TEMENOS Model Paper Questions

Q1. There is a river which has to be crossed using a boat that can accommodate only two persons at a time. On one side are three missionaries and three cannibals. All of them must reach the other side. Also in no condition should greater number of cannibals be left with less number of missionaries or they will eat them. How will they cross the river?

ANS:

Side A = 3 Cannibals, 3 missionaries
Side B = 0 Cannibals, 0 missionaries

1 cannibal and 1 missionary goes in the boat
Side A = 2 Cannibals, 2 missionaries
Side B = 1 Cannibals, 1 missionaries

1 missionary returns back and 2 cannibals go there
Side A = 0 Cannibals, 3 missionaries
Side B = 3 Cannibals, 0 missionaries

1 cannibal returns and 2 missionaries go
Side A = 1 Cannibals, 1 missionaries
Side B = 2 Cannibals, 2 missionaries

1 missionary and 1 cannibal return and 2 missionaries go
Side A = 2 Cannibals, 0 missionaries
Side B = 1 Cannibals, 3 missionaries

One cannibal back, two cannibals go
Side A = 1 Cannibals, 0 missionaries
Side B = 2 Cannibals, 3 missionaries

One cannibal back, two cannibals go
Side A = 0 Cannibals, 0 missionaries
Side B = 3 Cannibals, 3 missionaries

Thus all have crossed successfully.

Q2. Virginia Woolf is a grandmother aged between fifty and seventy. Each of her sons have as many sons as they have brothers. If the combined number is equal to Woolfs age. What is her age?

ANS: 64

Explanation:

Assume that the number of Woolfs sons = n
Number of brothers of each son = n-1
Number of sons for each of Woolfs son = n-1
Woolfs age = n-1*n-1
- which is equal to a perfect square between fifty and seventy.
- which is equal to 64.

Q3. A round bouncing object is dropped from a building of height 20 feet. Every time it touches the floor, it bounces back to a height which is one half of the height of the last bounce. If you measure till the objects comes to rest, how much distance would it have covered by then?

a) 30 feet
b) 40 feet
c) 50 feet
d) 60 feet

ANS: d) 60 feet

Explanation:

First time = 20 ft
Second time = 10ft down + 10 ft up
Third time = 5ft up + 5ft down
It will go on like this the object stops

Total distance traveled = 20 + (10 + 10) + (5 + 5) + (2.5 + 2.5) + . . .
= 20 + (10 + 5 + 2.5 + ...) + (10 + 5 + 2.5 + ...)

Assuming the object comes to rest at infinity,

Total distance traveled = 20 + [10/ (1 - 0.5)] + [10/ (1 - 0.5)]
= 20 + 20 + 20 = 60

Q4. Eggs have quite a unique property. They may be extremely fragile that they may break by mere a drop from your hand. However, they may not break even if they are dropped from the 100th floor. That is exactly what you have in this problem. You have two identical eggs and you have access to a 100 story building.

The question is how many drops you will make before you can find out the highest possible floor of the building from which the egg can be dropped without breaking. Remember you only have two eggs to break.

ANS:

Explanation:

Let us first assume that the number of drops required are N.

If the egg breaks at maximum number of tries, we will have N - 1 drops till it does not break. Thus we must drop the first egg from the height N. Now if the first drop of the first egg does not break the egg, we can have N - 2 drops for the second egg if the first egg breaks in the second drop.

Let us put that into a valid example for better understanding. Suppose we need 16 drops. Now let us drop the egg from the sixteenth floor, if it breaks, we will try all the floors below sixteen. Suppose it does not breaks, then we have 15 drops left and we will drop it from 16+15+1 = 32nd floor. This is because if it breaks at 32nd floor, we can try all the way down to 17th floor in fourteen tries making the total tries to be 16.

Let us assume that 16 is the correct answer

1 + 15 16 if breaks at 16 checks from 1 to 15 in 15 drops
1 + 14 31 if breaks at 31 checks from 17 to 30 in 14 drops

1 + 13 45.....
1 + 12 58
1 + 11 70
1 + 10 81
1 + 9 91
1 + 8 100 we can easily do in the end as we have enough drops to complete the task.

Seeking the above case, we must note that we have achieved it in 14 or 14 drops but we still need to find out the optimal one. We know from above that the optimal one will require 0 linear trials in the last step.
Thus
(1+p) + (1+ (p-1)) + (1+ (p-2)) + ...+ (1+0) >= 100.
Let 1+p=q which is the answer we are looking for
q (q+1)/2 >=100
q=14
Thus the optimal number of drops required are 14.

Q5. Once in a prison with 100 prisoners, the Warden introduces a strange but interesting challenge to all the prisoners. This challenge can even grant them the freedom and thus every one of the prisoners becomes quite excited.

The warden selects one prisoner everyday randomly from the lot and moves him into a pitch black room with a bulb and a witch that controls the bulb. The prisoner can carry out three different actions in the room - He can switch on the bulb, switch it off or do nothing and sit idle. A prisoner can be picked up more than one time.

Now the warden introduces the twist in the challenge. He tells them that the prisoners can put a stop to the process any day they feel that every one of them has been confined to that room at least once. If the prisoners are correct, then every single one of them will be set free. But if they have put up a wrong judgment, all of them will be killed.

Seeking it to be the only chance of freedom, the prisoners take up the challenge. They are given some time to discuss regarding it before the process could begin. How will they plan things so that they are finally set free?

ANS:

Explanation:

They select one of the prisoner named Jason to do the trick and frame out a full proof plan. According to their plan, whenever a prisoner other than Jason is selected, they will follows some simple steps - If the bulb is off, they will switch it on but if the bulb is already lit, they wont do anything and sit idle.

If Jason is selected and he finds out that the bulb is lit, he will add one to his count and will switch off the bulb. If the bulb is already switched off, he will sit there idly. In such a manner when his count reaches to 99, he will tell the warden that every prisoner has now been to the room.

Let us craft out the solution in simpler terms. Whenever a prisoner goes inside the room, he simply switches on the bulb if it is off. Thus one prisoner will only light the bulb once. When Jason finds out that the bulb it on, he will know that this has been done by a new prisoner and he will add one to his count. He will keep doing this till his count reaches 99. 99 because, he already has been in the room which makes a total of 100. Thus it is a full proof plan that will definitely set them all free.