Q. No. 1 – 25 Carry One Mark Each

1. Which of the following statements are false?

   I. The order of a group is always divisible by the order of the subgroups.

   II. Intersection of two subgroups of a group G, may or may not be a subgroup of G.

   III. Proper subgroup of an infinite cyclic group is infinite.

   IV. Prime order group has both proper and improper subgroups.

   (A) I and II (B) II, III, IV (C) III and IV (D) II and IV

2. If the limit, $\lim_{x\to\alpha}\left[f_1\ x\ f_2\ x\right]$ exists, then

   (A) $\lim_{x\to\alpha} f_1\ x$ exists (B) $\lim_{x\to\alpha} f_2\ x$ exists

   (C) Both (A) and (B) (D) none of these

3. If A, B and C are the subsets of a universal set U, then $CX\ A^C \cup B^{C\ C}$ is

   (A) $CXA \cap CXB$ (B) $CXB \cup AXC$ (C) $CXA \cup CXB$ (D) $CXA \cap BXC$

4. A random variable X follows the uniform distribution in (a, b) with mean 4 and variance 12, then the values of a and b are respectively

   (A) -2, 10 (B) 10, -2 (C) 4, 8 (D) 2, 6

5. How many multiplexers of size 2×1 are needed to design a multiplexer of size $2^n\times1$?

   (A) $2^{n+1}-1$ (B) 2^n-1 (C) 2^n (D) n

6. Minimum number of 2- inputs NAND gates required to implement a half adder is ___

7. Which of the following addressing mode pair fetch operand in minimum & maximum time respectively?

   (A) Register direct & memory indirect (B) Register direct & indexed indirect

   (C) Immediate & Indexed (D) Immediate & Memory indirect

8. The range of integer that can represent using an n bit 2's complement number system is

   (A) -2^n to 2^n-1 (B) -2^n to $2^{n-1}-1$

   (C) -2^{n-1} to 2^n-1 (D) -2^{n-1} to $2^{n-1}-1$

9. Consider the following processes with CPU burst time in ms. Assume all processes arrive at time 0.

Process	Burst Time (ms)
P1	10
P2	3
P3	8
P4	5

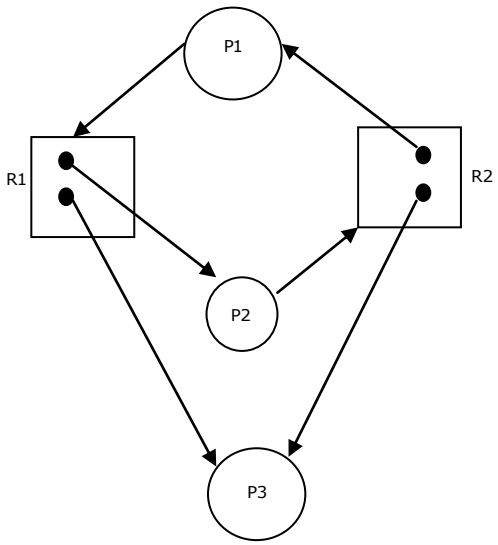
If the processes use First Come First Served Scheduling, for which of the following process order, the average waiting time of the processes will be minimum?

1. Order 1: P1 P2 P3 P4
2. Order 2: P2 P3 P4 P1
3. Order 3: P4 P3 P2 P1
4. Order 4: P4 P2 P3 P1

(A) Order 1 (B) Order 2 (C) Order 3 (D) Order 4

10. Say a system uses shortest job first scheduling (SJF) and exponential average of the measured lengths of previous CPU bursts, where $\alpha = 0.25$. The initial value of the predicted CPU burst time, $\tau_1 = 4$ unit. The predicted time for 4^{th} CPU burst (τ_4) for a process with burst times of 4 unit, 12 unit and 8 unit respectively is _____

11. Consider the resource allocation graph:



Which of the processes are in deadlock?

