Answer Keys

1	B	**2**	B	**3**	A	**4**	6	**5**	4	**6**	B	**7**	B
8	3	**9**	C	**10**	10	**11**	D	**12**	191	**13**	B	**14**	C
15	A	**16**	D	**17**	B	**18**	8	**19**	B	**20**	D	**21**	C
22	12	**23**	B	**24**	C	**25**	C	**26**	19	**27**	3	**28**	C
29	9	**30**	C	**31**	4	**32**	D	**33**	A	**34**	1001	**35**	A
36	A	**37**	D	**38**	D	**39**	A	**40**	D	**41**	B	**42**	A
43	4	**44**	A	**45**	B	**46**	B	**47**	C	**48**	A	**49**	C
50	C	**51**	B	**52**	B	**53**	B	**54**	C	**55**	B	**56**	B
57	A	**58**	C	**59**	A	**60**	B	**61**	C	**62**	D	**63**	B
64	B	**65**	B										

Explanations:-

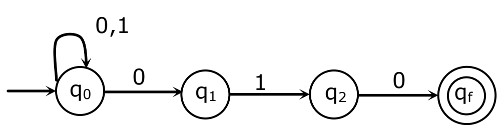
1. Any relation from A to B is a subset of $A \times B$
$|A \times B| = m \times n$, so total subsets are $2^{m \times n}$ which includes empty set
So number of non empty relations from A to B= $2^{m \times n} - 1$

2. $|\varnothing| = 0$; $P(\varnothing) = 2^0 = 1$ so $P(P(P(\varnothing))) = 2^{2^{2^0}} = 4$

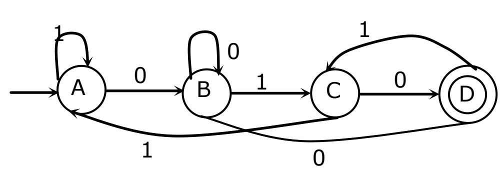
3. Every asymmetric relation is anti-symmetric but every anti-symmetric is not asymmetric.

4. Number of bits to represent hosts = 32-29 = 3.
Hence 2^3 hosts are possible per subnet. However host id 000 and 111 are not usable. Hence number of hosts in each subnet = $2^3 - 2 = 6$

5.



Equivalent of DFA would be



7. W(A), W(A)
Timestamp of (T_1) < Timestamp (T_2) and T_1 has issued write operation on data item (A) which was read by T_2. Hence T_1 is rolled back according to BTS, It is allowed under Thomas write rule by ignoring w(A) of T_1.

8. The sub query returns 'zero' number of rows(empty table). For each of the outer query tuple the condition will return true. Hence all the tuples from outer query will be selected.

9.
$$\begin{array}{lll} & 134.\ 87.\ 8.113 & & 134.\ 87.\ 8.121 \\ (\text{AND}) & 255.255.255.248 & (\text{AND}) & 255.255.255.248 \\ \hline & 134.\ 87.\ 8.112 & & 134.\ 87.\ 8.120 \\ \hline \end{array}$$

Hence $255.255.255.248$ is not a valid subnet mask.

10. The number of keys required for n users to communicate each other is $\frac{n(n-1)}{2}$

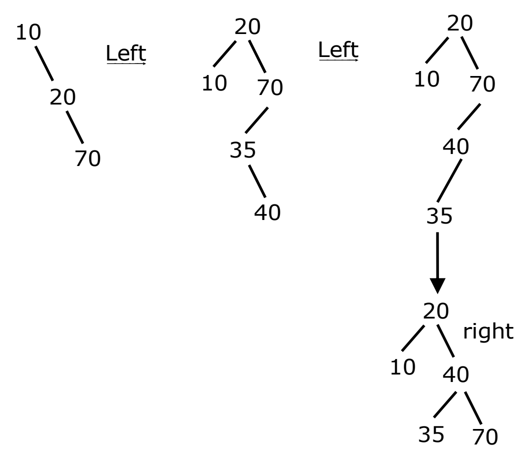
11. C language calling convention is from right to left, first 5 is passed to ++x, then x is incremented to 6, 6 is passed to x + + and its result is passed to 'x' Hence it prints 7,6,6.

12. rec (n) computes $\frac{n(n-1)}{2}+1$.

