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Answer Keys

1	1296	**2**	D	**3**	D	**4**	A	**5**	B	**6**	C	**7**	D
8	B	**9**	B	**10**	C	**11**	C	**12**	B	**13**	D	**14**	D
15	A	**16**	A	**17**	B	**18**	C	**19**	D	**20**	B	**21**	A
22	A	**23**	A	**24**	B	**25**	3	**26**	B	**27**	D	**28**	C
29	A	**30**	B	**31**	B	**32**	C	**33**	8	**34**	B	**35**	88
36	5	**37**	4.17	**38**	A	**39**	B	**40**	C	**41**	84.6	**42**	D
43	19	**44**	C	**45**	D	**46**	D	**47**	D	**48**	C	**49**	A
50	A	**51**	B	**52**	A	**53**	C	**54**	B	**55**	D	**56**	C
57	D	**58**	B	**59**	C	**60**	A	**61**	A	**62**	B	**63**	A
64	A	**65**	D										

Explanations:-

1. Number of spanning trees possible in a complete graph $k_n\left(n \ge 2\right) = n^{n-2}$; $k_6 = 6^{6-2} = 36 \times 36 = 1296.$

2. The given statement is: For every person x and every person y, if x and y are neighbours, then either x should help y or y will not help x.

$$(\forall x)(\forall y)\left(N(x,y) \to \left(H(x,y) \vee \neg P(y,x)\right)\right)$$

Its negation is

$$\neg\left((\forall x)(\forall y)\left(N(x,y)\right) \to \left(H(x,y) \vee \neg P(y,x)\right)\right)$$

i.e $(\exists x)\neg\left((\forall y)\left(\neg N(x,y)\right) \vee H(x,y) \vee \neg P(y,x)\right)$

i.e $(\exists x)(\exists y)\neg\left(\neg\left(N(x,y)\right) \vee H(x,y) \vee \neg P(y,x)\right)$

i.e $(\exists x)(\exists y)\left(N(x,y)\right) \wedge \neg H(x,y) \wedge P(y,x)\Big)$

3. $$x_{n+1} = \frac{2}{3}\left[x_n + \frac{a}{2x_n^2}\right]$$

$$= x_n - \frac{1}{3}x_n + \frac{a}{3x_n^2} = x_n - \frac{(x_n^3 - a)}{3x_n^2}, \text{gives cube root of 'a'}$$

4. OSPF is an implementation of Link State protocol.

In Link state Routing the flooding technique is used to exchange routing table with other nodes in a network.

Choke Packet is a congestion control technique where the packet is sent from any node to the source directly to inform it of congestion but not to the upstream node.

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6. 80386 processor has 32-bit address capacity hence it is capable of accessing $2^{32} = 2^2 \times 2^{30} = 4\,\text{GB} = 4096$ MB of main memory.

7. $CK = \{XU, ZU, VU\}$
partial dependencies are as follows :–
$x \to y, v \to y$.

8. Candidate key is A and $B \to C, C \to B$ are transitive dependencies and there are no partial dependencies. Hence it is in 2NF but not in 3NF

10. Available Window size in B=6000-2000=4000 B.
So in A, window size=min (rwnd, cwnd) =min(4000,3500)B=3500 B

12. Quick, insertion and selection sorts take n^2 time in worst case. Heap sort takes $n \log n$ time in any case.

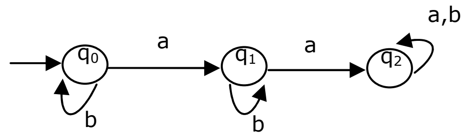
13. Sum of max. needs $\le$ no. of processes $+$ total no. of resources
$18 \le 4 + x$
$\Rightarrow x > 14$

14. Mean np= 2.50
Variance, npq = 1.25
$\Rightarrow \frac{npq}{np} = \frac{1.25}{2.5}$
$q = 0.5; \quad p = 0.5$
$n(0.5) = 2.50 \Rightarrow n = 5$
$P(x < 2) = P(x = 0) + P(x = 1) = 5_{C_0}\left(\frac{1}{2}\right)^5 + 5_{C_1}\left(\frac{1}{2}\right)^5$
$= \frac{6}{2^5} = \frac{6}{32} = \frac{3}{16}$

15. 12*4+0*3+8*3+0*2+x*3=5*(4+3+3+2+3)
So X=1 and output data rate of leaky bucket becomes 1Mbps

16. If L_1 is decidable, then L_2 should also be decidable.

17. Example: No. of a's at least '2' Contains 3 states



No. of a's at least 'n' Contain (n+1) states

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18. None of the rows will be returned since the clause "IN' will return false when compared with nulls.

