General Ability:-

Q. No. 1 – 5 Carry One Mark Each

1. **Choose the word that does not belong to the group.**
    (A) Barrack   (B) Duplex   (C) Gazebo   (D) Imbrue

2. There is a probability that he was charged with being _____; that many who boasted themselves of _____ and soberness, and wisdom, regarded him as acting like a madman.
    (A) pronounced, precision   (B) rococo, demented
    (C) deranged, prudence   (D) prudish, covert

3. The length of a rectangular plot is 20 metres more than its breadth. If the cost of fencing the plot @ 26.50 per metre is Rs. 5300, what is the length of the plot in metres?

4. Choose the word which is most nearly the SAME in meaning as the word given in bold as used in the passage.
    CATACLYSMIC

    (A) salubrious   (B) acrobatic   (C) alarming   (D) catastrophic

5. Each question gives a sentence with a part of the sentence underlined that may contain an error. Four alternative substitutes are given for the underlined portion. Identify the choice that replaces the underlined part to form a logically and grammatically correct statement and mark its number as your answer.

    As these changes in the rock are greatest at the surface and diminish downward, <u>we infer that they have been caused by agents that were working downward in the surface.</u>
    (A) we infer that they have been caused by agents that were working downward in the surface.
    (B) we are inferring that they have caused by agents working downward from the surface.
    (C) we infer so they have been caused by agents working downward on the surface.
    (D) we infer that they have been caused by agents working downward from the surface.

Q. No. 6 – 10 Carry Two Mark Each

6. Two pipes A and B can fill a tank in 1 hour 12 minutes and 1 hour 30 minutes respectively. Pipe C can empty the tank in 1 hour. Initially pipes A and B are opened and after 14 minutes C is also opened. In how much time will the tank be full?
    (A) 1 hr   (B) 80 min   (C) 84min   (D) 1 hr 32 min

7. " 4X68Y0 " is divisible by both 3 & 11. The non zero digits in the place of x & y are
    (A) 5 & 7   (B) 7 & 5   (C) 4 & 5   (D) 5 & 4

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8. The missing P & Q in the following series respectively are

```
                Q
           P        60
        12     60      60
      6     12     20     30
   2     3     4     5     6
```

(A) 30, 30   (B) 60, 60   (C) 30, 60   (D) 60, 120

9. The distance between two stations A and B is 600 km. One train leaves station A towards station B at the average speed of 54 kmph. After an hour another train left station B towards station A at the average speed of 66 km per hour. The distance from station A where the two trains meet is?

10. **Choose the option that best captures the essence of the given text.**

The birth of the embellishing art must be sought in that stage of animal development when instinct began to discover that certain attributes or adornments increased attractiveness. When art in its human sense came into existence ideas of embellishment soon extended from the *person*, with, which they had been associated, to all things with which man had to deal. The processes of the growth of the aesthetic idea are long and obscure.

(A) Embellished art is an outcome of instinct and intellect which provoked man to think that certain ornaments increased attractiveness. Ideas of embellishment extended from person to the things he dealt with.

(B) With the help of instinct, humans invented embellished art which increased attractiveness. Ideas of embellishment ranged from person to the things he dealt with. The growth of aesthetic ideas takes a long time.

(C) Though the process of growth of aesthetic ideas takes a long time, humans discovered their instinct and gave birth to the embellished art that could increase attractiveness in the person to the things he dealt with.

(D) Humans made embellished art on discovery of their instinct and this art captured the attractiveness of person and the things he dealt with. Due to this, the process of growth of aesthetic ideas takes a long time.

**Computer Science:-**

Q. No. 1 – 25 Carry One Mark Each

1. Determine true (T) or false (F) of the following statements.
   (a) The page fault rate for the optimal algorithm on S is the same as the page fault rate for the optimal algorithm on S^R where S^R is the reverse of the reference string S.

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(b) The page fault rate for the LRU algorithm on S is the same as the page fault rate for the LRU algorithm on S^R

(c) Global page replacement generally results in greater system throughput than local page replacement algorithm.