14.

$$\text{Effective access time} = 0.7(0.2\text{ ms} + 100\text{ ms}) + 0.3(0.2\text{ ms} + 200\text{ ms})$$
$$= 70.14 + 60.06 \Rightarrow 130.2\text{ ms}.$$

15.



$\therefore 2-\text{left},\ 1-\text{right rotations}$

16. PDA construction is not possible for any of the given languages.

17. $\Sigma_{HA1} = 1,\ C_{out\ (HA\ 1)} = 0 = x;\quad \Sigma_{HA2} = 0,\ C_{out\ (HA\ 2)} = 1,\ \ y = 1$

18. AE is the only candidate key and all the super sets of AE are super keys.

19. The 2's complement range -2^{n-1} to $\left(2^{n-1}-1\right)$

20. $Q_{n+1}(A,B,Q_n) = \overline{A}\,\overline{Q_n} + B\,Q_n$

(A) $1.\overline{Q_n} + 0 = \overline{Q_n}$ which means toggling

(B) $1.\overline{Q_n} + Q_n = 1$ which means set

(C) $0 + 0 = 0$ which means reset

(D) $1\overline{Q_n} + 0 = \overline{Q_n}$, which means toggle

22. $\Rightarrow 16 * 256$

$\Rightarrow 2^4 * 2^8 \Rightarrow 2^{12} \Rightarrow 12$ bits are used for addressing a track.

23. Total number of edges together in G and $\bar{G}$ will be $\frac{n(n-1)}{2}$ since $G \cup \bar{G} = k_n$ $\therefore$ Each of G and $\bar{G}$ must contain $\frac{n(n-1)}{4}$ edges $\Rightarrow n$ or $(n-1)$ must be multiple of 4

24. $f'(t) = 12t^2 + 30t - 18 = 0$

$\Rightarrow 2t^2 + 5t - 3 = 0 \Rightarrow 2t^2 + 6t - t - 3 = 0 \Rightarrow 2t(t+3) - (t+3) = 0 \Rightarrow (t+3)(2t-1) = 0$

$\Rightarrow t = -3$ or $\frac{1}{2}$

26.

	IF	ID	EX	MA	WB
1	I_1				
2	I_1				
3	I_2	I_1			
4	I_2	I_1			
5	I_3	I_2	I_1		
6	I_3	I_2	I_1		
7			I_1		
8			I_2	I_1	
9			I_2	I_1	
10		I_3	I_2		I_1
11		I_3		I_2	I_1
12			I_3	I_2	
13			I_3		I_2
14			I_3		I_2
15			I_3		
16				I_3	
17				I_3	
18					I_3
19					I_3

[I_3 does not goes in ID state until I_1 goes in WB because there is data dependency. So that number of cycle is 19]

27. After eliminating the common subexpressions the code will be as follows
$t_1 = x * y$; $P = t_1 + q$; $r = t_1 * s$; $d = t_1 + u$; $v = t_1$

28. Linked allocation only supports sequential access to disk blocks.

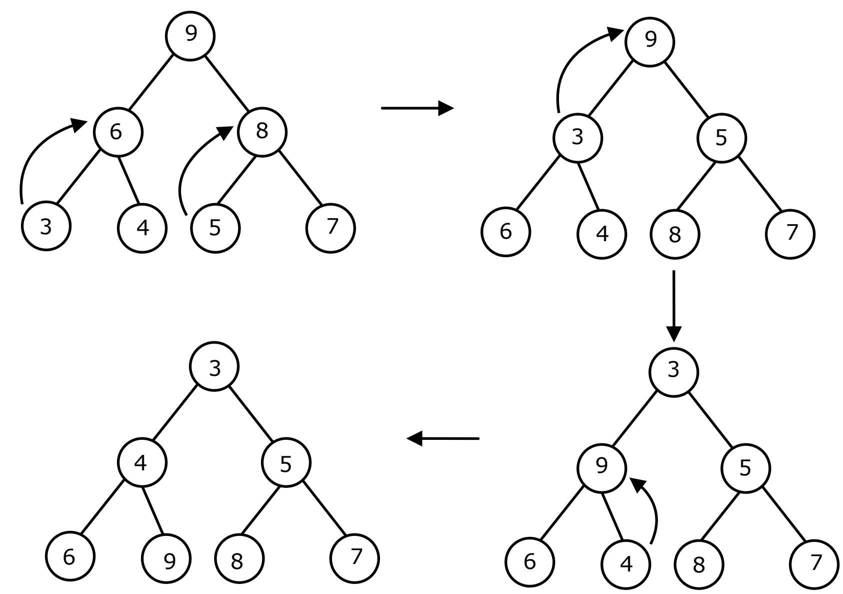
29.

