i' is running 'n' times so the loop 'j' will run nlogn time and loop 'k' will run nloglogn time.

$\therefore$ Time Complexity = nlogn + nloglogn

= O(nlogn)

**33. Ans: (c)**

**Sol:** True dependency is also known as Read After Write (RAW)

**34. Ans: (b)**

**Sol:** As we get key and participation constraint from course to registration, therefore the number of tuples in registration will be equal to the tuples in the course table.

**35. Ans: (c)**

**Sol:** Let x be any person,

P(x) = x is a politician and Q(x) = x is a sports person

**$S_1$:** Whenever L.H.S is true, we have R.H.S is also true and vice versa

$\therefore S_1$ is true.

**$S_2$:** If the universe of discourse contain one politician and one sports person then L.H.S is true and R.H.S is false.

$\therefore S_2$ is not valid

**$S_3$:** If the universe of discourse contain one politician and one sportsman.

For ex. U = {Rahul Gandhi, Virat Kohli}

then R.H.S is true and L.H.S is false

$\therefore$ L.H.S $\nLeftrightarrow$ R.H.S

**$S_4$:** Whenever L.H.S is true, we have R.H.S is also true, and vice versa

$\therefore S_4$ is true

**36. Ans: (d)**

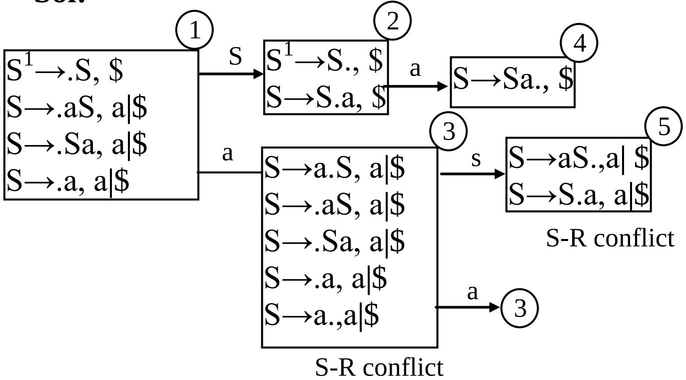
**Sol:** First ‘i’ is global

Second and third i are local

Third ‘i’ visible within the block

**37. Ans: (d)**

**Sol:**




**38. Ans: (a)**

**Sol:** Before subnetting maximum possible number of hosts = $(2^8-2)$ hosts = 254 hosts

After subnetting maximum possible number of hosts = $(2^3-2) * (2^5-2)$ hosts

= 6 * 30 hosts = 180 hosts

Reduction value = 254 – 180 = 74 hosts

**39. Ans: (b)**

**Sol:** A+B*(C+D)/F+D*E

A+B*(+CD)/F+D*E

A+(*B+CD)/F+(*DE)

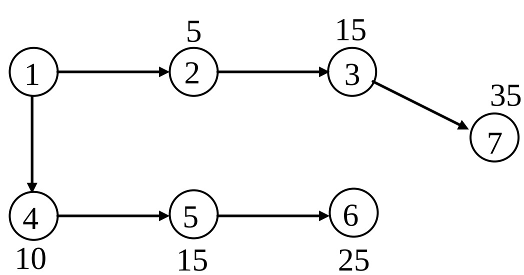
A+(/*B+CDF)+(*DE)

(+A/*B+CDF)+(*DE)

++A/*B+CDF*DE

**40. Ans: (c)**

**Sol:**




| | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| S = {1} | 5* | ∞ | 10 | ∞ | ∞ | ∞ |
| S = {1, 2} | 5* | 15 | 10* | ∞ | ∞ | ∞ |
| S = {1, 2, 4} | 5* | 15* | 10* | 15 | ∞ | ∞ |
| S = {1, 2, 4, 3} | 5* | 15* | 10* | 15* | ∞ | 35 |
| S = {1, 2, 4, 3, 5} | 5* | 15* | 10* | 15* | 25* | 35 |
| S= {1, 2, 4, 3, 5, 6} | 5* | 15* | 10* | 15* | 25* | 35* |
| S={1, 2, 4, 3, 5, 6, 7} | 5* | 15* | 10* | 15* | 25* | 35* |

