Roll:1705045

**Out of the text assignment #3**

**10 prisoners were told that they would be given an opportunity if being free. Next day in the morning they will be arranged as per desire of the jailor  in a line  so that anybody can see heads of all people in the front. Then they would be given a cap on each one's head from  large collection of white and black hats. Then the person standing last in the line would be asked the colour of the heat he was wearing. If the answer was correct he would be set free. Then the next person would be asked the same question, and finally the person in the front of the line. Prisoners after reaching cell devised a way in which more than half of the prisoners would be set free. What is the strategy? What about if there were  prisoners and each of them was given hat of any of the known m colours?**

Answer:

**For 2 colors:**

Let’s number White as 0 and Black as 1.

Considering an example for 10 prisoners,

1 0 1 1 0 0 1 1 1 1(last one in the queue).

At first,

last one say (the sum of numbered value of hats he can see)%2.

Here he will say 6%2=0 or White.

Now the second last one will find (the sum of numbered value of hats he can see)%2.He will find 5%2=1.It is possible only if his color is 1,as last one said 0.Because for all 0<=x<=1,(6-x)%2=1 only if x=1.

Any other value of x (in 0<=x<=1) will not support that last one answer is 0 and his answer is 1.

So he will say 1(or Black).

Through same process,the third last one will find (the sum of numbered value of hats he can see)%2.He will find 4%2=0.According to answer of the second last one,his color has to be 1(or Black).

In this way,9 person will be rescued,last one possesses the possibility as ½.

**For m colors,n prisoners:**

Here are n hats with m colors.

This will be done by same process.

Each color will be labelled from 0 to m-1.

Considering an example of 7 prisoners and 4 color(White,Black,Blue,Red).We label them from 0 to 3 respectively.

The queue be: 1 2 1 3 0 1 2(last one).

At first,

last one say (the sum of numbered value of hats he can see)%m.

Here he will say 8%4=0 or White.

Now the second last one will find (the sum of numbered value of hats he can see)%4.He will find 7%4=1.It is possible only if his color is 1,as last one said 0.Because for all 0<=x<=3,(8-x)%4=1 is true only if x=1.

Any other value of x (in 0<=x<=3) will not support that last one’s answer is 0 and his answer is 1.

So he will say 1(or Black).

The third last one will find (the sum of numbered value of hats he can see)%4.He will find 7%4=1.

It is possible only if his color is 0.Because for all 0<=x<=3,(7-x)%4=1 is true only if x=0.

He will say 0(White).

This process continues.

So,n-1 will be rescued surely,last one holds the possibility to be rescued as 1/m.