P1	12
	~~13~~14
P2	~~22~~ 21
	23
P3	~~31~~33
	32

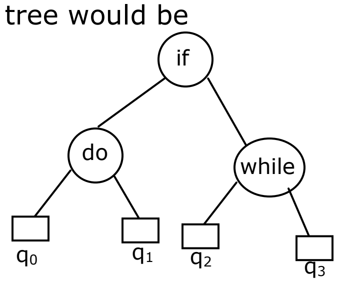
Equal allocation $\rightarrow$ P1 – 2, P2 – 2, P3 – 2
Number of page faults – 9

30. $n_{C_1} + n_{C_2} + n_{C_3} + ... + n_{C_n} = 2^n$.

31



33. Optimal cost binary search tree would be



Cost = 2(0.3) + 1(0.2) + 2(0.15) + 2(0.05 + 0.15 + 0.1 + 0.05)= 0.6 + 0.2 + 0.3 + 0.7 = 1.8

34. Total time by $kp1 \Rightarrow (k+n-1)*t_p = (5+1000-1)*4\text{ ns} = 4016\text{ ns}$

Total time by $kp2 \Rightarrow (k+n-1)*t_p = (6+1000-1)*3\text{ ns} = 3015\text{ ns}$

Saved time $= 4016 - 3015 = 1001\text{ ns}$

35. F1 and F2 cover each other hence both are equivalent.

36. Either 15 clusters, 16 regions 20-routers (or) 20 clusters – 16 regions – 15 routers.

So total number of entries $= 15+16+20 = 51$; $15 \times 16 \times 20 = 4800$.

37. To break a transposition code, an attacker must construct a look up table for all possible permutations of the n-length cipher text. This will require the attacker to construct a table of size n!. Out of these n! entries, one will be the original plaintext. To represent n! entries we need $\lceil \log_2 n! \rceil$ bits.

38. (d,e) has neither least upper bound nor greatest lower bound.

41. Safe Sequence: $< P_2, P_1, P_3, P_0 >$ so P_0 will execute last.

42. N = 5, p = probability of success $= \frac{30}{100}$; f = probability of failure $= \frac{70}{100}$

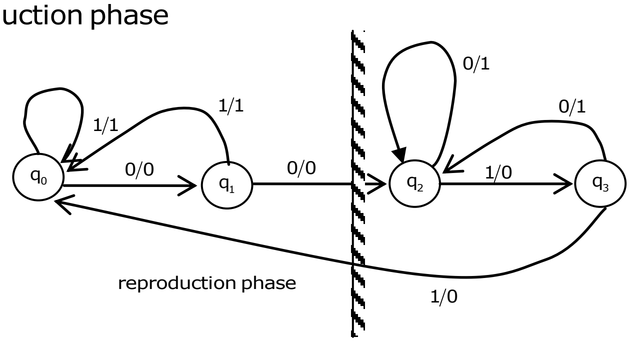
x > 3; Required probability $= p(x=4) + p(x=5) = C(5,4)\left(\frac{3}{10}\right)^4\left(\frac{7}{10}\right) + C(5,5)\left(\frac{3}{10}\right)^5$

43.

$$x = \begin{array}{r|r|r} 0111100 & 011 & 0 \\ 011100 & 100 & 0 \end{array}$$

reproduction phase

Complement phase



44. $(C\,012.25)_H = (1100\ \ 0000\ \ 0001\ \ 0010\ .\ 0010\ \ 0101)_2$

$= (140022.112)_8$

$(10111001110.101)_2 = (2716.5)_8$

$$\begin{array}{r} 140022.112 \\ -\ \ 2716.5 \\ \hline (135103.412)_8 \\ \hline \end{array}$$

45. $x = \frac{1}{t} \Rightarrow \frac{1}{x} = t \qquad \therefore f(x) = t - \frac{1}{x};$

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} = x_n - \frac{t - \frac{1}{x_n}}{\frac{1}{x_n^{\,2}}} = x_n - x_n(t\,x_n - 1) = x_n(2 - tx_n)$$