(A) P1 only (B) P1 and P2
(C) P1, P2 and P3 (D) The system is deadlock free

12. Which of the following statements are true?
(i) Physical address does not have topological significance.
(ii) ARP request can be used by a host to find the MAC address of a host within the same network.
(iii) Every LAN network should contain one RARP server.
(iv) Mapping IP addresses in DHCP is both static and dynamic.
(A) (i), (ii) and (iii) (B) (ii), (iii) and (iv)
(B) (i) (iii) and (iv) (D) (i), (ii), (iii) and (iv)

13. In a flow graph with 10 vertices and 15 edges the cyclomatic complexity $V(G)$ is _____

14. If the nullity of $A=\begin{bmatrix}1 & 2 & 1\\ 2 & K & -1\\ -1 & -2 & 1\end{bmatrix}$ is 1, the value of K is
(A) 4 (B) 1 (C) 2 (D) 3

15. Which of the following three-Address code satisfies the below given expression?
$a+b\times a+b+c+d$
(A) $t_1=a+b,\ t_2=b\times t_1,\ t_3=t_2+c,\ t_4=t_3+d$
(B) $t_1=a+b,\ t_2=b\times t_1,\ t_3=a+t_2,\ t_4=t_3+c,\ t_5=t_4+d$
(C) $t_1=a\times b,\ t_2=b\times t_1,\ t_3=a+t_2,\ t_4=t_3+c,\ t_5=t_4+d$
(D) None of these

16. In a region of N colleges, 30% of the colleges have three hostels, 50% of the colleges have two hostels, remaining have only one hostel. What is the probability that a randomly picked hostel belongs to a college with three hostels?
(A) $\frac{5}{21}$ (B) $\frac{8}{21}$ (C) $\frac{1}{21}$ (D) $\frac{9}{21}$

17 Approximating the integral $\int_a^b f(x)dx$ in the interval [a,b] which of the following gives the correct formula for Simpson's rule?
(A) $\frac{b-a}{4}\left[f(b)+f\left(\frac{a+b}{2}\right)\right]$ (B) $\frac{b-a}{4}\left[\frac{f(a)+f(b)}{4}+f\left(\frac{a+b}{4}\right)\right]$
(C) $\frac{b-a}{4}\left[\frac{f(a)+f(b)}{3}+\frac{4}{3}\left\{f\left(\frac{3a+b}{4}\right)+f\left(\frac{a+3b}{4}\right)\right\}+\frac{2}{3}f\left(\frac{a+b}{2}\right)\right]$
(D) None of these

18. The number of states in the minimal DFA which accepts the regular expression $a+aaa^*$ is _____

19. Which of the following is a regular language?

(A) $L = \{a^{2^n} \mid n \geq 1\}$ (B) $L = \{a^{n!} \mid 1 \leq n \leq 1000\}$

(C) $L = \{a^p \mid p \text{ is prime}\}$ (D) $L = \{xx \mid x \in \{a,b\}^*\}$

20. Which of the following statements is true for "substitution of values for names whose values are constant"?

i. Local optimization
ii. Loop optimization
iii. Constant folding

(A) only (i) (B) only (ii) (C) only (iii) (D) All

21. Consider the following relation instance:

A	B	C
1	2	3
2	3	5
1	4	3
2	3	6

Which of the following FD's are satisfied by the above relation instance?
I) A → B II) A → C III) C → A IV) AB → C V)BC → A VI) AC → B

(A) II, III & V only (B) III, IV & V only
(C) III & V only (D) V only

22. Which among the following 2-phase locking protocols is a deadlock free?

(A) Basic 2PL (B) Strict 2PL (C) Rigorous 2PL (D) Conservative 2PL

23. The minimal finite automata that accepts all strings of a's and b's, where the number of a's is at least 'n' contains

(A) n states (B)(n+1) states (C)(n+2)states (D) (n+3) states

24. Consider the following code snippet:

```
#include<studio.h>
#define a 10
int main()
{

    printf("%d,%d,%d",a++,++a,a++);
    return 0;
}
```

What will be the output?

(A) 12, 12, 10 (B) 52, 52, 50 (C) 52, 51, 50 (D) Compiler Error

25. What will be the output of the following program?

```
int main()
{
        int x=10, y=20, z=5, p=1,i;
         i=x<y<z<p;
        printf ("%d";i);
        return 0;
}
```

(A) 0 (B) 1 (C) 10 (D) 5

Q. No. 26 – 51 Carry Two Marks Each

26. For a relation defined as $R : A \to A$, where the set A is having 11 elements, match List-I with appropriate choice in List-II

List-I		List-II	
(P)	Irreflexive relations	I.	$2^{11} \times 3^{55}$
(Q)	Asymmetric relations	II.	$2^{110}\ 2^{11} - 1$
(R)	Anti symmetric relations	III.	3^{55}
(S)	Not reflexive relations	IV.	2^{110}

(A) $P-II, Q-III, R-IV, S-I$ (B) $P-II, Q-I, R-IV, S-III$

(C) $P-IV, Q-III, R-I, S-II$ (D) $P-IV, Q-I, R-III, S-II$

27. Let

$N\ x,y$: x and y are neighbors

$H\ x,y$: x should help y.