19.

	$\bar{a}\,\bar{b}$	$\bar{a}\,b$	$a\,b$	$a\,\bar{b}$
$\bar{c}\,\bar{d}$		1	1	
$\bar{c}\,d$	1	1	1	1
$c\,d$				
$c\,\bar{d}$				

This is k – Map for $b\bar{c} + \bar{c}d$

	$\bar{A}\,\bar{B}$	$\bar{A}\,B$	$A\,B$	$A\,\bar{B}$
$\bar{c}\,\bar{d}$		1	1	
$\bar{c}\,d$	1	1	1	1
$c\,d$				
$c\,d^1$				

$f = b\bar{c} + \bar{c}d$

	$\bar{A}\,\bar{B}$	$\bar{A}\,B$	$A\,B$	$A\,\bar{B}$
$\bar{c}\,\bar{d}$		1	1	
$\bar{c}\,d$	1	1	1	1
$c\,d$				
$c\,d^1$				

$f = b\,\bar{c}\,d + \bar{a}\,\bar{c}\,d + b\,\bar{c}\,d + a\,\bar{c}\,d$

So functionally $b\,\bar{c} + \bar{c}\,d = b\,\bar{c}\,d + \bar{a}\,\bar{c}\,d + b\,\bar{c}\,d + a\,\bar{c}\,d$

20.

xy \ WZ	00	01	11	10
00	0	P	0	0
01	0	0	1	1
11	1	1	1	1
10	Q	R	0	0

$SOP = yw + xy = y(x + w)$

So. P, Q, R are all zero's.

21. Value assigned in statment 5 will be used in 6 & 7. In statement 9 fresh value will be assigned so in statement 8 register could be assigned to other variable. Similarly value assigned to 9 will be used by statement 10. So at 11-12 register could be assigned to other variable. Similarly it cant be used from 13 to 17 and at 20.

23. A process must have input and output attached to it.

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24. $P = \frac{\partial f}{\partial x} = 4x^3 + 4y$

$q = \frac{\partial f}{\partial y} = 4y^3 + 4x - 4y$

$r = 12x^2;\ s = 4;\ t = 12y^2 - 4$

$r \text{ at } \left(\sqrt{2}, -\sqrt{2}\right) = 24$

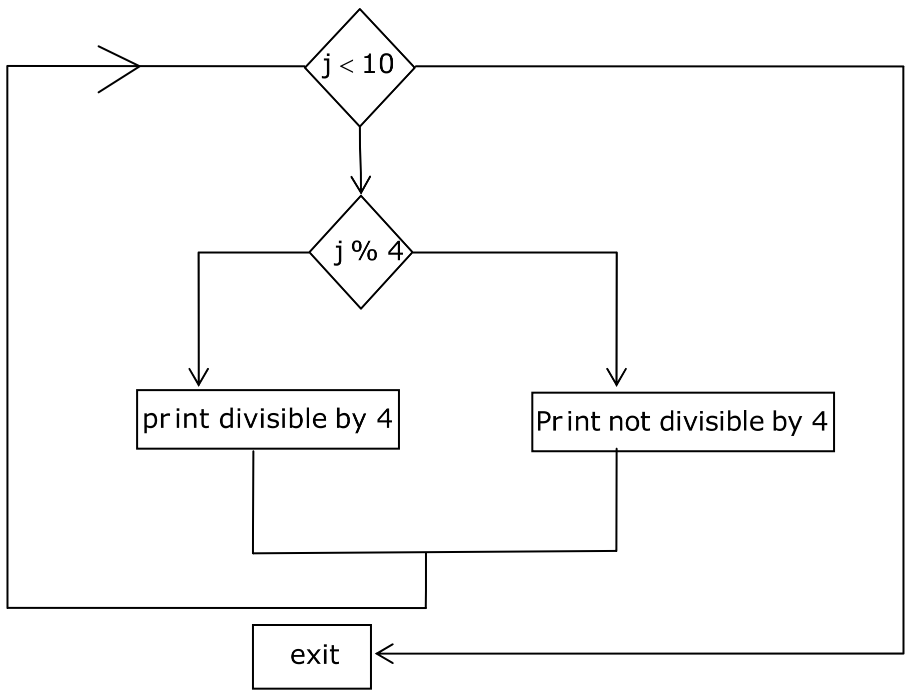
$s \text{ at } \left(\sqrt{2}, -\sqrt{2}\right) = 4$

