Q. No. 1 – 25 Carry One Mark Each
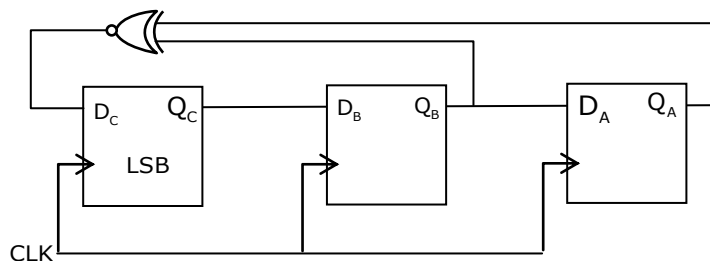
1. Which of the following regular expression generates the set of all strings not containing "baa" as a substring over input alphabet {a,b}?

    (A) a*(b*a)*   (B) a*b*ab   (C) a*baba*   (D) a*(ba+b)*

2. Consider the following synchronous sequential circuit:

    Assuming all the flip flops to be cleared initially, what will be the state of the sequential counter after applying 173 clock pulses?

    (A) 6   (B) 5   (C) 4   (D) 2

3. Choose the correct option:

    Assertion [A]: The cycle allocation between the user process and DMA process depends only on the DMA channel activity.

    Reason [R]: DMA provides capability of combining multiple interrupts into one, also lack of software overhead from loop-controlled instructions.

    (A) Both [A] and [R] are correct, and [R] is the correct reason for [A]
    (B) Both [A] and [R] are correct, and [R] is not the correct reason for [A]
    (C) Both [A] and [R] are incorrect statements
    (D) [A] is incorrect but [R] is correct statement

4. A byte addressable computer can support maximum of 2^i KB memory and has 2^j instructions. An instruction involving 2 operands and 1 operator needs how many bits?

    (A) 3i   (B) 2i + j   (C) 2i + j + 20   (D) i + j

5. For the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2} + F(n)$, what will be the particular solution, if

    Case 1 : $F(n) = 3^n(5n+1)$

    Case 2 : $F(n) = 2^n(5n+1)$

    (A) Case 1 : $a_n^P = 3^n(An+B)$, Case 2 : $a_n^P = 2^n(An+B)$

    (B) Case 1 : $a_n^P = 3^n(An+B)$, Case 2 : $a_n^P = 2^n n(An+B)$

    (C) Case 1 : $a_n^P = 3^n n^2(An+B)$, Case 2 : $a_n^P = 2^n n^2(An+B)$

    (D) Case 1 : $a_n^P = 3^n n^2(An+B)$, Case 2 : $a_n^P = 2^n(An+B)$

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6. In typical RISC ISA, delayed branch executes which instruction irrespective of whether the branch condition is true or false?
    (A) Instruction immediately following the branch condition
    (B) Instruction immediately preceding the branch condition
    (C) Instruction that belongs to a different sub-routine
    (D) It waits till the branch condition is evaluated

7. If $\frac{dy}{dx} = x + y$, y(0) = 1 and h = 0.1 the value of K_2 in 4th order Runge-Kutta method is
    (A) 0   (B) 0.1   (C) 0.11   (D) 0.001

8. What is the output of the following program if **dynamic scoping** is used?

    ```
    int a, b, c;

    void func1()
       {
           int a, b;
           a = 6;
           b = 8;
           func2();
           a = a+b+c;
           print(a);
       }

    void func2()
       {
           int b, c;
           b = 4;
           c = a+b;
           a += 11;
           print(c);
       }

    void main()
       {
           a = 3; b = 5; c = 7;
           func1();
       }
    ```
    (A) 7 19   (B) 10 1   (C) 10 23   (D) 10 32

9. Map the following statements to true(T)/false(F) respectively.
    S1: All XML elements must be lower case
    S2: All XML elements must have a closing tag
    S3: All XML documents must have a DTD
    (A) FTF   (B) TTF   (C) FFT   (D) FTT

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10. Which of the following is not correct regarding Prototype model?