$P\ x,y$: x will help y.

Write the negation of the following statements in symbolic form.

"Everyone should help his neighbours, or his neighbours will not help him".

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

(B) $\exists x\ \exists y\ N\ x,y \to H\ x,y \vee \neg P\ y,x$

(C) $\exists x\ \exists y\ N\ x,y \wedge \neg H\ x,y \wedge \neg P\ y,x$

(D) $\exists x\ \exists y\ N\ x,y \wedge \neg H\ x,y \wedge P\ y,x$

28 If $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 2 & 4 \\ 1 & 1 & 5 \end{bmatrix}$ then $\left|A^{501} - A^{500}\right|$ is _____

(A) 0 (B) 1 (D) 501 (D) 500

29. What will be the output of the following piece of code?

```
Void foo()
{
      int i=1;
      fork();
        i++;
      printf("%d",i);
      fork();
        i++;
      printf("%d",i);
      fork();
        i++;
      printf("%d",i);
}
```

(A) 2 2 3 3 3 3 4 4 4 4 4 4 4 4

(B) 2 3 3 2 3 4 4 4 3 4 4 4 4 4

(C) 2 3 4 2 3 4 4 3 4 4 4 3 4 4

(D) All of these

30. Consider the following 3 processes with 3 binary semaphores with initial values s0=0, s1=0, s2=1

```
P:                  Q:                  R:
While(1)            While(1)            While(1)
{                   {                   {
 P(s0);              P(s1);              P(s2);
 Print(0);           Print(1);           Print(2);
 V(s1);              V(s1);              V(s0);
}                   }                   }
```

What will be the correct pattern generated by these 3 processes?

(A) $(201)^*$ (B) $(012)^*$ (C) $(201^+)^*$ (D) 201^+

31. Suppose we have a system with 32 bit virtual address, page size of 4 KB, and 4 bytes per page table entry. Suppose we use two-level paging and arrange for all page tables to fit into a single page frame. How will the bits of the address be divided up as outer index, inner index and offset?

(A) 12, 8, 12 (B) 8, 12, 12 (C) 10,10,12 (D) 6,14, 12

32. A class B address has the subnet mask of 255.255.224.0. What is the IP address of the second host in the second sub-network of the main network address 132.55.0.0?

(A) 132.55.0.1 (B) 132.55.32.2 (C) 132.55.64.1 (D) 132.55.64.2

33. Minimum bit difference between all pairs of valid code words is 5 in a coding scheme. This scheme can correct errors upto

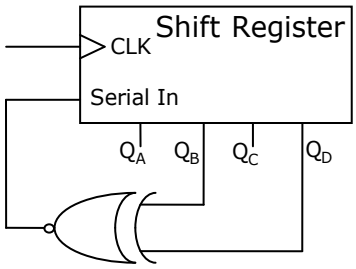
(A) 1 bit (B) 2 bits (C) 3 bits (D) 4 bits

34. Consider the following bit stream

"01111010011111101110"

Using bit stuffing framing method in Data Link layer, the number of 0's present in the bit stream after performing bit stuffing using the flag "0111" is _____

35. A 4-bit serial-in-parallel-out shift register is used with a feedback as shown in figure. The shifting sequence is $Q_A \rightarrow Q_B \rightarrow Q_C \rightarrow Q_D$. If the output is 0000 initially, then the output repeats after



(A) 4 clock cycles

(B) 6 clock cycles

(C) 15 clock cycles

(D) 16 clock cycles

36. In a system, cache memory access time is 100ns and main memory is 10 time slower than cache memory. The hit ratio for read request is 0.92 and 85% of memory requests generated by CPU are for read and the remaining is for write.