(A) a-T,b-F,c-T (B) a-T,b-T,c-T (C) a-F,b-F,c-F (D) a-T,b-F,c-F

2. Match the following:

1.	Inverted page table	a.	Use of chaining
2.	Page table	b.	Supports user view of code
3.	Segmentation	c.	One entry for each logical page of the program
4.	Hashed paging	d.	Contiguous memory allocation
5.	External fragmentation	e.	One entry for each real page of memory

(A) $1-e, 2-c, 3-a, 4-b, 5-d$ (B) $1-e, 2-c, 3-b, 4-a, 5-d$

(C) $1-e, 2-c, 3-d, 4-b, 5-a$ (D) $1-c, 2-e, 3-b, 4-a, 5-d$

3. Which of the following statements is/are true?

S1: There exists a simple disconnected graph with n vertices where degrees of all vertices are distinct (n>1)

S2: If there are exactly two vertices of odd degree in a simple graph then there must exist a path between those two odd vertices.

(A) S1 only   (B) S2 only

(C) Both S1 and S2   (D) Neither S1 nor S2

4. Find the equivalent of the propositional statement $P \to (Q \to R)$.

(A) $(P \wedge Q) \to \sim R$ (B) $(P \vee Q) \to R$ (C) $(P \vee Q)$ (D) $(P \wedge Q) \to R$

5. A subset of a poset is called an antichain, if every two elements of this subset are incomparable.

How many antichains are there in the poset with the following Hasse diagram?
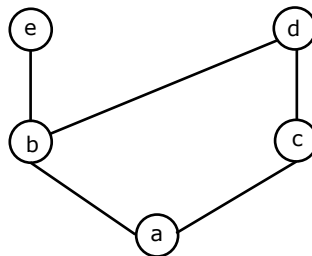
6. Suppose Host A is sending Host B a large file over a TCP connection. Then which of the following statements is/are true?

S1: The number of unacknowledged bytes that A sends cannot exceed the size of the receiver buffer.

S2: If the sequence number for a segment of this connection is m, then the sequence number of the subsequent segment will be necessarily (m+1).

(A) S1 only   (B) S2 only

(C) Both S1 & S2   (D) Neither S1 nor S2

7. A router outside the organization received a packet 224.240.7.91. Consider following steps taken by router.

1. The router looks in its routing table to find out how to route the packet to the destination.
2. The router looks at the first byte of the address to find the class.
3. The default mask for the class is ANDED (logical AND operation) and address is found.

Which of the following shows correct required step for finding the route?

(A) 3 - 1   (B) Only 1   (C) 2 – 3 - 1   (D) 1 – 2 - 3

8. Consider the address 141.14.196.46 and subnet mask 255.255.192.0. Find the subnet id?

(A) 141.14.192.0   (B) 141.14.1.46

(C) 25.255.192.0   (D) None of these

9. Consider a set associative cache with fixed block size. With increase in set associativity of cache, the cache metadata/tags size will _____

(A) Decrease

(B) Increase

(C) Remains Constant

(D) None of these

10. Consider the following organization of main memory and cache memory:

 Main memory: 64K ×16

 Cache memory: 256 ×16

Memory is word-addressable and block size is of 8 words. Determine the size of tag field, if direct mapping is used for transforming data from main memory to cache memory.(in bits)

11. Consider the following pattern of multiplier:

(a) 010101010101   (b) 111111111111

(c) 1111100111000

Which of the above string will give best performance for Booth's multiplication algorithm?

(A) Only (a)   (B) Only (b)   (C) Only (c)   (D) Both (b) & (c)

12. Rajiv takes two context free languages L_1 and L_2 and performs the following operation on both the languages.

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(i) He unions L_1 and L_2 to obtain a new language L_3

(ii) He concentrates L_1 and L_3 to obtain L_4

(iii) He takes complement of L_4 to obtain L_5.

The language L_5 is

(A) Context free language but not context sensitive

(B) Recursive but not context sensitive

(C) Context sensitive language.

(D) Recursive enumerable but not Recursive

13. Determine the minimum number of states contained in the DFA (Deterministic Finite Automata) accepting "all strings that start with 0 and has odd length or start with 1 and has even length" over the alphabet $\sum = \{0,1\}$.

