Answer Keys

1	B	**2**	B	**3**	15	**4**	D	**5**	C	**6**	18	**7**	C
8	205	**9**	C	**10**	3	**11**	A	**12**	B	**13**	A	**14**	C
15	B	**16**	B	**17**	D	**18**	B	**19**	D	**20**	A	**21**	B
22	B	**23**	B	**24**	6	**25**	C	**26**	A	**27**	C	**28**	A
29	C	**30**	A	**31**	B	**32**	A	**33**	B	**34**	D	**35**	A
36	C	**37**	A	**38**	D	**39**	B	**40**	B	**41**	D	**42**	1.5
43	20	**44**	A	**45**	3	**46**	C	**47**	250	**48**	2	**49**	7
50	C	**51**	A	**52**	C	**53**	B	**54**	D	**55**	B	**56**	B
57	C	**58**	B	**59**	A	**60**	D	**61**	D	**62**	B	**63**	C
64	C	**65**	A										

Explanations:-

1. One temporary variable is required atmost.

2. 1.000000 is printed but not 1.2 because 6 & 5 are both integers 6/5 yields integer 1. This 1 when stored in 'a' is converted into 1.000000

3. Number of moves required to solve the puzzle is $2^n - 1$ (where n is the number of disks) $= 2^4 - 1 = 15$

4. Since A is orthogonal, $A^TA = AA^T = I$

$$|A^TA| = |AA^T| = |I| \Rightarrow |A^T||A| = |A||A^T| = |I|$$

$$|A|^2 = 1 \ \left(\because |A| = |A^T|\right) \Rightarrow |A| = \pm 1$$

5. Choosing a labelled graph on n vertices is equivalent to choosing, for each of the $\binom{n}{2}$ = n(n-1)/2 possible edges, whether or not to include that edge: 2 choices for each possible edge, which by the product principle means 2 × 2 × . . . × 2 = $2^{n(n-1)/2}$ choices overall.

6. 6. ${}^nc_2 = 153$

$$\frac{n \times (n-1)}{2} = 153$$

$$n \times (n-1) = 306$$

$$n^2 - n - 306 = 0$$

$$\Rightarrow n(n-1) = (18)(17)$$

$$\therefore \quad n = 18$$

7.

A	B	1	2	3
1010	1011	0001	0010	0011

010	101	011	000	100	100	011
2	5	3	0	4	4	3

8. $k+(n-1)=6+(200-1)=205\text{ cycles}$

9. CFL's are closed under substitution but not under intersection. Regular languages are not closed under infinite union but under finite union and substitution.

10. String 010 is not present in 's' but present in 'r' whose length is 3.

13. If only one CPU has to get the bus then all other processors should not get, so probability that only one processor gets the bus is $p(1-p)^{n-1}$ and that one processor can be any of total n processors. So required probability will be $np(1-p)^{n-1}$.

14. The scanf function is such that it terminates its input on the first white space. It finds only the string 'Good' which will be read into the array w1. Since the blank space after Good will terminate the string.

15. A vertex 'v' is an articulation point in the graph iff deleting v disconnects the graph

19. $ABCD = I$

$\Rightarrow BCD = A^{-1}$

$\Rightarrow BC = A^{-1}D^{-1}$

$\Rightarrow B = A^{-1}D^{-1}C^{-1} \Rightarrow B^{-1} = \left(A^{-1}D^{-1}C^{-1}\right)$

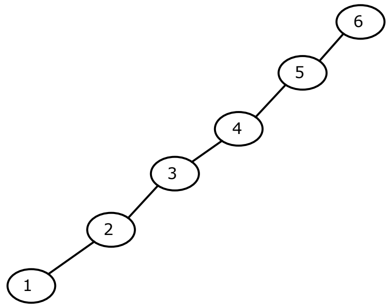
$\Rightarrow \bar{B}^{1} = CDA$

$\Rightarrow \left(\overset{-1}{B}\right)^{T} = A^{T}D^{T}C^{T}$

20. $(*+234)+(5**678)+9$

$$|A-\lambda I| = \begin{vmatrix} 6-\lambda & -2 & 2 \\ -2 & 3-\lambda & -1 \\ 2 & -1 & 3-\lambda \end{vmatrix}$$