(A) Prototype is used to identify the requirements

(B) When detailed input or output efficiency of algorithm is not known prototype model is used

(C) Long term maintainability is achieved almost every time

(D) It focuses on those aspects which will be visible to end user

11. What is the output of the following code snippet?

```
int Add int x, int y {
return x+y;
}
int main   {
printf "%d",Add 7,3 + Add 1,2 ;
}
```

(A) Compilation error   (B) Compiler dependent

(C) 13   (D) None of these

12. Consider the statements:

I.   2-SAT is in P

II. 3-SAT is in P

III. 2-coloring problem is in P

IV. 3-coloring problem is in P

Map the above statements to true/ false.

(A) I-true II-false III-false IV-false

(B) I-false II-false III-true   IV-false

(C) I-true II-false III-true   IV-false

(D) I-false II-false III-false IV-false

13. With indirect communication among processes the messages are sent to and received from mail boxes. In this scheme, consider the following statements about communication link and map them to true(T)/false(F) respectively.

1. A link can be associated with more than two processes

2. A pair of communicating processes cannot have more than one link

(A) TF   (B) FT   (C) FF   (D) TT

14. A program on workstation A attempts to open a TCP connection to port 1FFD H on a machine B, and a UDP connection to port 5EFA H on machine C. Which of the two machines generate an ICMP port unreachable error if both the applications on the corresponding ports on B and C are down?

(A) Only B   (B) Only C

(C) Both B and C   (D)Neither B nor C

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15. For the given input symbol $\in$, the output produced by the Moore machine is 'A' and the output produced by the Mealy machine is 'B', then which of the following is true?

(A) A = the output associated with initial state, B = $\in$

(B) A = $\in$, B= the output associated with initial state

(C) A = the output associated with input symbol, B = $\in$

(D) A = $\in$, B = the output associated with input symbol

16. What is the output of the following program?

```
int fun int n
 {
    if n & n − 1
    return 1;
    return 0;
 }

int main
 {
    int *p int ;
    p = fun;
    printf "%d",p 1025 ;
    return 0;
 }
```

(A) 1   (B) 0

(C) Compiler dependent   (D) Compilation error

17. If f_1 x is O g_1 x and f_2 x is O g_2 x then $f_1(x) + f_2(x)$ is

(A) O g_1 x $+ g_2$ x   (B) O min g_1 x ,g_2 x

(C) O max g_1 x ,g_2 x   (D) O g_1 x $\times g_2$ x

18. In the given relation R(ABCD) with FD's { A→D, B→C, C→B, D→A} the number of candidate keys is _____

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19.   Consider the following processes, with their CPU Burst time given in milliseconds

Process	Burst time
P_1	4
P_2	3
P_3	2
P_4	1

Assume that all the processes are arrived into the ready queue at time 0, in the above order. Using round robin scheduling with a time slice of 2 milliseconds, the average waiting time for the above process in milliseconds is _____

20.   The circuit shown below is a 4-bit SIPO register loaded with 1011.
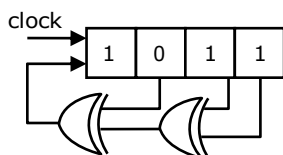
If clock pulses are applied continuously, then the number of clock pulses required to give the same data 1011 again is _____

21.   If $2.3_4 + 1.2_4 = y_4$ then the value of y is _____

22.   A system uses the Go – Back – N protocol with a window size of 8. Each packet carries 1024 bits of data, the distance between the sender and receiver is 1000km and the propagation speed is 2×10^8 m/sec. By ignoring transmission, waiting, processing delays and also assuming that no data or control frame is lost or damaged, the time taken to send 1M bits of data in seconds is_____

23.   Which of the following statements are TRUE?
1. All unambiguous grammars are regular.
2. Every LL(K) and LR(K) grammar is unambiguous.
3. A regular language can never be inherently ambiguous.
4. A grammar is ambiguous if it contains a string for which both LMD and RMD can be written.
(A) 1 and 4 only   (B) 2 and 3 only
(C) 1 and 2 only   (D) 3 and 4 only

24.   Which of the following field of activation record of a procedure points to the activation record of the calling procedure?

