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Answer Keys

1	C	**2**	D	**3**	D	**4**	C	**5**	C	**6**	D	**7**	D
8	C	**9**	C	**10**	A	**11**	D	**12**	D	**13**	A	**14**	D
15	A	**16**	C	**17**	B	**18**	D	**19**	C	**20**	A	**21**	B
22	A	**23**	B	**24**	C	**25**	C	**26**	B	**27**	D	**28**	C
29	B	**30**	D	**31**	C	**32**	A	**33**	C	**34**	D	**35**	D
36	B	**37**	D	**38**	C	**39**	C	**40**	B	**41**	D	**42**	A
43	B	**44**	A	**45**	C	**46**	616	**47**	B	**48**	D	**49**	B
50	C	**51**	C	**52**	A	**53**	C	**54**	B	**55**	C	**56**	D
57	D	**58**	B	**59**	A	**60**	A	**61**	C	**62**	D	**63**	A
64	C	**65**	D										

Explanations:-

3. K_n contains $\frac{(n-1)!}{2}$ different Hamiltonian circuits.

4. Number of reflective relations $= 2^{n^2-n} = 2^{25-5} = 2^{20}$

   $(n = \text{Number of elements in a set})$

5. First, note that

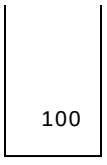
$$\lim_{n\to\infty}\left(\frac{n+2}{n+1}\right)^{2n+3} = \lim_{n\to\infty}\left(1+\frac{1}{n+1}\right)^{2(n+1)+1} = \lim_{n\to\infty}\left(\left(1+\frac{1}{n+1}\right)^{(n+1)}\right)^2\left(1+\frac{1}{n+1}\right)$$

$$= e^2 \times 1 = e^2 \left(\because \left[1+\frac{1}{(n+1)}\right]^{n+1} = e\right)$$

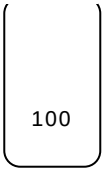
6.

Clocks	1	2	3	4	5	6	7	8	9	10
Load	FI	DA	FO	EX						
ADD		FI	DA	-	FO	EX				
INC			FI	-	DA	-	FO	EX		
Store				-	FI	-	DA	-	FO	EX

7. Let $R_1 = 100$



$R_1 = 104$
$R_2 = 100$
$R_3 = 104$



$R_1 = 100$

No change on R_1

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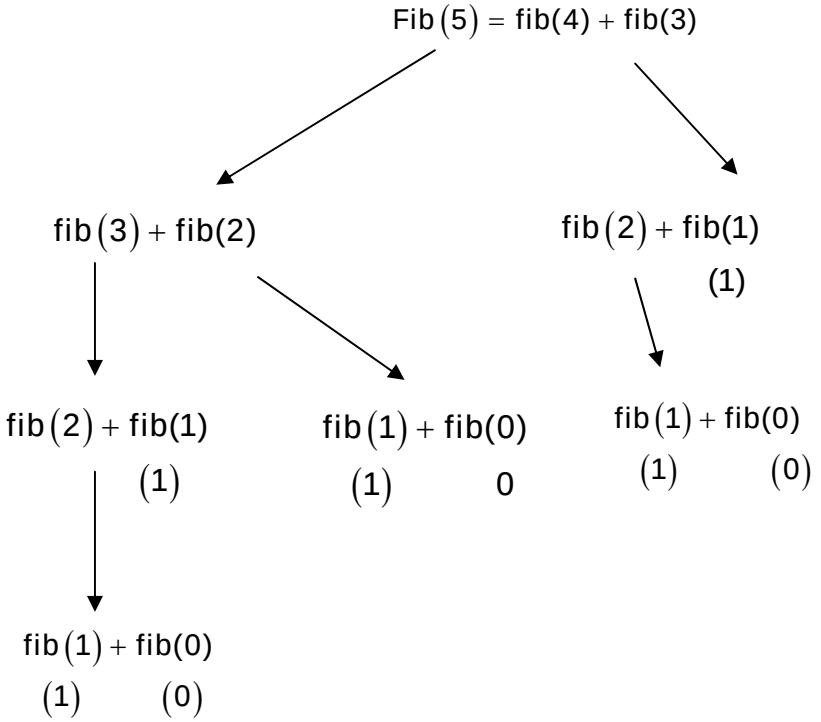
13.



15.