$t \text{ at } \left(\sqrt{2}, -\sqrt{2}\right) = 20 \quad \therefore rt - s^2 = 464 > 0 \quad \text{and } r > 0$

minimum value exists at $\left(\sqrt{2}, -\sqrt{2}\right)$

minimum is $f\left(\sqrt{2}, -\sqrt{2}\right) = -8$

25.



Number of conditions = 2(P)

Cyclomatic complexity = P+1= 2+1 = 3

26. Page 5 has address ranges from 5120 to 6143 that page is not in main memory so 5124 has page fault.

27. $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 3 & 2 & 1 \end{bmatrix} \times \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 1 \\ 0 & 0 & -1 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ 3 & 8 & 10 \end{bmatrix}$

29. Physical address $= 16$ bits $\Rightarrow$ 64 KB PAS

$\Rightarrow$ size of each partition = 8 KB

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30. (i) degree of $(v_1) = \deg(v_2) = \deg(v_9) = \deg(v_5) = 2$
$\deg(v_3) = 4$

(ii) $\deg(a \text{ or } b \text{ or } c \text{ or } d) = 5, \deg(e) = 4.$

A non- directed multigraph has an Euler circuit if and only if it is connected and all of its vertices are of even degree. So (i) is correct (iv) wrong.

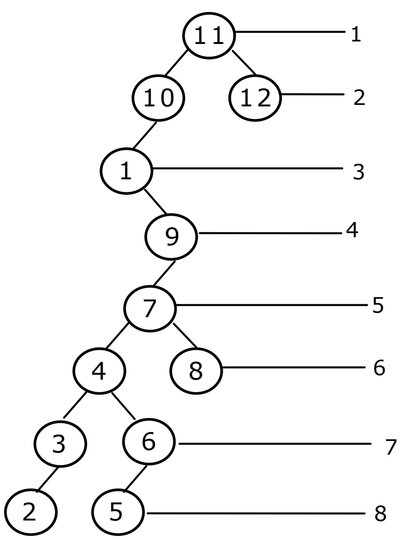
(iii) $\deg(a \text{ or } b \text{ or } c \text{ or } d) = 5, \deg(e) = 4.$

(iii) There is a non-reachable vertex is there. So there is no Eular path and Euler cycle

31. It's a implementation of DIVISION [÷] operation using CARTESIAN PRODUCT [×] and MINUS [-].

32. Values of n & i on each iteration are
15, 30
45, 90
135, 270
As 135 > 100, 270 will be returned.

33.



34. If τ_{n+1} is the expected time for (n+1) the CPU Burst and t_n is the length of nth CPU burst, then
$\tau_{n+1} = \alpha * t_n + (1-\alpha) * \tau_n$ and $\tau_1=4$
$\tau_2 = 0.25 * 4 + 0.75 * 4 = 4$
$\tau_3 = 0.25 * 12 + 0.75 * 4 = 6$
$\tau_4 = 0.25 * 8 + 0.75 * 6 = 6.5$

35. η_1 = Unique operators in program; η_2 = Unique operands in program
Calculated program length by $= \eta_1 \log_2 \eta_1 + \eta_2 \log_2 \eta_2 = 64 + 24 = 88$

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36. Sec 1-> (42+4)-12=34 mb
Sec 2-> (34+4)-12=26 mb
Sec 3->(26 +4)-12=18 mb
Sec 4->(18+4)-12=10 mb
Sec 5->(10+4)-12=2 mb
Sec 6->(2+4)<12