21. Decreasing order. 6, 5,4,3,2,



23. Take alternate vertices of the cycle.

24. Total number of subset of set n is:

$^nC_0 + {}^nC_1 + {}^nC_2 + \ldots\ldots\ldots\ldots {}^nC_n = 2^n \Rightarrow {}^n C_0$ is even likewise $^nC_2$

$^nC_0 + {}^nC_2 + \ldots\ldots\ldots\ldots {}^nC_n = 2^n - \left({}^nC_1 + {}^nC_3 + \ldots \right) -----(1)$

We know that

$^nC_0 - {}^nC_1 + {}^nC_2 - {}^nC_3 \ (-1)^n \, {}^nC_n = 0$

$^nC_0 + {}^nC_2 + \ldots. = {}^nC_1 + {}^nC_3 + \ldots.$ ------------(2)

From (1) and (2) we have 32+32=$2^n \Rightarrow n = 6$

25. The 40-20-40 rule-of-thumb suggests that 40% of the resources should be spent on analysis and design, 20% on coding , and 40% on testing.

26. R=$\{(1,1)(2,2)(3,3)(1,2)\}$ $\quad$ $S = \{(1,1)(2,2)(3,3)(1,3)\}$

$\Rightarrow$ R-S=$(1,2)$ irreflexive; $S - R = (1,3)$irreflexive

28. The following combinations are possible with the given condition

HHTTT, HHHTT,HHHHT

Number of ways of arranging HHTTT = $\frac{5!}{2!3!} = 10$

Number of ways of arranging HHHTT = $\frac{5!}{3!2!} = 10$

Number of ways of arranging HHHHT = $\frac{5!}{4!} = 5$

Therefore total number of ways = 10+10+5 = 25

Hence the required probability $= \frac{25}{32}$

29. $\underset{\left(\text{Consensus term}\right)}{(a'+b)} . \underbrace{(c'+b).(a'+c)}_{\text{and gate}} = (c'+b)(a'+c)$ $(\because \text{Consensus theorem})$

$(c'+b)(a'+c) = c'c + a'c' + a'b + bc = a'c' + bc \left[\because a'b \text{ is consensus term}\right]$

31. It will push 'X' for first 'a' and all other a's will be bypassed. Whenever b encounters it will pop X and bypasses all other b's

32. If we put 0 in rightmost 32-26=6 bits, we get 1st address, if we put 1 in rightmost 6 bits, we get last address.

33. $R = 5\text{Mbps};\ d = 25 \times 200 = 5000;\ M = 25;\ b = 7.5\text{bits}$

$v = 2 \times 10^8 \text{m / sec}$

$RL = \frac{d}{v} + \frac{Mb}{R}\sec = \frac{5000}{2 \times 10^8} + \frac{25 \times 7.5}{5 \times 10^6} = 62.5\mu\sec$

$RL = {}^{dR}\!/_{v} + Mb \text{ bits} = 312.5\text{bits}$

35. $|A-\lambda I| = \begin{vmatrix} 6-\lambda & -2 & 2 \\ -2 & 3-\lambda & -1 \\ 2 & -1 & 3-\lambda \end{vmatrix}$

$= (6-\lambda)\left\{(3-\lambda)^2 - 1\right\} - 2\left\{-2+2(3-\lambda)\right\} + 2\left\{2-2(3-\lambda)\right\}$

$= (6-\lambda)(3-\lambda-1)(3-\lambda+1) - 2(4-2\lambda) + 2(2\lambda-4)$

$= (2-\lambda)\left\{(6-\lambda)(4-\lambda) - 4 - 4\right\} = (2-\lambda)\left(\lambda^2 - 10\lambda + 16\right)$

