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

01. Ans: 0.9677 range 0.96 to 0.97

Sol: Let A = Event that the family has atleast one girl

B = Event that the family has atleast one boy

Required probability = $P(A|B) = \frac{P(A \cap B)}{P(B)}$

$P(B) = 1 - P(\text{The family has no boy})$

$= 1 - \left(\frac{1}{2}\right)^5 = \frac{31}{32}$

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

$= 1 - \left\{\frac{1}{32} + \frac{1}{32}\right\} = \frac{15}{16}$

Required probability $= \frac{\left(\frac{15}{16}\right)}{\left(\frac{31}{32}\right)} = \frac{30}{31} = 0.9677$

02. Ans: (c)

Sol: $\sum = \{0, 1\}$

wxw^R is generated by the regular expression

$\varepsilon + 0(0 + 1)^*0 + 1(0 + 1)^* 1$

where both w, $x \in (0 + 1)^*$, so on concatenation wxw^R is also member of $(0 + 1)^*$

$\therefore \{wxw^R \mid w, x \in (0 + 1)^*\}$ is a regular language.

03. Ans: 15

Sol: Gantt chart:-

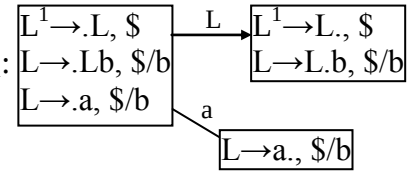
P1	P2	P3	P4	P5	P6	P3	P2	P1

0 1 2 3 4 6 12 14 15 18

04. Ans: (a)

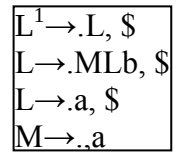
Sol:

For G_1:



G_1 is LR(1)

For G_2:



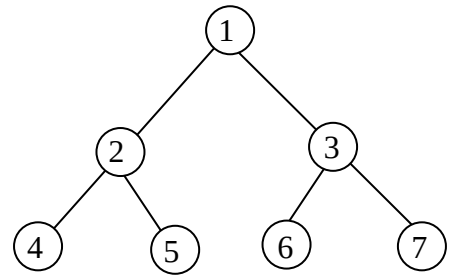
G_2 is not LR(1)

S-R conflict

05. Ans: (b)

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

Example: N = 7



06. Ans: 4

Sol: Result of given query

P	Q	U
2	b	5
2	b	6
2	c	5
3	d	6

07. Ans: (b)

Sol: For a full adder

A	B	C	Sum (F_1)	Carry (F_2)
0	0	0	0	0
0	0	1	1	0
0	1	0	1	0
0	1	1	0	1
1	0	0	1	0
1	0	1	0	1
1	1	0	0	1
1	1	1	1	1

$F_1 = \Sigma m(1,2,4,7)$

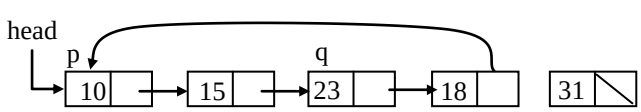
$F_2 = \Sigma m(3,5,6,7)$

08. Ans: (d)

Sol: Socket is a logical end point consists of port number and IP address

09. Ans: (b)

Sol:



q→next→next→data is 15

10. Ans: (b)

Sol: Let P(x) = x is a politician

and Q(x) = x is a sports man

(a) For the universe of discourse,

U= {Sachin Tendulkar, Aamir khan}

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

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

(b) For any universe of discourse, whenever L.H.S is true and the R.H.S is also true and vice versa.

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

(c) Let U = {Virat Kohli, Rahulgandhi}

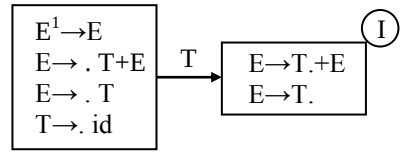
For the universe of discourse,

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

$\therefore$ R.H.S $\not\Rightarrow$ L.H.S

11. Ans: 1

Sol:



In LR(0) parse table the entries Action (I, +) contains both shift and reduce actions.

12. Ans: (a)

Sol: Every LR(0) is definitely LR(1).

13. Ans: (b)

Sol: I/O bound process will take less time on CPU & then will be given to I/O device. Then CPU bound process can be scheduled to CPU and both process can run parallely to give better performance.

14. Ans: (a)

Sol: Many-to-One model maps multiple user-level threads to one kernel level thread. Hence entire process will block if a thread makes a blocking system call.