The average access time (in ns) considering both read & write request (assuming write through policy is used) is _____

37. Consider two pipelines A and B. The pipeline A has 8 stages with uniform stage delay of 2ns. The pipeline B has 5 stages with the stage delays 3 ns, 2ns, 1ns, 3 ns, 2ns. Time saved (in ns) with pipeline A compared to pipeline B for executing 100 instructions is _____

38. Match the following

(i) Resource conflicts	(p) Change of the value of PC
(ii) Data dependency conflicts	(q) WAR hazard
(iii) Branch conflicts	(r) Memory access by two segments
(iv) Anti dependence	(s) Depends on previous result
(A) i-r, ii-p, iii-s, iv-q	(B) i-r, ii-s, iii-p, iv-q
(C) i-s, ii-r, iii-q, iv-p	(D) i-r, ii-s, iii-q, iv-p

39. Which of the following statements are false?

(i) Every finite subset of a non regular set is regular

(ii) Every subset of a regular set is regular

(iii) L1 is regular and L2 is not, then $L1 \cap L2$ cannot be regular

(A) (iii) only	(B) (ii) only
(C) (ii) and (iii) only	(D) (i), (ii) and (iii)

40. Which of the following defines string 'w' of language that can be generated by the following CFG ?

$S \rightarrow XY$

$X \rightarrow aX \mid bX \mid a$

$Y \rightarrow Ya \mid Yb \mid a$

(A) w has atleast one 'b'	(B) w should end with 'a'
(C) w has no consecutive 'a's or 'b's	(D) w has atleast two consecutive 'a's

41. Match the following:

OSI Layer	**Responsibilities**
1. Network Layer	p. Encoding & Translation
2. Transport Layer	q. Addressing
3. Data Link Layer	r. Transmission Modes
4. Session Layer	s. Segmentation and Reassembly
5. Presentation Layer	t. Dialogue Control
6. Physical Layer	u. Access Control

(A) 1-s, 2-t, 3-u, 4-r, 5-p, 6-q	(B) 1-q, 2-s, 3-u, 4-t, 5-p, 6-r
(C) 1-s, 2-u, 3-p, 4-r, 5-q. 6-t	(D) 1-q, 2-u, 3-p, 4-t, 5-s. 6-r

42. The number of nodes if we construct the B+ tree with order(internal node) = 3 and order(leaf node) =2 for the sequence of keys "5, 8, 1, 7, 3, 12, 9, 6" is _____

43. Consider the following code segment.

```
void foo(int x, int y)
{
X+=y;
Y+=x;
}
main()
{
int x=4.5;
foo(x,x);
}
```

What is the final value of x in both call by value and call by reference respectively?

(A) 4 and 12 (B) 5 and 12 (C) 12 and 16 (D) 4 and 16

44. Which of the following can't be the contents of stack from bottom to top at a time instant in evaluating the postfix expression: 863/+32*- (where * is multiplication operator)?

(A) 10, 6 (B) 10, 3 (C) 10, 3, 2 (D) 10, 5

45. The maximum height of any AVL tree with 9 nodes where height of the root of a tree is 0 is _____

46. Consider a job sequencing scenario in which each job has burst time of 1 unit. Jobs $\{J_1 \ldots J_8\}$ has profits P ={30, 20, 60, 50, 90, 10, 70, 40} and deadline D={3, 1, 2, 1, 3, 4, 2, 3}. The maximum achievable profit is _____

47. Consider the following instance of the fractional knapsack problem:

number of items n=5, capacity of knapsack W=12

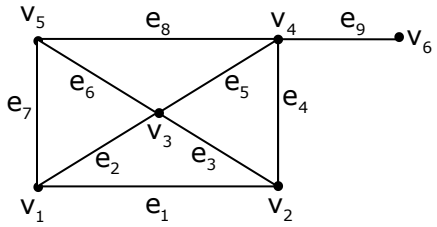
$P_1, P_2, P_3, P_4, P_5 = 10, 6, 15, 8, 6$ and $w_1, w_2, w_3, w_4, w_5 = 2, 3, 15, 4, 1$

What would be the maximum profit?

(A) 32 (B) 39 (C) 37 (D) None of these

Common Data Questions: 48 & 49

Consider the graph $G\ V,E$ shown below.