$= (2-\lambda)(\lambda-8)(\lambda-2)$; Least eigen value =2

Then $(A\text{-}\lambda I)X = 0$; $(A\text{-}2I)X = 0$

$$\begin{bmatrix} 6-\lambda & -2 & 2 \\ -2 & 3-\lambda & -1 \\ 2 & -1 & 3-\lambda \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$\Rightarrow$ For λ=2, $\begin{bmatrix} 4 & -2 & 2 \\ -2 & 1 & -1 \\ 2 & -1 & 1 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$

$$\left.\begin{aligned} 4x - 2y + 2z &= 0 \\ -2x + y - z &= 0 \\ 2x - y + z &= 0 \end{aligned}\right\}$$ All the three equations reduce to the single equation

2x-y+z=0; Let $x=k_1$; $z=k_2$; $y=2k_1+k_2$

$$\therefore X = \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} k_1 \\ 2k_1 + k_2 \\ k_2 \end{bmatrix}$$

For $k_1 = k_2 = 1$, $X = \begin{bmatrix} 1 & 3 & 1 \end{bmatrix}^T$

37. Number of ways a train made to stop 'p' times of 'n' intermediate stations between two places such that no two stopping's are consecutive are

$(n - p + 1)C_p$

$= (12 - 4 + 1)\, C_4$

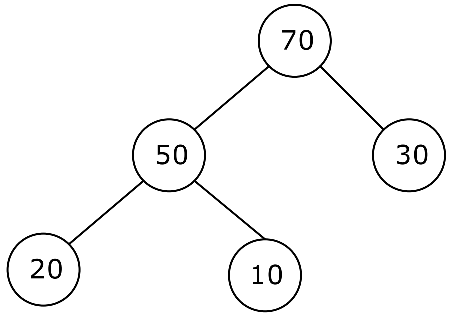
$= 9\, C_4$

38. $\dfrac{(n-k)(n-k+1)}{2}$

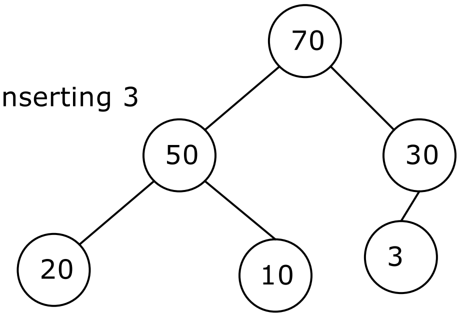
all k-1 component of vertex single and kth component of complete graph.

40. For full m-ary tree with h height, $l \le m^h$

41.



After inserting 3



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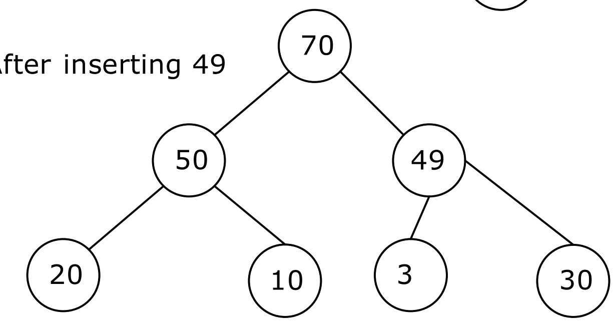

42. $$EAT = h_t\left(t_t + t_m\right) + \left(1 - h_t\right)\left[p * \left(t_t + (n+1)t_m\right) + (1-p) * t_d\right]$$
$$= 0.7 * (0 + 5\ \mu s) + 0.3 * \left[0.8\left(0 + 2 * 5\ \mu s\right) + 0.2 * 25\ ms\right]$$
$$= 3.5\ \mu s + 0.3 * \left[8\ \mu s + 5000\ \mu s\right]$$
$$= 1505.9\ \mu s = 1.5\ ms$$

43. Efficient compaction is the one which moves the less amount of memory, 'P4' can be moved to
Free a chunk of 20 K Bytes.