37. Header + data in each segment=1000 B
So data in each segment=1000-40=960 B=960x8 b
So no of segments=ceil $(4\times10^6/(960\times8))=521$.
So overhead=$521*40*8/(4\times10^6)=4.17\%$

38. Characteristic equation is t-3=0, t=3
function of recurrence relation = $n^s.b^n = (n+2).3^n$
recurrence relation $= \phi(n) = 0$
i.e b is characteristic root with multiplicity m.
Complementary function $= G.3^n$
Particular solution $= 3^n\left(An+B\right).n^1$

$$= 3^n\left(An^2+Bn\right) \quad ......(1)$$

Substitute in given recurrance relation

$$3^n\left(An^2+Bn\right)-3.3^{n-1}\left(A(n-1)^2+B(n-1)\right)$$

$$= 3^n(n+2)$$

$$\left(An^2+Bn\right)-\left(A(n-1)^2+B(n-1)\right)=n+2$$

$$\left(B+2A-B\right)=1$$

$$2A=1 \Rightarrow A=\frac{1}{2}$$

$$-A+B=2$$

$$B=\frac{5}{2}$$

Substitute A, B in equation (1)

$$P.G=3^n\left(\frac{n^2}{2}+\frac{5n}{2}\right)$$

The required solution

$$a_n = C_1.3^n+3^n\left(\frac{n^2+5n}{2}\right)$$

$$=\frac{3^n}{2}\left[2C_1+n^2+5n\right]$$

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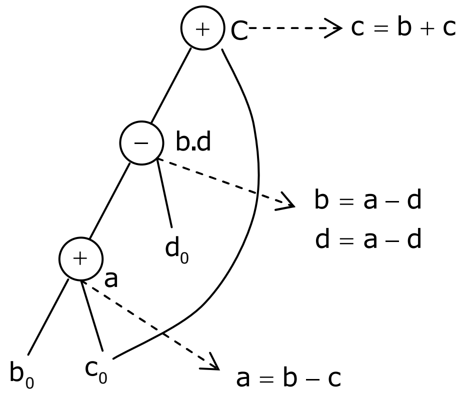
39.

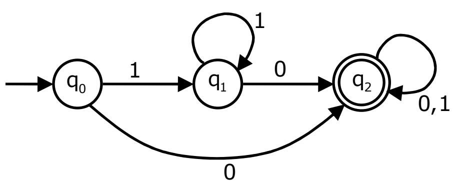


40. $\left(11*0+0\right)\left(0+1\right)*0*1* = \left(11*0+0\right)\left(0+1\right)*$

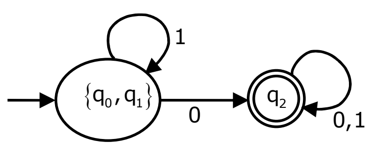
[This is simply because $\left(0+1\right)*$ includes all strings of 0 and 1.

So, a trailing $0*1*$ is redundant.]

The DFA corresponding to $\left(11*0+0\right)\left(0+1\right)*$ is,



Now, $\{q_0, q_1\}$ has the same set of transitions. Hence they can be thought as a single state. [Minimize the DFA]



