

Analytical Part

1. You and your friend are playing a game with a fair coin (head and tail are equally likely). At first you will toss the coin. Then your friend (if the game is not over). Then you again and this continues until the game ends. The player who will get a head on the coin will win the game and the game ends. (3+5)
 - i. What is the probability that the game will finish in less than 6 move?
 - ii. What is the probability that you will win the game?

Ans :

2. Here is a function that reverse a number . if the parameter $n = 1234$, the function will return r where $r = 4321$. But one of the line of the function is missing. You have to write the missing line. (5)

```
int reverse(int n)
{
    int r = 0;
    while(n>0)
    {
        //Here is the missing line
        n=n/10;
    }
    return r;
}
```

Ans :

3. Little K is writing a program to check whether two rectangles (say the are A and B) intersect each other. Her algorithm is simple. She takes rectangle A and checks whether each vertex of it lies within rectangle B. Is there any flaw in her algorithm? Draw counter example if there is any. (7)

Ans :

4. Look at the following pseudo code.

```
ans := 0
for i := 1 to N do
    for j := i + 1 to N do
        for k := j + 1 to N do
            ans := ans + 1
```

Now find the formula for **ans** for a given **N**.

(5)

Ans :

5. How many ways to arrange 6 cows and 8 donkeys in a line to take photo? Curiously you can not distinguished a cow from other cows and you can not distinguished a donkey from other donkeys.

(5)

Ans :

6. Find the sum.

(5)

```
x=1
y=1000000000000000
long long int sum=0;
for(long long int i = x; i <= y; i++) sum += (i * i) % 4;
```

Ans :

7. A number is written with 27 ones. Is it a multiple of 27? Prove your answer and find the remainder.

(10)

Ans :

8. How many non-prime numbers ≤ 40 which are divisible by the sum of their prime factors?

(7)

Ans :

9. The double data-type in C has 64 bits of which are 1 bit for sign, 11 bit for exponent and 52 bit for mantissa (fraction). What is the largest irrational number that is possible to fully store in double data-type? Explain. (3)

Ans :

10. You have a grid of squares, which must be either filled in black or marked with X. Beside each row of the grid are listed the lengths of the runs of black squares on that row. Above each column are listed the lengths of the runs of black squares in that column. Your aim is to find all black squares. (20)

	3 3	3	2	2 3	6	8	5	7	3 1	3 1
1 1										
2 1										
1 5										
1 7										
1 6										
6										
4										
2 1 1 2										
4										
4										

11. Look at the following code.

```

unsigned int f(unsigned int n) {
    if (n == 1) return 1;
    else return f(n/2) + f(n - n/2) + 1;
}
void main() {
    unsigned int sum = 0;
    for (unsigned int i = 1; i <= 1000000000; ++i) sum += f(i);
    printf("%ud\n", sum);
}

```

What is the output?

(15)

Ans :

12. One of the questions in this paper (both analytical and programming) has it's mark written in binary. Can you identify it? Write the problem number. (10)

Ans :

13. Look at the following code.

```
void Function(int x) {  
    if(x<=0) {  
        print("X ");  
        return;  
    } else {  
        Function(x-1);  
        Function(x-2);  
    }  
}
```

If i call Function(5) , how many times X will be printed?

(8)

Ans :

Programming Problems

1. Rajohn has n indistinguishable caps. He put them on a desk in a particular order and went out. After returning, he came to know that someone changed the order of the caps so that only one cap is in its original position and each of the other caps are in a position originally occupied by a different cap. He began to wonder how many order of caps can be possible. (5+10)

What is the answer when $n = 4$ and $n = 20$?

2. How many times aba subsequence exist in the given string?

Easy :-

aabbabbabbaba

Hard:-

aabbabbabbabaababababbbbabbbababababbabbabbabababbababbabaabbabbabaabbabbbaba

Note:- In mathematics, a **subsequence** is a sequence that can be derived from another sequence by deleting some elements without changing the order of the remaining elements. For example, the sequence (A, B, D) is a subsequence of (A, B, C, D, E, F).

3. You are given these points in 2d plane.

(-46,-91) (78,-54) (-66,44) (-22,3) (33,-63) (84,40) (48,-15) (-83,-62) (100,-92) (-2,24) (-25,-41) (-28,-73) (-26,-62) (41,-49) (88,72) (20,-34) (34,-3) (-69,97) (-60,25) (-31,98)

Line 'L' passes through the maximum number of points. What are those points? For multiple answers, any of them will do, but points are to be listed in order of their appearance in the original list. (15)

4. How many continuous sub-sequence of the following sequence has a sum divisible by 13?

(1, 1, 9, 7, 12, 4, 12, 5, 8, 2, 7, 2, 10, 2, 3) (10)