15. Ans: (c)

Sol: e = 13, p = 7, q = 17

$z = 6 \times 16 = 96$

$(e \times d) = 1 \bmod z$ & e = 13

$(e \times d)$ = multiple of 96 + 1

i = 1 $96 \times 1 + 1 = 97\%\ 96 = 1$

$e \times d = 97$; d = 97/13 = fraction

i = 2 $96 \times 2 = 192 + 1 = 193$

$e \times d = 193$ fraction

i = 3 $96 \times 3 = 288 + 1 = 289$

$e \times d = 289$ fraction

i = 4 $96 \times 4 = 384$ $384 + 1 = 385$

$e \times d = 385$ fraction

i = 5 $96 \times 5 = 480$ $480 + 1 = 481$

$e \times d = 481$ $d = \frac{481}{13} = 37$

M = 6

Given p = 7, q = 17

$n = 7 \times 17$

$= 119$

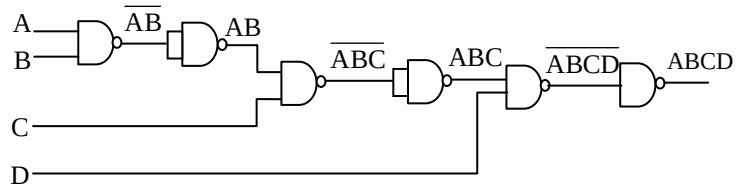
$C = M^e \bmod n$

$= 6^{13} \bmod 119$

$= 27$

16. Ans: 6

Sol: $Y = ABCD = \overline{\overline{ABCD}}$



$\therefore$ 6 NAND gates are required.

17. Ans: (b)

Sol: By the Binomial theorem, we have

$$(1-x)^{-4} = \sum_{n=0}^{\infty} \frac{(n+1)(n+2)(n+3)}{6} x^n$$

$$\Rightarrow \frac{6x}{(1-x)^4} = \sum_{n=0}^{\infty} \{(n+1)(n+2)(n+3)x^{n+1}\}$$

$$\Rightarrow \frac{6x}{(1-x)^4} = \sum_{r=1}^{\infty} r.(r+1)(r+2)\,x^r$$

where, r = n + 1

18. Ans: 15

Sol: Let the number of tag bits for direct mapped cache is 'x'

then number of tag bits for 'N' way associative mapped cache is $x + \log_2 N$.

for 16 way associative, tag size

$= x + \log_2 16 = 18$

and for 2 way associative, tag size

$= x + \log_2 2$

$x + 4 = 18$, $x = 14$

Hence tag size for 2 way block set associative cache is 14 + 1 = 15 bits.

19. Ans :(b)

Sol: Follow (F)= {+,*,),$}

20. Ans: (c)

Sol: I. Disadvantage because of more probes.

II. Advantage because of less space in comparison with chaining.

III. Disadvantage because of overflow problem.

21. Ans: 3

Sol: The candidate keys are

F, AB, CB

22. Ans: 25

Sol: 1. calculate R = RTT = $2 \times T_p$

$= 2 \times 250 = 500$ ms

2. calculate Data size = B × R

3. window size $= \frac{\text{data size}}{\text{frame size}}$

$$= \frac{50 \times k \times \frac{b}{s} \times 2 \times 250 \times m \times s}{1000}$$

$= 25$

23. Ans: (d)

24. Ans: (b)

Sol: Inverse of a function exists iff f is a bijection.

Here, f is not a bijection

for example f(1) = f(2) = a

$\Rightarrow$ f is not 1 – 1

g is a bijection

$\Rightarrow g^{-1}$ exists.

25. Ans: (b)

Sol: Output of MUX1 is $F_1 = \overline{Y}.\overline{X} + YX = X \odot Y$

Now output of MUX2 is $F_2 = \overline{F}_1\overline{Z} + F_1Z$ $[\because S = F_1]$

$F_2 = F_1 \odot Z$ but $F_1 = X \odot Y$

$F_2 = X \odot Y \odot Z = \overline{\overline{X} \oplus \overline{Y} \oplus Z}$.

26. Ans: (c)

27. Ans: (d)

Sol: Precedence graph contains cycle from T2→T3 and T3→T2 and also violates view rules.

As it is having dirty reads it requires cascading rollbacks.

As there is no commit operation we can't decide about recoverability.