$\therefore$ R.E. $= 1*0\left(0+1\right)*$

41. $T_{avg} = H_1 T_1 + (1 - H_1) T_2$

$40 = 20H_1 - 150H_1 + 150$

$-110 = 20H_1 - 150H_1$

$H_1 = \dfrac{110}{130} = 0.846 = 84.6\,\%$

$T_2 = 150$ ns

$T_1 = 20$ ns

$T_{avg} = 40$ ns

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42. At $x = 0$

$f(0) = 0 \Rightarrow \quad L.L = \lim_{x \to 0-} f(x) = 0$

$R.L = \lim_{x \to 0+} f(x) = 5 \times 0 - 4 = -4$

$\Rightarrow f(x)$ is discontinuous at $x = 0$

At $x = 1$

$f(1) = 5 \times 1 - 4 = 1$

$L.L = \lim_{x \to 0-} f(x) = 5 \times 1 - 4 = 1$

$R.L = \lim_{x \to 0+} f(x) = 4 \times 1^2 - 3.1 = 1$

$\Rightarrow f(x)$ is continuous at $x = 1$

At $x = 2$

$f(2) = 3 \times 2 + 4 = 10$

$L.L = \lim_{x \to 2-} f(x) = 4 \times 2^2 - 3.2 = 10$

$R.L = \lim_{x \to 0+} f(x) = 3 \times 2 + 4 = 10$

$\Rightarrow f(x)$ is continuous at $x = 2$

43. Basic size $= m \times n = 3 \times 8 = 3 \times 2^3$

$T\ arg\ et$ size $= p \times q = 7 \times 128 = 7 \times 2^7$

No.of levels $= k = \frac{p}{m} \times \frac{7}{3} = \log_n^q = 3$

No.of decoders of size $m \times n$ needed are

$$= \sum_{1=1}^{k} \frac{q}{n^{(k-i+1)}} = \sum_{i=1}^{3} \frac{128}{n^{(3-i+1)}} = \frac{128}{8^3} + \frac{128}{8^2} + \frac{128}{8} = 1 + 2 + 16 = 19.$$

45. Spectral matrix is the resultant diagonal matrix obtained by $D = P^{-1}$ A P.P is modal matrix consisting eigen vectors

But the spectral matrix consists always the eigen values as its principal diagonal elements

$$\therefore D = \begin{bmatrix} -2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 6 \end{bmatrix}$$

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46. V(n,r)= no. of combination of n objects taken r at a time with unlimited repetition.

$V(n,r)=C(n-1+r,r)=(n+r-1)_{C_r}$

Required no. of solutions are same as no. of non-negative integer solutions of equation.

$(x_1+x_2+x_3+x_4+x_5+x_6)+x_7=10$

Required no. of solutions=V(7,10) $=(7+10-1)_{C_{10}}=16_{C_{10}}=16_{C_6}$

48&49. Since, Sujith can win the game in 1^{st}, 3^{rd}, 5^{th}, – – – – –trials

$\therefore P=\frac{1}{6},\ q=\frac{5}{6};P(\text{Sujith wins in }1^{st}\text{ trial})=\frac{1}{6};\ P(\text{Sujith wins in }3^{rd}\text{ trial})=\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{1}{6}$

$P(\text{Sujith wins in }5^{15}\text{ trial})=\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{5}{6}\cdot\frac{1}{6}$

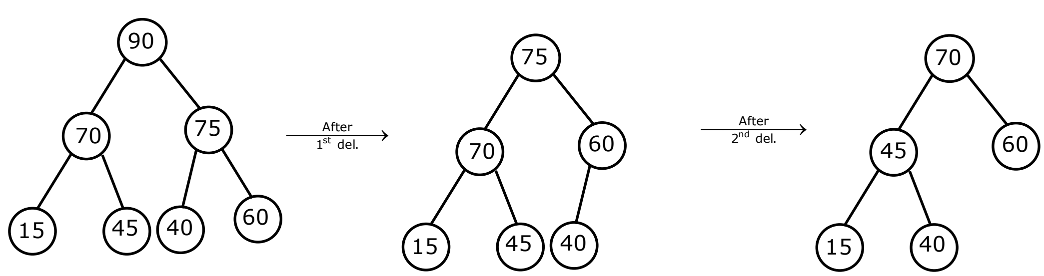
$$\therefore P(\text{sujith wins})=\frac{1}{6}+\left(\frac{5}{6}\right)^2\cdot\frac{1}{6}+\left(\frac{5}{6}\right)^4\frac{1}{6}+......=\frac{\frac{1}{6}}{1-\left(\frac{5}{6}\right)^2}=\frac{6}{11}$$

$\therefore$Expectation of sujith is $\frac{6}{11}\times 2200=\text{Rs}.12000$

$$\text{P (Ajith wins)} = \frac{5}{6}\cdot\frac{1}{6}+\left(\frac{5}{6}\right)^3\frac{1}{6}+\left(\frac{5}{6}\right)^4\cdot\frac{1}{6}+.....=\frac{\frac{5}{6}\cdot\frac{1}{6}}{1-\left(\frac{5}{6}\right)^2}=\frac{5}{11}$$

$\therefore$ Expectation of Ajith = $\frac{5}{11}\times 2200=\text{Rs}.10000$

50.