47. G_1 $\begin{array}{l} S \to aSc \mid B \\ B \to aBb \mid \in \end{array}$ $\qquad L = \{a^i b^j c^k \mid i = j + k\}$

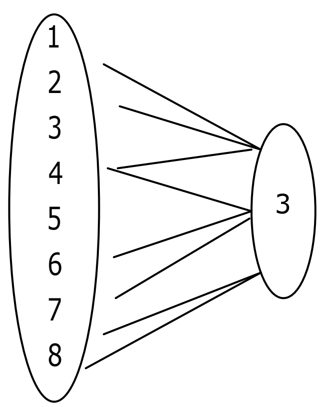
G_2 $\begin{array}{l} S \to aSc \mid B \\ B \to bBcc \mid \in \end{array}$ $\qquad L = \{a^i b^j c^k \mid k = i + 2j\}$

G_3 $\begin{array}{l} S \to aSc \mid B \\ B \to bBc \mid \in \end{array}$ $\qquad L = \{a^i b^j c^k \mid k = i + j\}$

48. $A = \{1,2,3,4,5,6,7,8\}\ \ B = \{3\}.$

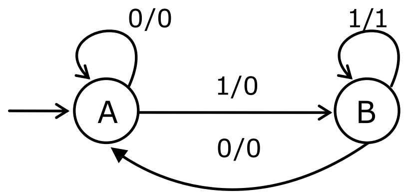
Number of one to one functions from B to A $= 8_{P_1} = 8.$

49. Only one onto function is possible from A to B which is shown below.

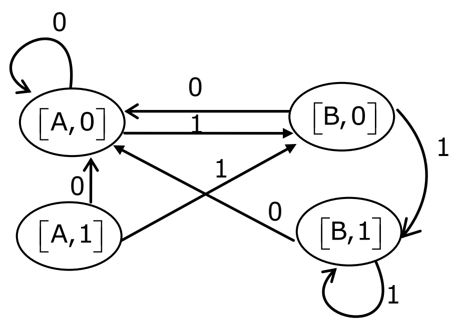


only "1".

50 & 51. Minimized Mealy Machine is



The equivalent Moore Machine is



52. For semi detached, effort $E = a_b * (KLOC)^{b_b} = 3.0 * (10)^{1.12} = 39.55$ person – month.

53. Duration $D = c_b * (E)^{d_b} = 2.5 * (39.55)^{0.35} = 9$ months

54. Blocking factor $= \left\lfloor \frac{1024}{100} \right\rfloor = 10$

number of blocks required to store employee file $= \left\lceil \frac{30000}{10} \right\rceil = 3000$

blocking factor of index file $= \left\lfloor \frac{1024}{9+6} \right\rfloor = 68$

number of first level index blocks $= \left\lceil \frac{30000}{68} \right\rceil = 442$ (as it is dense index)

55. $\lceil \log_2 442 \rceil + 1 = 10$ block accesses

56. (**X** tries to bring down **Y**)

60. $n(s) = 52, \quad n(E) = 2$

$P(E) = \frac{n(E)}{n(s)} = \frac{2}{52} = \frac{1}{26}$

62. Number of digits from 1 to 99 = 189
Number of digits from 1 to 999 = 2889
Since 2777 is in between 189 & 2889.
So it has to be present in somewhere in the range of 100 to 999
We need to find 2777^{th} term after 1.
i.e $2777-189=2588^{th}$ term after 99.
Dividing 2588 by 3 we get 862 and remainder 2
ie., our answer is the 2^{nd} digit of the number that occurs after 862th number after 99.
862th number after 99 = 862 + 99 = 961
Number after 961 = 962
$\therefore$ Second digit of 962 = 6

63. $4^{71} + 4^{72} + 4^{73} + 4^{74} = 4^{71}\left(1+4+4^2+4^3\right)$
$= 4^{71} \times 85 = 4^{70} \times 340$ is divisible by 10

64. L.C.M of $2, 4, 6, 8, 10$ & $12 = 120$ sec $= 2$ min
In 30 minutes they toll $\frac{30}{2} = 15$ times
But they have already toll once then they start tolling on given intervals
So required number = $15 + 1 = 16$

65. Total no. of employees participated in dancing = $8000 \times 22\% = 1760$
Total no. of female employees participated in dancing = $3000 \times 20\% = 600$
Total no. of male employees participated in dancing = $1760 - 600 = 1160$
Required ratio = $1160:600 = 29:15$