44. A, BC are keys B→F violates the 2NF definition

45. The output table is

Customer	**Sum (order_ price)**
Rakesh	400
Ramesh	300
Suresh	1000

47. Average cycle for an instruction

$= 8\times 0.3 + 4\times 0.2 + 12\times 0.3 + 12\times 0.2$

$= 9.2$ cycle per instruction

Clock frequency is $2.3\ \text{GH}_2$

2.3×10^9 cycle $-$ 1 second

2.3×10^9 cycle $- \dfrac{2.3\times 10^9}{9.2}$ Instruction $= 250$ MIPS

48.

0	
1	
2	
23	3 ← 103
34	4
103	5
6	6
17	7
48	8
99	9

49. When we insert 333 in the above hash table, hash function will return location number "3", which is already occupied, so there will be collision. With linear probing there will be six more collisions from locations '4' to '9' and 333 will be placed at location '0'. Hence there will be total 7 collisions.

50. 1 rotation - $\dfrac{1}{40}$ sec ; $\dfrac{1}{40}$ sec $-$ 62500bits

$1\,\text{sec} - 62500\times 40\text{bits}$

$= \dfrac{62500\times 40}{1000\times 8}$ k bytes

$= \dfrac{625}{2} = 312.5$k bytes

51. Each sector 256 bytes + 4 bytes (control) = 260bytes

Number of sectors $= \dfrac{62500}{260\times 8} = \dfrac{62500}{2080} = 30.04$

52. C, D and F are the useless symbols in given grammar.

53. After removal of useless symbol the grammar will be

$S \to aBA$

$A \to aAE / E$

$B \to b$

$E \to eE / e$

$A \to E$ is the only production which is not according to GNF.

54. Time for an instruction in non-pipeline system=40 + 10 + 25+ 15= 90ns.

55. Speedup factor=time in non-pipeline/time in pipeline=90/40=2.25

56. Use positive degree (smart) before enough

58. A, C, D are alloys
B is pure metal

59. Sky, Fly has no vowels
Cry, Fry has no vowels

60. Atul's rank = 8^{th}
Madhu's rank = 8+5 =13^{th}
Madhu's rank from the bottom = 30 – 13+1 = 18^{th}

62. $7x + 5y = 60$

Where x is number of children whose age is 7
Where y is number of children whose age is 5 i.e. x=5, y=5.
But $7a + 5b = 48$

That is only when $a = 4$ & $b = 4$

Total ways $= 5C_4 \times 5C_4 = 25$

63. Let the quantity of the milk in the container originally be x litres.
Then quantity of milk left in container after 3 operations =

$$\left[x\left(1-\frac{6}{x}\right)^3\right] \text{litres} \Rightarrow \left(\frac{x-6}{x}\right)^3 = \frac{27}{64} = \left(\frac{3}{4}\right)^3$$

$$\frac{x-6}{x} = \frac{3}{4} \Rightarrow 4x - 24 = 3x \quad \therefore \; x = 24$$

64.
$$\begin{matrix} 4 & a & 3 \\ 9 & 8 & 4 \\ 13 & b & 7 \end{matrix} \Rightarrow \quad a + 8 = b; \;\; b - a = 8$$

Also, 13b7 is divisible by 11

$= (7+3) - (b+1) = (9-b)$

$= 9 - b = 0, \;\; b - a = 8, \;\; b + a = 10$

$(b-a).(b+a) = 80$

65. In 1997 $\frac{E}{I} = 1.75$ i.e, $E = 1.75I$

Now required Imports =

$I + 40\% \text{ of } I = 1.4I$

$\text{Ratio} = \frac{1.75I}{1.4I} = \frac{175}{140} = \frac{5}{4}$