14. A shift-reduce parser carries out the actions specified within braces immediately after reducing with the corresponding rule of grammar.

$S \rightarrow xxW(\text{print 'a'})$

$S \rightarrow y(\text{print 'b'})$

$W \rightarrow Sz(\text{print 'c'})$

What is the translation of xxxxyzz using the syntax directed translation scheme described by the above rules?

(A) bcaca   (B) aabcc   (C) aabca   (D) ccbaa

15. Consider the following grammar for generating Boolean expression:

$E \rightarrow E \text{ OR } E$

$E \rightarrow E \text{ AND } E$

$E \rightarrow \text{NOT } E$

$E \rightarrow (E)$

$E \rightarrow \text{TRUE}$

$E \rightarrow \text{FALSE}$

$E \rightarrow \text{ID}$

The above grammar is

(A) Ambiguous   (B) Non-ambiguous

(C) LL (1)   (D) Both (A) & (C)

16. Consider the following function:

```
void f (Queue Q){
int i;
if (! Empty(Q)){
i = _____ A _____;
f (Q);
_____ B _____;
}
}
```

What operations must be performed at A and B so that Queue will be reversed?

(A) $A = insert(i, Q)$
$B = insert(i, Q)$

(B) $A = insert(i, Q)$
$B = delete(Q)$

(C) $A = delete(Q)$
$B = insert(i, Q)$

(D) $A = delete(Q)$
$B = delete(Q)$

17. Which of the following statements is/are true?

S1. A sorting algorithm is in-place if the relative order of common element is maintained after sorting.

S2. A sorting algorithm is stable if it requires very little additional space besides the initial array holding the elements that are to be sorted.

(A) Only S1
(B) Only S2
(C) Both S1 & S2
(D) Neither S1 nor S2

18. If f(x) is differentiable and $g'(x) > 0$ such that f(1)=2, g(1)=2, f(2)=8 and $f'(x) = 2g'(x)$ for each x in [1,2] then the value of g(2) is _____

19. Consider the following grammar
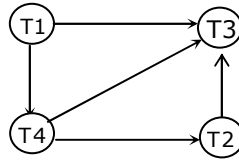
$S \to Sa\,Sb\,|c|\,Q\,q$

$Q \to Qm| \in$

It can be

(A) Parsed by LL(0) but not by LL(1) parser

(B) Parsed by LL(1) but not by LL(0) parser

(C) Parsed by both LL(0) & LL(1) parser

(D) Can not be parser by LL(0) or LL(1) parser

20. Suppose that cardinalities of relations A and B are m and n respectively, then the maximum cardinality of the resultant relation $A \div B$ is (A divides B)

(A) m
(B) m-n
(C) $\left\lceil \dfrac{m}{n} \right\rceil$
(D) $\left\lfloor \dfrac{m}{n} \right\rfloor$

21. Which of the following is conflict equivalent serial schedule for the precedence graph given below involving three transactions T1, T2 and T3?

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(1) T1,T4,T3,T2   (2) T1,T4,T2,T3   (3) T2,T1,T3,T4   (4) T2,T1,T4,T3

(A) (2) only   (B) (1) & (2) only   (C) (3) & (4) only   (D) None of these

22. Consider the following schedule 'S' involving 3 Transactions T_1, T_2 and T_3

$S: r_3(x); r_1(x); r_2(x); w_1(y); r_2(y); w_2(x); C_3; C_1; C_2;$

Which of the following is true regarding the above schedule?

(A) It is recoverable and also cascadeless

(B) It is recoverable but not cascadeless

(C) It is not recoverable

(D) It is strict schedule, so it is both recoverable and cascadeless

23. Determine the values of A, B and C respectively for the following Boolean equations:

$AB + \overline{AC} = 1, \ AC + B = 0$

(A) 1, 1, 1   (B) 1, 1, 0   (C) 0, 0, 1   (D) 0, 0, 0

24. Match the following lists:

List I	List II
(a) $(12121)_3$	P. $(5252)_8$
(b) $(4310)_5$	Q. $(2B)_{12}$
(c) $(50)_7$	R. $(304)_7$
(d) $(AAA)_{12}$	S. $(210111)_3$

(A) a – P, b – Q, c – S, d – R   (B) a – Q, b – S, c – R, d – P

(C) a – S, b – R, c – Q, d – P   (D) a – R, b – S, c – Q, d – P

25. Which of the following statements is/are true?

S1: +ve logic AND operation behaves as –ve logic OR operation.