S	R	P	T	Q

0 8 14 16 26 30

$$\text{average response time} = \frac{0+8+14+16+26}{5} = \frac{64}{5} = 12.8 \text{ mins}$$

16. E.M.A.T. $= (1-p) \times ma + p$x page fault service time

where p = page fault rate

EMAT $= 0.75 \times 200 + 0.25 \times 2000000$ ns $= 500150$ n.s

18. Size of disk = 40GB; Disk block size = 4kB

Number of blocks in the disk = $\frac{40 \times 2^{30}}{4 \times 2^{10}}$ = 10M blocks

In Bitmap method each block needs 1 bit $\Rightarrow$ We need 10M bits

Number of blocks for keeping track of free space = $\frac{10 \times 2^{20}}{4 \times 2^{10} \times 8}$ = 320 blocks

19. Key; xy,zy ; $z \rightarrow x$ Violates BCNF condition

22. For full m-ary tree, total nodes = m*internal nodes + 1

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26. We can model the problem as distribution of 30 similar balls into 5 distinct boxes. First distribute

2 ball in box 1

3 balls in box 2

4 balls in box 3

5 balls in box 4 and

6 balls in box 5

These leaves 10 balls to be distributed into 5 boxes with unlimited repetition

i.e. $c(5+10-1,10) = c(14,10)$

Alternate solution : As $x_i \geq i$; Consider $y_i = x_i - (i+1), y_i \geq 0$

So we can transform; $x_1 + x_2 + x_3 + x_4 + x_5 = 30$

$(x_1 - 2) + (x_2 - 3) + (x_3 - 4) + (x_4 - 5) + (x_5 - 6) = 30 - 20$ to

$y_1 + y_2 + y_3 + y_4 + y_5 = 10$; $y_i \geq 0$

Number of possible solutions for this linear equation are

$^{n+r-1}C_{r-1} = {}^{10+5-1}C_{5-1} = {}^{14}C_4 = {}^{14}C_{10}$

27. The characteristic polynomial of A is found from the equation $|A - \lambda I| = 0$

$\begin{vmatrix} 3-\lambda & 1 \\ -1 & -1-\lambda \end{vmatrix} = 0.$; This determinant evaluates to the polynomial $\lambda^2 - 2\lambda - 2 = 0$.

28. $p(9.6 \leq x \leq 13.8) = p(x \leq 13.8) - p(x \leq 9.6) = \phi\left(\frac{13.8-\mu}{2}\right) - \phi\left(\frac{9.6-\mu}{2}\right)$

$p(x > 9.6) = 1 - p(x \leq 9.6) = 1 - \phi\left(\frac{9.6-\mu}{2}\right)$

$\phi\left(\frac{13.8-\mu}{2}\right) - \phi\left(\frac{9.6-\mu}{2}\right) = 0.7008 \Rightarrow \phi\left(\frac{13.8-\mu}{2}\right) = 0.7008 + 1 - 0.8159$

$\Rightarrow \phi\left(\frac{13.8-\mu}{2}\right) = 0.8849 = \phi(1.2) \Rightarrow \frac{13.8-\mu}{2} = 1.2 \Rightarrow \mu = 11.4$

30. Vertex connectivity is minimum number of vertices removal of which will make the graph disconnected. Edge connectivity is the minimum number of edges removal of which will make the graph disconnected.

31. 4 gate levels are required.

After one level all Pi's and Gi's are available.

After two gate levels (AND followed by OR) all Ci's are available and after one more gate level(XOR) all Si's are available.

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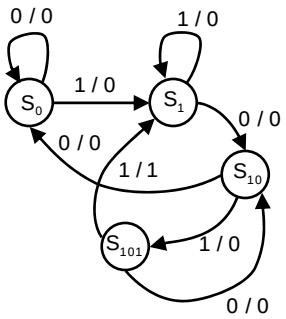
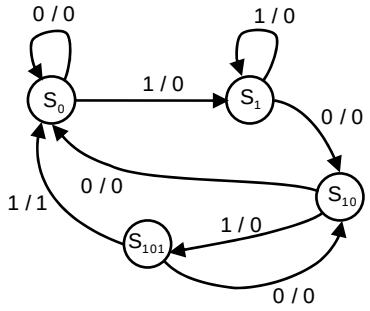
32.



Sequence detector with overlap



Sequence detector without overlap.