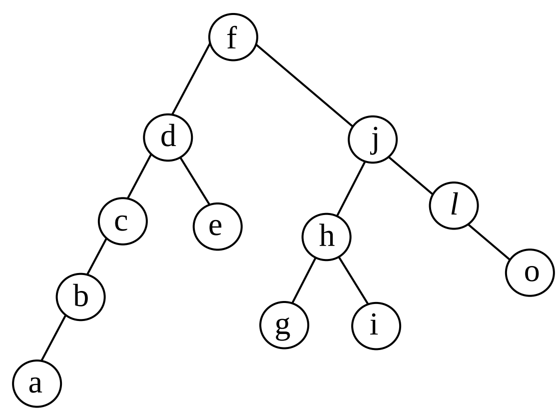
**41. Ans: (b)**

**Sol:** Both B → F and E → B are transitive dependencies then the relation is in 2NF.

**42. Ans: (a)**

**Sol:** Pre-order = f, d, c, b, a, e, j, h, g, i, *l*, o

In-order = a, b, c, d, e, f, g, h, i, j, *l*, o




Post-order = a, b, c, e, d, g, i, h, o, *l*, j, f

**43. Ans: 7**

**Sol:** The DFA for $L^1$ is obtained by interchanging final and Non-final states. So number of final states in the DFA that accepts $L^1$ is 10–3 = 7

**44. Ans: 56**

**Sol:** If G is a bipartite graph with n vertices then

$$|E| \le \left\lfloor \frac{n^2}{4} \right\rfloor \text{ where } n = 15$$

$$\Rightarrow |E| \le \left\lfloor \frac{225}{4} \right\rfloor \Rightarrow |E| \le 56$$

$\therefore$ Maximum number of edges possible = 56

**45. Ans: (d)**

**Sol:** $\eta_{\text{stop \& wait}} = \frac{tx}{RTT} \Big| \eta_{\text{sliding window}} = \frac{N * tx}{RTT}$

$$\eta_{\text{stop \& wait}} = \frac{1}{N} * \eta_{\text{sliding window}}$$

$[\eta_{\text{sliding window}} = 1, \text{ When } N = 5]$

$$\eta_{\text{stop \& wait}} = \frac{1}{5} = 20\%$$

**46. Ans: 4**

**Sol:** After every three consecutive bits sender stuff a zero bit

$\boxed{011110}$ 01110 011101011101110 0110 $\boxed{011110}$

Start Delimiter ↑ ↑ ↑ ↑ End Delimiter

**47. Ans: (b)**

**Sol:** The time complexity of kruskals algorithm for G(V, E)

= O(ElogE)

$$= \frac{V(V-1)}{2} \log \frac{V(V-1)}{2}$$

$$\left[\text{In complete graph } G(V, E), |E| = \frac{V(V-1)}{2}\right]$$

$$= \left(\frac{V^2 - V}{2}\right) \log \frac{V(V-1)}{2}$$

$$= \frac{V^2 - V}{2} \log \frac{V^2}{V} - \frac{V^2 - V}{2} \log \frac{V}{2} \cong \left(V^2 \log V\right)$$

**48. Ans: 10**

**Sol:** j = ((((2 * 3) / 4) + (2.0/5)) + (8/5))

After evaluating above expression we have

j = 2

k = – 1

when

i = 0, i+k=–1→1 time printf statement executed

i = 1, i+k=0→1 time printf statement executed

i = 2, i+k=1→ 3 times printf statement executed

i = 3, i+k=2→ 3 times printf statement executed

i = 4, i+k=3→ 2 times printf statement executed

$\therefore$ Total 10 times printf statement executed

**49. Ans: 32**

**Sol:** The Hasse diagram of the poset is 4-cube.

Number of edges in n-cube = $n.2^{n-1}$

$\therefore$ Number of edges in the Hasse diagram

= $4.\ 2^{4-1} = 32$

**50. Ans: (d)**

**Sol:** Page table entry of outer table = 32 bits

Page table entry of inner table = 64 bits

Frame size = 4 KB

Number of frames = 128 MB/4 KB= $2^5.\ 2^{10} = 2^{15}$

Size of outer page table = $(2^{13}\times2^5)/8$= 32 KB

Size of inner page table=$(2^{14}\times2^6)/8$= 128 KB

**51. Ans: (d)**

**Sol:** $J_1 = \overline{Q}_2$, $J_2 = Q_1$, $Z = \overline{Q}_0\,\overline{Q}_1\,\overline{Q}_2$

The state table is as shown below.

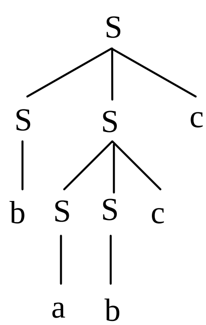
| Clk | Inputs | | | | | | Outputs | | | Z |
|---|---|---|---|---|---|---|---|---|---|---|
| | $J_0$ | $K_0$ | $J_1$ | $K_1$ | $J_2$ | $K_2$ | $Q_0$ | $Q_1$ | $Q_2$ | |
| 0 | - | - | - | - | - | - | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 |
| 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
| 3 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| 4 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 5 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 6 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |

Hence output becomes high after every 6 clock pulses.