S2: function f(A,B,C) = AB + BC + CA is a self dual function.

(A) S1 only   (B) S2 only

(C) Both S1 & S2   (D) Neither S1 nor S2

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Q. No. 26 – 55 Carry Two Marks Each

26. Perform a shift – reduce parser of the input aaa + a * + according to the grammar?

$$A \to AA + |AA * |a$$

Show the stack and remaining input at each stage using the form ($ stack, input $). Then, identify the pair that is NOT a stage of the shift-reduce parser.

(A) $(\$\ AAA*, +\$)$

(B) $(\$\ AA+, \$)$

(C) $(\$\ AAa+, a*+\$)$

(D) $(\$\ AAA+, a*+\$)$

27. Consider 100Mbps, 100baseT Ethernet. In order to have efficiency of 0.50, what should be the maximum distance between hub and router, if frame size is 64 bytes and propagation speed is 60% of speed of light?(in m)

28. Consider an 802.3 LAN with 500 stations connected to five 500 meter segments. The data rate is 10 Mbps and the slot time is 51.2µsec. If all stations transmit with equal probability, what is the channel utilization using a frame size of 512 bytes? Assume number of contention slots are 1.716.(in percent)

29. In case of Dijkstra's algorithm (one of the implementations of link state algorithm), if n is the number of nodes (excluding the source) how many number of nodes one need to search in worst case through all the iterations?

(A) n^2

(B) $\dfrac{n(n+1)}{2}$

(C) n^3

(D) $n^2 \log n$

30. A five stage pipeline is having following sequence of stages:

    IF – Instruction fetch from instruction memory

    RD – Instruction decode and Register read

    EX – Execute-ALU cooperation for data & address calculation

    MA – Data memory access

    WB – Register write back

    Consider following sequence of operations:

    Load $X[R_1]$ R_2 $Mem[X+R_1] \to R_2$

    Add R_3R_4 R_5 $R_3 + R_4 \to R_5$

    SUB R_5R_2 R_6 $R_5 - R_2 \to R_6$

    If operand forwarding technique is used, how many clock cycles it will take to complete the above sequence of instructions?

31. Which of the following is true w.r.t the following languages?

    i. $\left\{ ww^R x | w, x \text{ in } (r+s)^+ \right\}$ ii. $\left\{ wxw^R | w, x \text{ in } (a+b)^+ \right\}$

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iii. $\{www \mid |w| <= 100 \text{ in } (0+1)^*\}$ iv. $\{a^n b^n c^n \mid n >= 1000\}$

(A) Only (i),(ii) and (iii) are regular

(B) (i),(ii) & (iv) are not regular but (iii) is regular

(C) Only (ii) & (iii) are regular

(D) None of these is regular

32. Consider the following grammar:

S' → S

S → aAd | bBd | aBe | bAe

A → c

B → c

Which of the following statements is/are true w.r.t. the above grammar?

S1: The given grammar is LR(1).

S2: After merging LR(1) states the grammar will generate reduce-reduce conflict.

(A) S1 only   (B) S2 only   (C) Both S1 & S2   (D) Neither S1 nor S2

33. Consider the following DAG

Which of the following is/are can be the linear order of Topological sort

i) A, B, C, D, E, F   ii) F, A, B, C, E, D   iii) F, A, B, C, D, E

(A) Only i   (B) Only i, ii   (C) Only ii, iii   (D) Only i, iii

34. Consider the following C program:

```
int f (int n)
{
        if (n <= 1)      return 1;
        n = (n – 1)² – 2 – n² + 3 * n;
        f(n);
        printf("%d ", n);
}
```

What is the output if the initial call is f(6)?