28. Ans: (d)

Sol: Ideal speed up = number of stages = 5

For 'A', Pipeline time = (5 + 99) × 20 ns

= 2080 ns

and non pipeline time = 10000 ns

$\therefore$ speed up = 4.8

then $\eta = \frac{4.8}{5} = 96$

For 'B', Pipeline time=1004× 20 = 20080ns

non pipeline time = 1000×5 × 20 = 100000

Speed up = 4.98

then $\eta = \frac{4.98}{5} = 99.6$

29. Ans: (a)

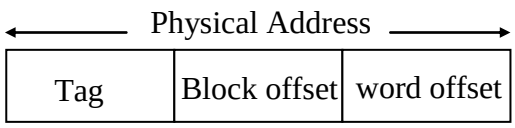
Sol: **LIFO:** The page which comes last in the memory (Largest loading time)

LRU: The page which has not been referred since long (Smallest reference time)

30. Ans: (c)

Sol: Size of cache memory = N × N words
$= N^2$ words

Number of bits in tag field = N



Hence physical memory size
$= 2^N \times$ cache size
$= 2^N \times N^2$ words.

31. Ans: (c)

Sol: $A = \begin{bmatrix} 1 & 3 & 1 & -2 \\ 1 & 4 & 3 & -1 \\ 2 & 3 & -4 & -7 \\ 3 & 8 & 1 & -7 \end{bmatrix}$

Applying $R_2 - R_1$, $R_3 - 2R_1$, $R_4 - 3R_1$

$$A \sim \begin{bmatrix} 1 & 3 & 1 & -2 \\ 0 & 1 & 2 & 1 \\ 0 & -3 & -6 & -3 \\ 0 & -1 & -2 & -1 \end{bmatrix}$$

Applying $R_3 + 3R_2$ and $R_4 + R_2$

$$A \sim \begin{bmatrix} 1 & 3 & 1 & -2 \\ 0 & 1 & 2 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

= Echelon form of A

$\Rightarrow$ Rank of A = 2

Number of linearly independent solutions
= n – k.

Where n is the number of variables and k is the rank of A
= 4 – 2 = 2.

32. Ans: 200

33. Ans: (d)

Sol: The **network allocation vector** (**NAV**) is a virtual carrier-sensing mechanism used with wireless **network** protocols such as IEEE 802.11. The virtual carrier-sensing is a logical abstraction which limits the need for physical carrier-sensing at the air interface in order to save power.

34. Ans: (a)

Sol: $\lim_{x \to 2^-} f(x) = \lim_{x \to 2^+} f(x) = \lim_{x \to 2} f(x) = 3$

$\therefore$ The above function is continuous at x=2

but $f'(x) = \begin{cases} 1, & x \le 2 \\ -1, & x > 2 \end{cases}$

$\therefore \lim_{x \to 2^-} f'(x) = 1$ and $\lim_{x \to 2^+} f(x) = -1$

i.e. f(x) is not differentiable at x = 2

35. Ans: (c)

Sol: $\sum_{i=0}^{n} i^3 = X \Rightarrow X = \left[\frac{n(n+1)}{2}\right]^2$

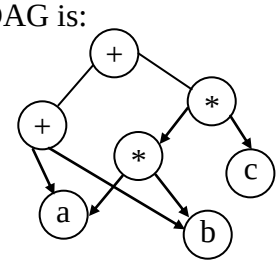
($\because$ Sum of cubes of 'n' natural numbers)

$X = \Theta(n^4)$, $O(n^5)$ but not $\Theta(n^5)$

36. Ans: (d)

Sol: Expression: a + b + a * b * c

The DAG is:



37. Ans: (d)

Sol: From circuit $J = \overline{Q_n}; K = 1$

Clock	J	K	Q_n(output)
0	-	-	0
1	1	1	1
2	0	1	0
3	1	1	1
4	0	1	0
5	1	1	1
6	0	1	0

Hence output at Q is 0 1 0 1 0 1

38. Ans: (a)

Sol: **S_1:** Let $A = (p \to q) \wedge (p \to r)$

and $B = p \to (q \vee r)$

Here, B is false only when p is true, q is false and r is false.

For these truth values A is also false.

$\therefore A \to B$ is valid

S_2: Let $A = (p \to q) \to (p \to r)$

and $B = p \to (q \vee r)$

If {p is true, q is false and R is false} then A is true and B is false.

$\therefore (A \to B)$ is not valid

S_3: Let $A = (p \to q) \vee (p \to r)$

and $B = p \to (q \vee r)$

Here, whenever B is false, the antecent A is also false.