(A) Control Link   (B) Access Link   (C) Temporaries   (D) Return Value

25. By using which of the following techniques, an optimizing compiler can optimize itself?
    (A) Cross Compiler
    (B) Translator
    (C) Boot Strapping
    (D) Assembler

Q. No. 26 – 55 Carry Two Marks Each

26. The system of equations $2x + 4y = 7$, $X + 2y = 0$ has
    (A) Unique solution
    (B) No solution
    (C) Exactly two solutions
    (D) Infinite no. of solutions

27. Consider the following statements about the 'Locality of Reference' principle used in the computer memory systems.
    I.   The principal states that an already accessed memory location is accessed further again and it is also more likely that adjacent memory locations will also be accessed.
    II. The principle states that memory can be accessed simultaneously and in parallel on the basis of data content rather than by specific address or location.
    III. This principle help to reduce the average access time, and increase memory hits.

    Which of the above statements is/are TRUE?
    (A) I only
    (B) II only
    (C) II and III only
    (D) I and III only

28. To multiply two 32bit integers what should be the minimum size of the multiplicand and multiplier register assuming only product register is available apart from these two?
    (A) 32bit, 32bit
    (B) 64bit, 32bit
    (C) 64bit, 64bit
    (D) 32bit, 64bit

29. Consider the group $0,1,2,3,4$ $,+_5$. What will be the value of 2^{-3} and 3^{-2} for the given group?
    (A) 1 and 1
    (B) 2 and 3
    (C) 4 and 4
    (D) 3 and 2

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30.   Consider the following table structures:
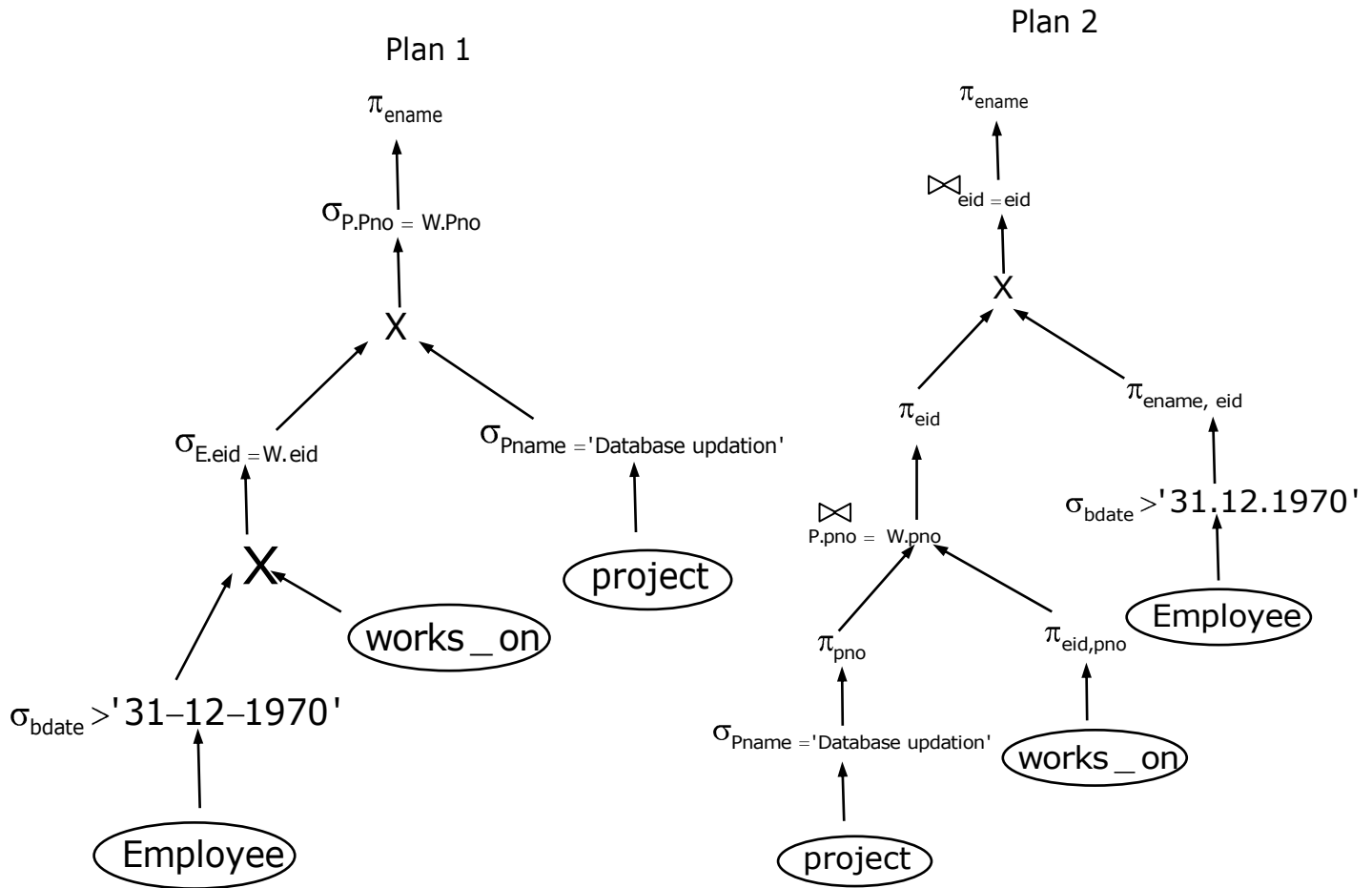
CREATE TABLE dept(dno number PRIMARY KEY, dname varchar2(30));