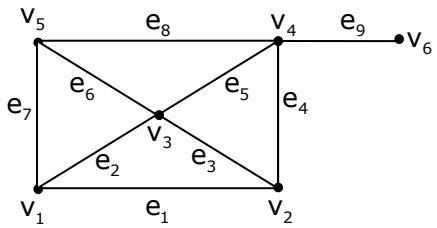


Graph $G\ V,E$

48. Which of the following are the cut set of the above graph?

(A) e_8,e_4,e_2,e_6 (B) e_8,e_6,e_2,e_1 (C) e_8,e_7,e_2,e_1,e_6 (D) e_9,e_8

Consider the graph $G\ V,E$ shown below.



Graph $G\ V,E$

49. Which of the following is the cut vertex of the above graph?

(A) v_3 (B) v_6 (C) v_4 (D) v_5

Common Data Questions: 50 & 51

An IPv4 packet has arrived with offset value 80(decimal) and value of HLEN field is 10 (Decimal) .The value of total length field is 200(decimal).

50. What are the first and last byte numbers respectively?

(A) 80 and 279 (B) 640 and 799 (C) 320 and 519 (D) 640 and 839

An IPv4 packet has arrived with offset value 80(decimal) and value of HLEN field is 10 (Decimal) .The value of total length field is 200(decimal).

51. What is the length of option field in the header?

(A) 20 Bytes (B) 10 Bytes (C) 40 Bytes (D) 0 Bytes

Linked Answer Questions: Q.52 to Q.55 Carry Two Marks Each

Statement for Linked Answer Questions: 52 & 53

Consider the following schedules:

S1	
T1	**T2**
R(A)	
W(A)	
	R(B)
R(B)	
W(B)	
	W(A)
	R(C)
R(C)	

S2	
T1	**T2**
	R(B)
	W(A)
R(A)	
W(A)	
R(B)	
W(B)	
	R(C)
R(C)	

S3	
T1	**T2**
R(A)	
W(A)	
	R(B)
	W(A)
R(B)	
W(B)	
R(C)	
	R(C)

S4	
T1	**T2**
	R(B)
R(A)	
	W(A)
W(A)	
R(B)	
W(B)	
	R(C)
R(C)	

52. Which of the above schedule(s) is/are conflict serializable?
(A) S1 and S2 only (B) S2 only (C) S1 only (D) None of thes

Consider the following schedules:

S1	
T1	**T2**
R(A)	
W(A)	
	R(B)
R(B)	
W(B)	
	W(A)
	R(C)
R(C)	

S2	
T1	**T2**
	R(B)
	W(A)
R(A)	
W(A)	
R(B)	
W(B)	
	R(C)
R(C)	

S3	
T1	**T2**
R(A)	
W(A)	
	R(B)
	W(A)
R(B)	
W(B)	
R(C)	
	R(C)

S4	
T1	**T2**
	R(B)
R(A)	
	W(A)
W(A)	
R(B)	
W(B)	
	R(C)
R(C)	

53. Which of the following is TRUE with regards to the correct answer for the above question?

(A) S1 is conflict serializable to T1, T2

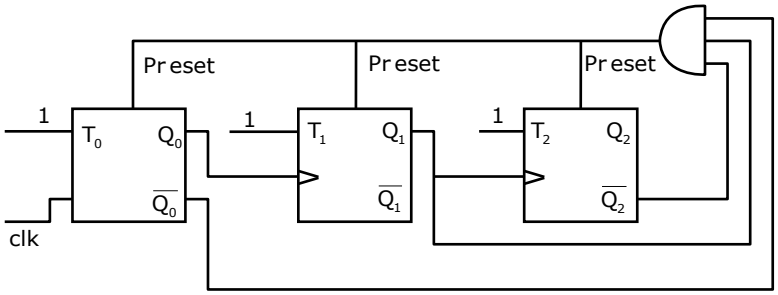
(B) S2 is conflict serializable to T2, T1

(C) Both (A) & (B)

(D) None of these

Statement for Linked Answer Questions: 54 & 55

Consider the circuit shown below.