$\therefore (A \to B)$ is valid

S_4: Let $A = (p \to q) \leftrightarrow (p \to r)$

and $B = p \to (q \vee r)$

Here, B is true, only when p is true, q is false, and r is false.

For this set of truth values, A has truth value true.

$\therefore (A \to B)$ is not valid.

39. Ans: (d)

Sol: BC → CD is a transitive dependency

40. Ans: (b)

Sol: Here unary minus (or negation) operator is used twice. Same maths rules applies, i.e. minus *minus = plus.

41. Ans: (b)

Sol: In virtual memory system CPU generates virtual address, so for translation first of all TLB should be accessed. As given in case of TLB miss, memory system should be accessed. In memory system the first access should be of cache before main memory.

42. Ans: (b)

Sol: Lack of synchronization among competing processes in IPC environment may

potentially lead to sometimes inconsistencies like in producer consumer problem and other times loss of data as in printer daemon problem.

43. Ans: (a)

Sol: NAT is short for Network Address Translation. NAT is an Internet standard that enables a local-area network (LAN) to use one set of IP addresses for internal traffic and a second set of addresses for external traffic. A NAT box located where the LAN meets the Internet makes all necessary IP address translations.

The Purpose of NAT

NAT serves three main purposes:

- Provides a type of firewall by hiding internal IP addresses
- Enables a company to use more internal IP addresses. Since they're used internally only, there's no possibility of conflict with IP addresses used by other companies and organizations.
- Allows a company to combine multiple ISDN connections into a single Internet connection.

44. Ans: (d)

Sol: A stable sort retains the order of identical items. Bubble sort and Merge sort is the example of such sorting algorithm. Heap sort and Quick sort does not retain this property.

45. Ans: (c)

Sol: Output at GATE 1 $= \overline{AB}$

Output at GATE 2 $= \overline{\overline{AB}} \cdot \overline{\overline{B}} = AB + B = B$

Output at GATE 3 $= \overline{B.B} = \overline{B}$

Output at GATE 4 $= \overline{B + \overline{C}} = \overline{B} \cdot C$

Output at GATE 5

$$= Y = \overline{\overline{B} + \overline{B}C} = \overline{\overline{B}(1 + C)}$$

$$Y = \overline{\overline{B}} = B$$

46. Ans: (b)

Sol: Let G = set of all odd integers.

G is closed with respect to multiplication.

Multiplication of odd integers is associative.

1 is identity element of G with respect to multiplication.

$\therefore$ G is a monoid w.r.t multiplication.

G is not a group w.r.t multiplication. For example, inverse of $3 = \frac{1}{3}$

But $\frac{1}{3} \notin G$.

47. Ans: (d)

Sol: There is an error in this line i>=50 ? return(*x): return(*y);. We cannot use return keyword in the ternary operators.

48. Ans: (d)

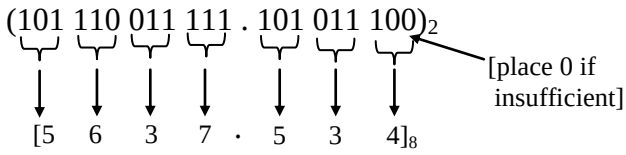
Sol: The given graph is a complete graph K_6, with 6 vertices of odd degree.

$\therefore$ G is not traversable

49. Ans: 5637.534

Sol: $(B9F.AE)_{16} = (1011\ 1001\ 1111.\ 1010\ 1110)_2$

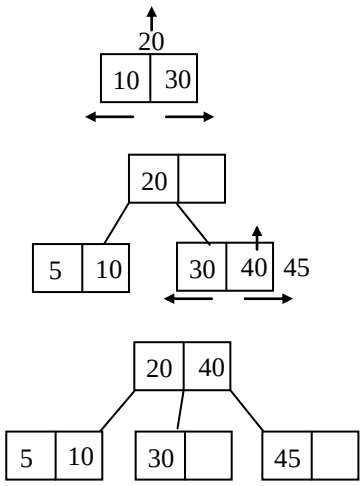
Now make 3 bits as single group



$= (5637.534)_8$

50. Ans: 2

Sol:



2- times leaf node splitted

51. Ans: (a)

Sol: Parameters are evaluated from right to left so in abc(++a, a++); it is first a++ evaluated , later ++a evaluated

$\therefore$ abc(10,8); i.e. passing values 10, 8 to abc(int x, int y).

52. Ans: (d)

Sol: Collision number for A is 1, and for B it is 2.