CREATE TABLE emp(eno number PRIMARY KEY, ename varchar2(30), dno number references dept(dno) ON DELETE CASCADE ON UPDATE CASCADE);

Which of the following statements is FALSE for the above table structures?

(A) Insert into DEPT is always successful
(B) Update on DEPT is always successful
(C) Delete on DEPT is always successful
(D) Update on EMP is always successful

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31. Consider the following relation schemas Employee E, Project P and Works_on W:

E (eid, ename, bdate, sex, edeptno., salary)

P (pno, pname, ploc, pdept no.)

W (eid, pno, hours)

To execute a query that retrieves names of employees born after 1970 and who work on a project named 'Database updation'.

We have following plans to execute the query.

Plan 1

π_{ename}

$\sigma_{P.Pno = W.Pno}$

X

$\sigma_{E.eid = W.eid}$ $\sigma_{Pname = 'Database updation'}$

X   project

works_on

$\sigma_{bdate} > '31-12-1970'$

Employee

Plan 2

π_{ename}

$\bowtie_{eid = eid}$

X

π_{eid} $\pi_{ename, eid}$

$\bowtie_{P.pno = W.pno}$ $\sigma_{bdate} > '31.12.1970'$

π_{pno} $\pi_{eid,pno}$ Employee

$\sigma_{Pname = 'Database updation'}$ works_on

project

Which of the following is true?

(A) Both plan 1 and plan 2 execute with same performance in terms of query optimization

(B) Plan 1 executes faster than plan 2

(C) The performance and execution speed of plan 1 and plan 2 can only be compared when database is present with entries, as performance differ on different databases

(D) Plan 2 is much more optimized than plan 1 for every possible database, hence executes faster

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32. Consider any general function $f : A \to B$, where cardinality of set A is 'm' and that of set B is 'n' $n \geq m$.

Find the total number of possible functions and number of many to one functions respectively.

(A) $m^n, m^n - {}^mP_n$

(B) $n^m, n^m - {}^nP_m$

(C) $m^n, {}^mP_n$

(D) $n^m, n^m \left\{ {}^nP_m = \dfrac{n!}{n-m \ !} \right\}$

33. The probability that a Contractor will get an infrastructure contract is 0.2. The probability that the contractor will get a welfare contract is 0.4. The probability that he will get both contracts is 0.1. What is the probability that the contractor will get either one of the contract is

(A) 0.5 (B) 0.3 (C) 0.8 (D) None

34. A graph is said to be 2-colourable if each vertex can be coloured either red or blue and no two vertices of the same colour are connected by an edge. If some graph is not 2-colorable, then we can reduce it to become 2-colorable by deleting some edges. We are given any simple graph with 101 nodes. k is the least required number of edges we have to delete in order to make this graph 2-colorable (Eg: $k=0$ for a graph which is already 2-colorable).