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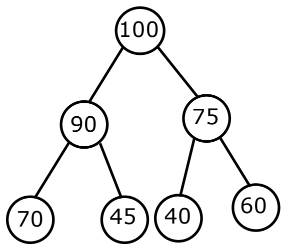
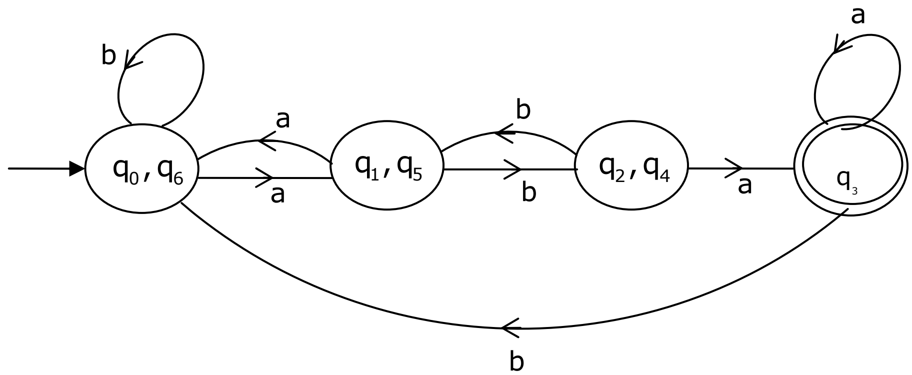
51. It will result in two exchanges and resultant will be



So the content is A={100, 90, 75, 70, 45, 40, 60}

52.



53. As in the above MDFA, q_0 is merged with q_6 and q_1 is merged with q_5.

55. S = 2. So all five process may go on CS simultaneously.

60 This series can be written as

$\left(1+2+3+......\text{to 50 terms}\right)-\left(6+7+8+.....\text{to 50 terms}\right)$

Both these are in AP's

$a=1,\ n=50,\ d=1$ for first series

$a=6,\ n=50\ \&\ d=1$ for second series

$25\left(2+49\right)\ -\ 25\left(12+49\right)\ \left(\text{using AP's }=\frac{n}{2}\left[2a+\left(n-1\right)d\right]\right)$

$25\left(51-61\right)=-250$

61 The net movement of the monkey = 2 steps in 4 seconds, ie., 1 step for every 2 seconds. In our bid to solve equation quickly, we may tend to directly multiply 21 steps by 2 seconds and arrive at 42 seconds. But consider this. After the monkey reaches the 18^{th} step he has to climb another 3 steps to reach 21 which he will do in the next 3 seconds (the fact that he slips another step after reaching the 21^{st} is of no concern). Therefore total time taken by the monkey = $18\times2+3=39\,\text{sec}$.

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62 For a number from 1 to 100 not be divisible by 5 or 8, we need to remove all numbers that are divisible by 5 or 8.
Thus we remove 5, 8, 10, 15, 16, 20, 24, 25, 30, 32, 35, 40, 45, 48, 50, 55, 56, 60, 64, 65, 70, 72, 75, 80, 85, 88, 90, 95, 96 & 100
i.e., 30 numbers from the 100 are removed.
Hence required probability = $\frac{70}{100} = \frac{7}{10}$

63 When there is a loss at 10% $\rightarrow$ 160 = 90% of CP_2
$\therefore C.P_2 = 177.37$
When there is a profit of 10% $\rightarrow$ 160 = 110% of CP_1
$\therefore C.P_1 = 145.45$
$\text{Total C.P} = 177.77 + 145.45 = 323.23$
$\text{Loss} = 3.23$

64. $\frac{\left(56/7\right)}{2} = 4$
$\frac{\left(48/8\right)}{2} = 3$
$\frac{\left(36/9\right)}{2} = 2$
So, the answer is 2.

65 (D) is the only answer choice that weakens the argument.
All the others, in fact, are out of scope

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