**52. Ans: (b)**

**53. Ans: 10**

**Sol:**




Bottom-up evaluation of parse tree outputs 10.

**54. Ans: (b)**

**Sol:** Let $A = \begin{bmatrix} a & b \\ b & c \end{bmatrix}$

If $\lambda$ is eigen value of A and X is the corresponding eigen vector then, $AX = \lambda X$

For $\lambda = 1$, we have

$$\begin{bmatrix} a & b \\ b & c \end{bmatrix}\begin{bmatrix} 1 \\ 1 \end{bmatrix} = 1\begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

$\Rightarrow a + b = 1$ ............ (1)

and $b + c = 1$ .......... (2)

For symmetric matrix, the eigen vectors of A are orthogonal.

The eigen vector for $\lambda = 4$ is $(1, -1)$

Now, $AX = \lambda X$ becomes

$$\begin{bmatrix} a & b \\ b & c \end{bmatrix}\begin{bmatrix} 1 \\ -1 \end{bmatrix} = 4\begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

$\Rightarrow a - b = 4$ ..........(3)

$\Rightarrow b - c = -4$ ......... (4)

solving (1), (2), (3) and (4), we get

$$a = \frac{5}{2},\ b = \frac{-3}{2} \text{ and } c = \frac{5}{2}$$

$$\therefore\ A = \frac{1}{2}\begin{bmatrix} 5 & -3 \\ -3 & 5 \end{bmatrix}.$$

**55. Ans: 47550**

**Sol:** Number of records of relation R is

$N_R = 2000$

Number of records of relation S is $N_S = 500$

Size of each record = 5 B

Size of Block = 100 Bytes

$\therefore$ Number of records in a block $= \frac{100}{5}$

= 20 records per block

Number of blocks needed for R is

$$B_R = \frac{2000}{20} = 100 \text{ blocks}$$

Number of block needed for S is

$$B_S = \frac{500}{20} = 25 \text{ blocks}$$

We can have less number of block nested loop join's for accessing blocks, if the relation which has less number of records in the outer loop.

$\therefore$ Total block accesses in block nested loop join

$= N_S \times B_R + B_S - B_S \times B_R + B_S$

$= 500 \times 100 + 25 - 25 \times 100 + 25$

$= 47550$

**56. Ans: (c)**

**Sol:** (passive voice - verb in past participle form)

**57. Ans: (c)**

**Sol:** 'between.... to' is wrong. 'between.......and'.

**58. Ans: (d)**

**Sol:** Suggestion is friendly/ smooth

Demand is unfriendly/Rough

Take is smooth

Grab is Rough

**59. Ans: (c)**

**Sol:** Let the four numbers be x, x + 2, x + 4, and x + 6.

$\Rightarrow x + x + 2 + x + 4 + x + 6 = 36$

$\Rightarrow 4x + 12 = 36$

$\Rightarrow x = 6$

Therefore, the numbers are 6, 8, 10 & 12.

Therefore, the sum of their squares = $6^2 + 8^2 + 10^2 + 12^2 = 36 + 64 + 100 + 144 = 344$.

**60. Ans: (a)**

**Sol:** We know that an ordinary year has 1 odd day and a leap year has 2 odd days.

During this period, namely 2005, 2006, 2007, 2008, 2009, 2010.

Total number of odd days =

(1 +1 +1 + 2 + 1 + 1)days = 7 = 0 odd days.

Hence, the calendar for 2005 will serve for the year 2011 too.

**61. Ans: (d)**

**Sol:** The solution to this problem can be obtained only with more information like ratio of the length of the rectangle to its breadth.

**62. Ans: (b)**

**Sol:** Amount = $\left[7500 \times \left(1 + \frac{4}{100}\right)^2\right]$

$= \left(7500 \times \frac{26}{25} \times \frac{26}{25}\right)$

$= 8112$

So, compound interest = (8112 – 7500) = 612

**63. Ans: (c)**

**Sol:** Let their present ages be 6x and 7x respectively.

Then, their age difference = 'x' years

i.e. 4 = 'x' years

$\therefore$Their present ages are 24 & 28 respectively

Ratio of ages after 4years = 24 + 4 : 28 + 4 = 7 : 8

**64. Ans: (b)**

**Sol:** Expenditure in year 2016 (in 000') = 3800

Expenditure in year 2015 (in 000') = 3075

$\Rightarrow$ Required % increase

$$= \frac{(3800-3075)}{3075}\times 100$$

$$= \frac{725}{30.75} = \frac{29}{1.23} = 23.57\%$$

**65. Ans: (b)**