33. $f = \bar{A}C + AB$

37. Language contains all the strings of even length

38. LL(1) Parsing Table

	(	)	int	+	*	$
S	$S \to XY$		$S \to XY$			
X	$X \to (S)$		$X \to \text{int}\, W$			
Y		$Y \to \in$	$Y \to +S$			$Y \to \in$
W		$W \to \in$	$W \to \in$		$W \to *X$	$W \to \in$

42. Final content:

56	93	23	87	32	65	26
0	1	2	3	4	5	6

After one pass of bubble sort content will be,

56	23	87	32	65	26	93
0	1	2	3	4	5	6

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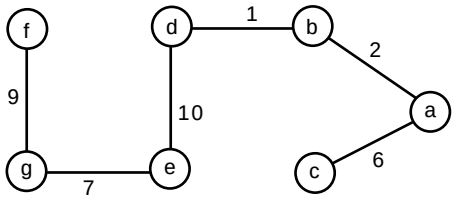
43. No vertex should appear in sequence before its predecessor.

44. If we solve the above problem by using dynamic programming the shortest path would be getting as ABGIK whose cost is 17. (ADGIK is another path with the same cost)

45. Vertex H is pushed twice for backtracking

47.



52. $1\text{sec} - 10^6, 1\mu\text{sec}$ - 1 instruction

Bus can have two characters

2 characters - $\frac{2}{2400} = \frac{1}{1200} \times 10^6 \mu\text{sec}$

$= 833.3\mu\text{sec}$; $\frac{x}{100} \times 10,00000 = 833.3, x = 0.0833\%$

53. 4 characters

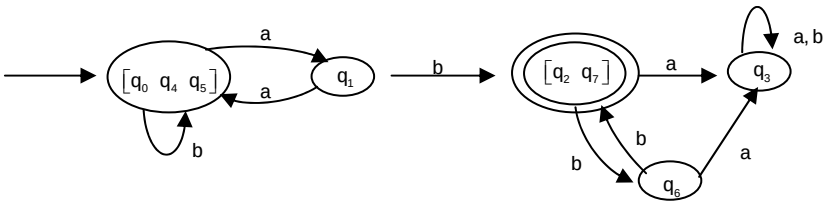
$\frac{4}{2400}\text{sec} = \frac{1}{600} \times 10^6 \mu\text{sec} = 1666.66\mu\text{sec}$

$\frac{x}{100} \times 10,00000 = 1666.66$

$x = 0.166666$, difference = 0.0833%

54. The number of equivalence classes = number of states in minimum DFA

Minimized DFA is shown below



55. The above DFA contains 4 non final states and 1 final state

60. L.C.M. of 16, 24 and 54 will give us interval of change $= 432$ sec $= 7$ min 12 sec

Now, for 37 min, the number of intervals = 37 X 60/432 = 5.1388 = 5 intervals. Therefore, the 3 signals will change simultaneously 5 times after 5AM.

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61. Rate of filling of water = 4 lts/min = 240 lts/hr. If V is the volume of the tank, rate of emptying of water = V/16 lts/hr. Now, if both inlet and leak are on and the tank takes 24 hours to empty, (V/16 – 240) X 24 = V => V = 11520 Litres.

62. $Q = T - 5$

$S = P - 10 = Q - 8$

Putting the value of T, $Q = 15$ yrs

$S = Q - 8 = 7$ yrs

$P - 10 = Q$

$P = 17$ yrs

But there is no data provided about R

So, we cannot find R's age

Data Inadequate

63. Let the imports in 2004 be I. Therefore, imports in 2005 = 2I. If exports in 2005 are E5, 2I/E5 = 0.65.We Know, I/E4 = 0.55 (E54 are the exports in 2004). Therefore, E5/E4 = 0.55 x 2/0.65 = 1.69. Therefore, (E5-E4)/E4 = 0.69 => 69% increase over 2004 exports.

64. N and R is equivalent to 14 & 18 respectively

$$(N \times R) \div 2 = (14 \times 18) \div 2 = \frac{252}{2} = 126; \quad (T \times Y) \div 5 = (20 \times 25) \div 5 = \frac{500}{5} = 100$$

$$(Y \times P) \div 8 = (25 \times 16) \div 8 = \frac{400}{8} = 50; \quad (K \times L) \div 11 = (11 \times 12) \div 11 = 12$$

$$(G \times ?) \div 14 = (7 \times ?) \div 14 \Rightarrow ? = 26 \Rightarrow Z$$

65. If the newly discovered micro-organism has been identified in several shapes, it can be inferred that (D) there must be some other way besides shape to identify this micro-organism. If this were not the case, scientists wouldn't know that it was the same micro-organism they were seeing when it took on different shapes.

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