(A) 5 5 5 5   (B) 1 1 1 1 1   (C) 5 4 3 2 1   (D) 1 2 3 4 5

35. Express the following recurrence relation in asymptotic notation.

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$$t(n) = 2t(\sqrt{n}) + \log n$$

(A) $\Theta(\log n \log \log n)$

(B) $\Theta(\log n)$

(C) $\Theta(\log \log n)$

(D) $\Theta(\sqrt{\log n})$

36. Let G be a simple undirected complete and weighted graph with vertex set V={0,1,2,…99}. Weight of the edge (u, v) is $|u - v|$ where $0 \le u, v \le 99$ and $u \ne v$. Weight of the corresponding maximum weighted spanning tree is

37. The solution function $y = f(x)$ for the D.E $\sin x \, dy = (\cos x - y) y \, dx$ passes through $\left(\dfrac{\pi}{4}, \sqrt{2}\right)$.

The magnitude of y at $x = \dfrac{-\pi}{4}$ is _____

38. The Eigen values of the matrix $3A^2 - \dfrac{1}{12} A + 3I$, where $A = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$ are _____

(A) $\dfrac{152}{3}, \dfrac{221}{2}$

(B) $\dfrac{142}{3}, \dfrac{321}{2}$

(C) $\dfrac{152}{3}, \dfrac{121}{2}$

(D) $\dfrac{142}{3}, \dfrac{121}{2}$

39. Consider the following algorithm:

Dosomething (x, n)

{

 m = n, temp = 1, z = x;

while $(m > 0)$ do

{

 while $((m \bmod z) = 0)$ do

{

$$m = \left\lfloor \frac{m}{2} \right\rfloor;$$

$$z = z^2;$$

}

$$m = m - 1, \; temp = temp \times z;$$

}

return temp;

}

The complexity of above algorithm is

(A) $\theta(\log n)$ (B) $\theta(n \log n)$ (C) $\theta(n^2)$ (D) $\theta(n)$

40. Let you are given an array of nine elements in increasing order. If you want to implement binary search on the given array of elements then the number of comparisons per successful search on an average will be_____.

41. Which of the following are tautologies?

$(i)\,(p \wedge q) \to p$ $(ii)\,p \to (p \vee q)$ $(iii)\, \sim p \to (p \to q)$

$(iv)\,(p \wedge (p \to q)) \to p$ $(v)\, \sim (p \to q) \to p$

(A) (i), (ii), (iii) and (iv) only   (B) (i), (ii), (iv) and (v) only

(C) (iii), (iv) and (v) only   (D) (i), (ii), (iii), (iv) and (v)

42. Consider the mapping f_1 and f_2 as described below:

$f_1 : R \to R$ defined by $f_1(x) = x^2 + x, \; x \in R$

$f_2 : Z \to Z$ defined by $f_2(y) = 2^y, \; y \in Z$

R : set of real numbers

Z : set of int egers

Then which of the following is true?

(A) f_1 is neither injective nor surjective

     f_2 is injective but not surjective

(B) f_1 is injective but not surjective

     f_2 is injective but not surjective

(C) f_1 and f_2 are both injective as well as surjective

(D) f_1 is not injective but surjective

     f_2 is injective but not surjective

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43. Consider the following relation R on the set of positive integers Z:

$R = \{(a,b) \in Z \times Z \mid a \equiv r \pmod 7 \text{ and } b \equiv r \pmod 7\}$ i.e. aRb iff a and b yield same remainder r when divided by 7. Then R is

(A) Reflexive, transitive but not symmetric

(B) Reflexive, symmetric and transitive

(C) Symmetric, transitive but not reflexive

(D) Reflexive but not symmetric or transitive

44. Consider M is a Turing machine

$M = \left(\{q_0, q_1, q_2, q_3, q_4\} \{a, b\} \{a, b, B\}, q_0, B, \{q_4\} \right)$

accept the language

$L = \{a^n b^n \mid n \geq 0\}$ the transition table for the Rules is

States	A	B	B
q_0	(q_1, B, R)		*
q_1	(q_1, a, R)	(q_1, b, R)	(q_2, B, L)
q_2		$(q_3 \ B, L)$	
q_3	(q_3, a, L)	(q_3, b, L)	**
q_4			

What is the value of * & * * in transition table?