The minimum value for 'k' to reach the worst case is _____

35. Assume that we are rolling 10 dice, then the probability of getting at least three 5's is _____

36. Which of the following functions is performed by loader?
a) Physically places the machine instructions and data into memory
b) Allocates space in memory for the programs and resolves symbolic references between objects decks
c) Adjusts all address dependent locations, such as address constants, to correspond to the allocated space
d) All of these

37. Match the following lists.

List I	List II
A. Activation Record	1. Linking Loader
B. Location Counter	2. Garbage Collection
C. Reference Counts	3. Sub-routine Call
D. Address Relocation	4. Assembler

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

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

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

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

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38.   Let there be two grammars G_1 & G_2. G_1 is left factored and free from left recursion, G_2 is not left factored and also not free from left recursion. Choose the correct option about the two grammars.

(A) G_1 is an ambiguous grammar but G_2 is unambiguous.

(B) G_1 is an unambiguous grammar but G_2 is ambiguous.
(C) G_1 is an ambiguous grammar but G_2 may or may not be ambiguous.
(D) G_1 and G_2 may or may not be ambiguous grammars.

39.   Which of the following statements are false ?

(I)   Given two arbitrary context free grammars G_1 , G_2 and it is undecidable whether $L(G_1) = L(G_2)$

(II)   Given two regular grammars G_1 , G_2 and it is undecidable whether $L(G_1) = L(G_2)$

(III) All recursive enumerable languages would be recursive, if halting problem is decidable.

(IV) For any CFG, it is undecidable whether or not a particular non-terminal 'X' in G is reachable.

(A) (I) & (III) only   (B) (II) & (IV) only

(C) (II) & (III) only   (D) (II), (III) & (IV) only

40.   Consider the following four statements given below, about Regular languages.
S1: Regular Expressions $0(0)^*(\varepsilon + 0) = 0^*$

S2: Regular Expressions $1^*0(11^*)^* = 1^* + 0(11)^*$

S3: Some regular languages can't be generated by any CFG.
S4: A subset of a regular language is regular.
Thus for each of the above statements, indicated whether
It is $\alpha \to$ True $\beta \to$ False ($r \to$ may be true for some, but not all cases)

(A) $S1-\alpha$, $S2-\beta$, $S3-\alpha$, $S4-r$

(B) $S1-\alpha$, $S2-\alpha$, $S3-r$, $S4-r$

(C) $S1-\beta$, $S2-\beta$, $S3-\beta$, $S4-\beta$

(D) $S1-\alpha$, $S2-\alpha$, $S3-\beta$, $S4-r$

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41. Output of the following program will be

    ```
    int main
     {
        int i, a[8] = 000, 001, 010, 011, 100, 101, 110, 111 ;
        for i = 0;i < 8;i + +
        printf "%d", a[i] ;
        return 0;
     }
    ```

    (A) 0, 1,2,3,4,5,6,7
    (B) 0,1,10, 11, 100, 101, 110, 110
    (C) 0,1,8,9,100,101,110,111
    (D) None of these

42. Consider the following letters along with their probability of occurrence

    v: 45%, w: 25%, x: 20%, y: 5%, z: 5%

    What is the original message for the following Huffman's Code? (Take smaller node as the left child with 0 code)

    011011111000110001010

    (A) vzxwvvyvww
    (B) vzxvvvyww
    (C) vzwxxvyvww
    (D) Not a valid code

43. Which of the following pre-order traversals represents a valid binary search tree?

    (A) 1 3 2 4 5 7 8 6
    (B) 4 3 2 1 5 7 8 6
    (C) 4 2 1 3 7 8 6 5
    (D) 3 2 1 5 4 7 6 8

44. Find the output after applying 2 passes of radix sort followed by 1 pass of bubble sort to the given integers: 120, 231, 417, 343, 542, 998, 675, 196. Tie is broken as per FIFO order.