Possible numbers for 'A' from backoff algorithm is (0,1),

for B they are (0, 1, 2, 3)

Going by the Combinations,

A will have 5 chances and

B has 1 chance out of 8.

Rest of the two is Undecided.

n = 1, A = (0,1) , B = (0,1)

A	B	Remark
0	0	Collision
0	1	A = ¼
1	0	B = 1/4
1	1	Collision

n = 2, A = (0,1) , B = (0,1,2,3)

A	B	Remark
0	0	Collision
0	1	A
0	2	A
0	3	A
1	0	B
1	1	Collision
1	2	A
1	3	A

$\therefore\ A = \frac{5}{8} = 0.625,\ \ B = \frac{1}{8} = 0.125$

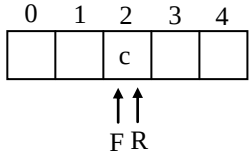
Hence Probability for 'A' is 5/8 = 0.625.

Similarly after 3rd round A(0, 1), B(0, 1, 2, 3, 4, 5, 6, 7)

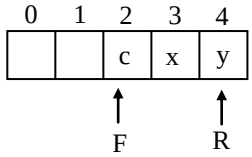
$A = \frac{13}{16} = 0.8125$, $B = \frac{1}{16}$, $C = \frac{2}{16}$.

53. Ans: (c)

Sol: After two deleted



After two inserted



So F = 2

R = 4

54. Ans: (b)

Sol: Let f(x, y) = (2x – y, x – 2y) = (u, v)

$\Rightarrow 2x - y = u$ and $x - 2y = v$

$\Rightarrow x = \frac{2u - v}{3}$ and $y = \frac{u - 2v}{3}$

$\Rightarrow f^{-1}(x, y) = \left(\frac{2x - y}{3}, \frac{x - 2y}{3}\right) \in R \times R \quad \forall$ x, y $\in$ R

55. Ans: (d)

Sol: All are independent transactions operating on different data items then it is equivalent to all possible serial schedules with T_1, T_2, T_3

56. Ans: (d)

Sol: (PART AND THE WHOLE) A fragment is a piece of broken bone; a shard is a piece of broken pottery. (D)

57. Ans: (a)

58. Ans: (d)

Sol: irretrievably means impossible to recover or get back, so irrevocably is the correct synonym, which means not capable of being changed : impossible to revoke.

59. Ans: (b)

Sol: Indiscriminate (adj.) means not discriminating or choosing randomly; haphazard; without distinction.

60. Ans: (a)

Sol: $a_0 = 1$; $a_n = 2a_{n-1}$ if n is odd

$a_n = a_{n-1}$ if n is even

$a_{100} = a_{100-1} = a_{99} = 2.a_{99-1} = 2.a_{99} = 2.a_{98-1}$

$= 2a_{97}$

$= 2.2a_{97-1} = 2^2.a_{96}$ ..... $2_{50}.a_0 = 2^{50}$

61. Ans: (c)

Sol: A = 1; B = 1

(a) B = B + 1 = 2

(b) & (c) A = A × B = 1 × 2 = 2

Step 2: B = 2 + 1 = 3; A = A×B = 2 × 3 = 6

Step 3: B = 3 + 1 = 4; A = A×B = 6×4 = 24

Step 4: B = 4 + 1 = 5; A = 24 × 5 = 120

Step 5: B = 5 + 1 = 6; A = 120 × 6 = 720

62. Ans: (a)

Sol: Ratio of efficiency (P & Q) = 2 : 1

Ratio of efficiency (P + Q, R) = 3 : 1

If R does 1 unit work, then P& Q together do 3 units.

Out of 3 units, P does 2 units and Q does 1 unit.

$\therefore$ Ratio of efficiency (P, Q & R) = 2 : 1 : 1

Hence, earnings should be divided in the ratio is 2 : 1 : 1

63. Ans: (c)

Sol: In 1972, A was as old as the number formed by the last two digits of his year of birth.

So, A was born in 1936 (as in 1972, he is 36 yrs older also, last two digits of 1936 are 36).

Hence, B was born in 1936 + 15 = 1951

so, he is 21 yrs old in 1972

64. Ans: (b)

Sol: Difference (in thousands) between the numbers of customers in the 2 complexes in:

January: 22 – 20 = 2

February: 25 – 24 = 1

March: 20 – 15 = 5

April: 28 – 25 = 3

May: 20 – 14 = 6 [Max]

June: 20 – 15 = 5

65. Ans: (b)

Sol: The issue is more about punishing criminals and so punishment is more important than crime prevention (correct answer B).