* and * * are respectively

(A) $(q_4, B, R), (q_0 B, R)$

(B) $(q_1, B, R), (q_0, B, R)$

(C) $(q_4, B, R), (q_1 B, R)$

(D) $(q_1, B, R), (q_2, B, R)$

45. Consider the following grammar:

$S \rightarrow ABSc \mid Abc$

$BA \rightarrow AB$

$Bb \rightarrow bb$

$Ab \rightarrow ab$

$Aa \rightarrow aa$

The language generated by the above grammar is the set of all strings made up of a, b, c such that

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(A) The number of a's, b's, and c's will be equal but the order of occurrence is   not fixed

(B) The number of a's is twice the number of b's and equal to that of c's

(C) The number of a's is equal to the number of b's and b's always precede c's

(D) The number of a's b's and c's are same and the a's precede b's, which precede c's

46.   Which of the following time stamp ordering protocols allow(s) the following schedules?

$T: W_1(A); W_3(A); R_2(A); W_4(A):$

Time stamps : $T_1 : 5, T_2 : 10, T_3 : 15; T_4 : 20$

(A) Thomas write rule   (B) Multiversion time stamp protocol

(C) Basic time stamp   (D) All of these

47.   On a system using demand paged memory, it takes 120ns to satisfy a memory request if the page is in memory. If the page is not in memory, the request takes (on average) 5ms. What would the page fault rate(in %) if the effective access time is $1000\mu s$? Assume the system is working on a single process and the CPU is idle during page swaps.

48.   Assume that 50% of all engineering students are good in mathematics. The probability that in a sample of 18 engineering students, at most 8 are good in mathematics is

(A) 0.12   (B) 0.56   (C) 0.23   (D) 0.04

49.   Suppose the elements 42, 23, 37, 71, 34, 51, 9 are inserted into an empty binary max heap in the same order. What is the level order traversal of the constructed max heap?

(A) 71, 42, 51, 23, 34,37, 9   (B) 71, 51, 37, 42, 23, 34, 9

(C) 71, 51,42, 9, 37, 23, 34   (D) None

50.   Calculate the number of page faults, considering FIFO replacement algorithm for the following page reference string, with 4 frames

1 2 3 4 1 3 5 2 1 5 4 3 2 3

51.   A memory system of 200K bytes size is organized using contiguous dynamic management. P,Q,R and S are process running with the following allocation and deallocation requests

(a) P requests 32KB

(b) Q requests 38KB

(c) R requests 26KB

(d) P completes and releases

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(e) S requests 45KB

(f) R completes and releases

(g) P requests 25KB

Calculate the minimum contiguous free space available in memory (in kb) at the end, if system uses best-fit strategy for allocation.

52. Consider the IEEE-754 single precision standard, in which sign takes 1 bit, mantissa 23 bits and exponent is of 8 bits. Biasing value is 127 and normalization is of 1.M form, where M represents the mantissa.

What is the largest number represented by IEEE-754 single precision standard?

(A) $(2-2^{-23}) \times 2^{127}$ (B) $(2-2^{-52}) \times 2^{1023}$ (C) 1×2^{-126} (D) None of these

53. Consider the following hexadecimal representation of a base 2, 32 bits floating point number:

$[BEC00000]_H$

Where first bit represents the sign bit, next 8-bits represent the exponent and last 23-bits represent mantissa. Mantissa is in normalized 1.fraction form and biasing is 127.

Write the decimal equivalent of the given floating point number.

(A) −1.5   (B) −0.5   (C) −0.675   (D) −0.375

54. Suppose that the file is ordered by the key field SSN (length of 4 bytes) and want to construct the primary index on SSN. Assume block size (B) is of 512 bytes, block pointer (P) is of 6 Bytes, record pointer is of 7 bytes. The file contains

30,000 employee records and each record size (R) is of 50 bytes.

Calculate the number of levels needed if we make it into a multi level index.

(A) 2 levels   (B) 4 levels   (C) 1 level   (D) 3 levels

55. The order of a non-leaf node in a B+ tree is maximum number of block pointer it can hold it the block size is 1024 byte, data record pointer is 16 byte, the key field is 10 byte long & block pointer is 8 byte long, what is the maximum number of keys a non-leaf node can hold?