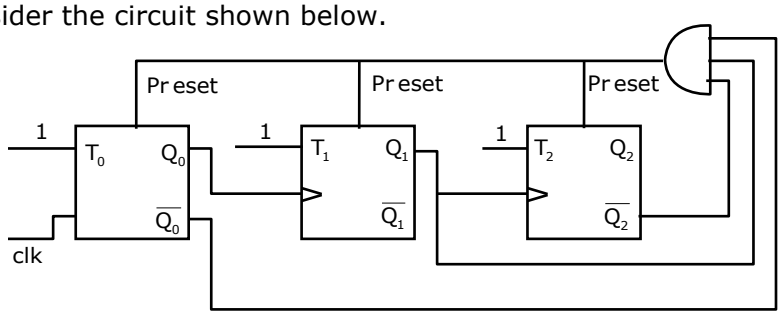


54. The circuit shown in figure acts as

(A) Mod-5 down counter (B) Mod-2 up counter

(C) Mod-5 up counter (D) Mod-3 down counter

Consider the circuit shown below.



55. For the above figure, if the present state is 011 then what will be the next state?

(A) 100 (B) 101 (C) 110 (D) 111

Q. No. 56 – 60 Carry One Mark Each

Choose grammatically wrong sentences:

56. (A) He was the first man to stand up

(B) Dog is a faithful animal

(C) The sooner you complete the better it is

(D) He is the stronger of the two

Choose a pair that has most similar relationship to the given pair:

57. State : Governor

(A) Parliament: Prime Minister (B) President: Country

(C) Father: Family (D) Loksabha : Speaker

58. The result of this was that we were held ..... for six hours in the departure lounge waiting for the end of the dispute.
(A) up (B) on (C) by (D) about

Choose the odd one out:

59. (A) ab ab ab (B) aa bb cc (C) abc abc (D) ba ba ba

60. A and B entered into partnership with capitals in ratio 4 : 5. After 3 months, A withdrew $\frac{1}{4}$ of his capital & B withdrew $\frac{1}{5}$ of his capital. Profit earned at the end of 10 months was Rs. 760. A's share on this profit is
(A) 330 (B) 360 (C) 380 (D) 430

Q. No. 61 – 65 Carry Two Marks Each

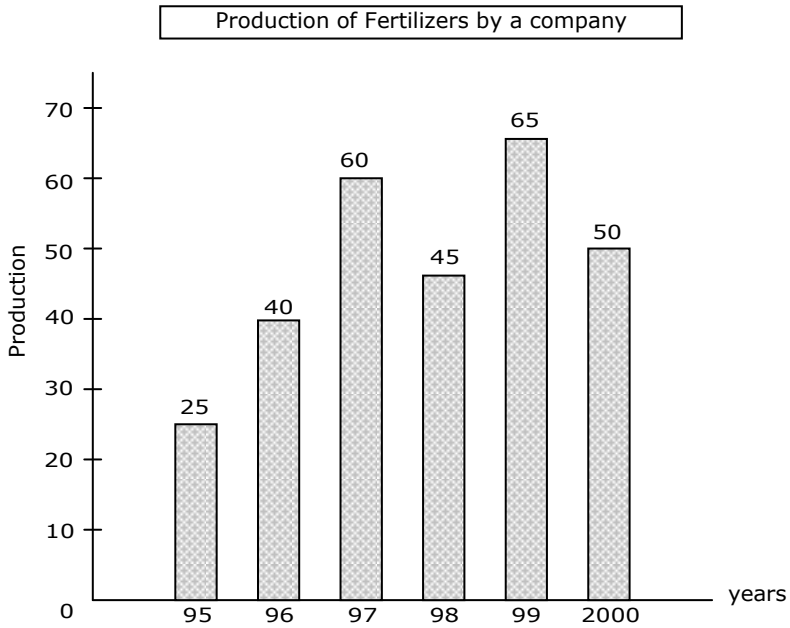
61. "The reservation system in Indian railways should be abolished".
Choose the argument irrelevant to the above statement:
(A) The income of railway reduces
(B) It reduces the economical barriers between have's and have-not's
(C) The reservation compartments need to be modified
(D) The general ticket counters will get rushed

62. Cost price of 130 articles is same as selling price of X articles. If profit is 30%, then value of x is
(A) 200 (B) 100 (C) 300 (D) 150

63. The sum of ages of 5 children born at interval of 3 years each is 50 years. What is the age of youngest child?
(A) 10 (B) 2 (C) 7 (D) 4

64. HCF of two numbers is 23 and other two factors of their LCM are 13 & 14. The largest of two numbers is
(A) 322 (B) 233 (C) 532 (D) 329

65.



Find the percentage difference in production of fertilizers in 2000 compare to 1995.

(A) 200% (B) 150% (C) 75% (D) 100%