    (A) 120, 231, 542, 343, 675, 196, 417, 998
    (B) 417, 120, 231, 343, 542, 675, 196, 998
    (C) 417, 120, 231, 542, 343, 675, 196, 998
    (D) 120, 231, 417, 343, 542, 196, 675, 998

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45.   Assuming only numbers and letters given in the input, what does the following program do?

```c
#include <stdio.h>
int main()
{
        int i,j, ascii[128];
        char ip[30];
        printf("Enter Input string: ");
        scanf("%s",ip);
        for(i=0;i<128;i++)
        {
            ascii[i]=0;
         }
        i=0;
        while(ip[i]!='\0')
         {
            j=(int)ip[i];
            ascii[j]++;
            if(ascii[j]>1)
            {
               printf("%c",ip[i]);
               return 0;
            }
          i++;
        }
        return 0;
}
```

(A) Prints the position of first repeated character in the string

(B) Prints the first repeated character in the string

(C) Prints the position of last repeated character in the string

(D) Prints the last repeated character in the string

46.   Consider a TCP machine having window size 32KB over a 512 Mbps channel that has one way delay of 20msec. The line efficiency in percentage is _____

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47. Consider the schedule

    S = {R₁(A),R2(B),W₂(A),W₁(A)}

    Assume that transaction T_1 has started execution before the Transaction T_2 then the schedule is

    (A) Allowed under Basic timestamp protocol but not under Thomas write rule

    (B) Not allowed under Basic timestamp protocol but allowed under Thomas write rule

    (C) Allowed under both Basic timestamp protocol and Thomas write rule

    (D) Not allowed under both Basic timestamp protocol and Thomas write rule

Common Data Questions: 48 & 49

Assume that we have ternary tree which means each node can have at most 3 children, namely left, middle and right. Consider the following function to calculate total number of nodes with exactly 3 children.

```
int find3Child Node *T
 {
   int i; if  T==NULL  return 0;
   i=T → left &&T → middle &&T → right ?1:0
   return _____;
}
```

48. What should be in blank?

    (A) i

    (B) $i +$ find3Child $T \to$ left ;

    (C) $i +$ find3Child $T \to$ left $+$ find3Child $T \to$ middle ;

    (D) $i +$ find3Child $T \to$ left $+$ find3Child $T \to$ middle $+$ find3Child $T \to$ right ;

Assume that we have ternary tree which means each node can have at most 3 children, namely left, middle and right. Consider the following function to calculate total number of nodes with exactly 3 children.

```
int find3Child Node *T
 {
   int i; if  T==NULL  return 0;
   i=T → left &&T → middle &&T → right ?1:0
   return _____;
}
```

49. What is running cost of above algorithm? Assume total number of nodes in tree is n.

    (A) O n^2 (B) O n^3 (C) O $n \log n$ (D) O n

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Common Data Questions: 50 & 51

An organization is granted the block 150.36.0.0/16.The administrator wants to create 512 subnets.

50.   What is the subnet mask?
(A) 255.255.255.128/25   (B) 255.255.255.192/26
(C) 255.255.255.224/27   (D) 255.255.255.240/28

An organization is granted the block 150.36.0.0/16.The administrator wants to create 512 subnets.

51.   Find number of addresses in each subnet. Find the first and last addresses in first subnet.
(A) 128, 150.36.0.1 and 150.36.0.127
(B) 128, 150.36.0.129 and 150.36.0.255
(C) 126, 150.36.0.1 and 150.36.0.126
(D) 126, 150.36.0.129 and 150.36.0.254

Statement for Linked Answer Questions: 52 & 53

Suppose there are m instructions to be executed in a program. Also 'P' is the probability that instructions are conditional branch instruction, 'q' is the probability of successful branch. Assuming average number of instructions completed in a simple pipelined processor is 1. Also branch instructions takes 'n' clock cycles per instruction.

52.   What should be the average CPI for the given program?
(A) 1 (B) $mpq\,n-1\,+P\,1-q\,mn$
(C) $1+pq\,n-1$ (D) None of these

Suppose there are m instructions to be executed in a program. Also 'P' is the probability that instructions are conditional branch instruction, 'q' is the probability of successful branch. Assuming average number of instructions completed in a simple pipelined processor is 1. Also branch instructions takes 'n' clock cycles per instruction.

53.   If in the previous question, the branches (all) evaluate out to be unsuccessful, then by what factor is the average CPI reduced with respect to previous result?
(A) No change   (B) by factor of $mp\,1-q$
(C) by factor of $1-pq+npq$ (D)by factor of (npq)

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Statement for Linked Answer Questions 54 & 55

Consider a process that has been allocated 3 page frames. Assume that system uses pure demand paging. While undergoing execution, the process makes the following sequence of page references

$1, 4, 5, 1, 6, 3, 1, 3, 2, 4, 5, 1$

54.   If optimal page replacement policy is used, then the number of page faults for the above reference string is

(A) 7   (B) 6   (C) 8   (D) None of these

Consider a process that has been allocated 3 page frames. Assume that system uses pure demand paging. While undergoing execution, the process makes the following sequence of page references

$1, 4, 5, 1, 6, 3, 1, 3, 2, 4, 5, 1$

55.   If LRU is used for the same reference string then which of the following is true?

(A) Optimal has 22% lesser page faults than LRU

(B) Optimal has 33% lesser page faults than LRU

(C) Optimal has 44% lesser page faults than LRU

(D) None of these

Q. No. 56 – 60 Carry One Mark Each

56.   George had a very well paid contract with a television advertiser of garden peas and he didn't want to fall out....... the company.

(A) Of   (B) with   (C) over   (D) under

57.   The synonym for the word "GAOL" is

(A) Destination   (B) Enthusiasm   (C) Bail   (D) Jail

58.   If you take the first left after the post office, you come to Sally's place and if you take the second .... to the right after that you come to the cottage where Andrew lives.

(A) Turn   (B) Turn up   (C) Turn in   (D) Turning

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59.   The moral of this fable is:

You mustn't ……. children for the mistakes of their parents.

(A) Reproach   (B) Reprieve   (C) Repeal   (D) Reject

60.   Among P, Q, R, S & T each having a different age. Q is 5 yrs younger than T & S is 10 & 8 years younger than P & Q respectively. If T age is 20 years, then what will the R age?

(A) 28   (B) 56

(C) None of these   (D) Data inadequate

Q. No. 61 – 65 Carry Two Marks Each

61.   You win some and loose some. You must enjoy winning. But do not let it go to the head. The moment it does, you are already on your way to failure. If you encounter a failure, don't beat yourself for it or anyone else for that matter.

Accept it, look at your own share in the problem, learn from it and move on.

Choose the summary:

(A) Where there is a will there is a way

(B) Failure is the stepping stone of success

(C) Winners don't do different things, but do things differently.

(D) When you lose, do not lose the lesson

62.   There are five hotels in a line. If 4 men go into the hotel at 11 am, then what will be the probability that each go into a different hotel?

(A) $\dfrac{124}{125}$ (B) $\dfrac{24}{125}$ (C) $\dfrac{42}{125}$ (D) $\dfrac{48}{625}$

63.   A boat is moving downstream and reaches its destination in 25 hr. while moving at a speed of 50 km/hr (given speed in still water). One particular day due to engine problem at mid-point, speed is reduced by 20% of the original. It reaches the destination 2.5 hr late. Find out the speed of the river.

(Assume its speed to be uniform).

(A) 10   (B) 20   (C) 15   (D) 5

64.   A is 60% as efficient as B. C does half of the work done by A and B together. If C alone does the work in 80 days, then A, B and C together can do the work in

(A) $\dfrac{3}{80}$ (B) $\dfrac{4}{50}$ (C) $\dfrac{3}{85}$ (D) None of these

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65. Study the following Table:

Expenditure of a company (in lakh rupees) per Annum over given years

Year	Items of Expenditure				
	Salary	Fuel & Transport	Bonus	Interest on loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	101	3.84	41.6	74
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

Total expenditure on all these items in 1998 was approximately. What % of expenditure in 2002?

(A) 72% (B) 68.5% (C) 69.45% (D) 67%

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