# **Programming Fundamental**

## **Assignment no 1**

### **Problem 1 (1.1)**

* First, we fill the 8-litter drum and add to the 5-litter drum, here we left with the 3 litter.
* For 2 litter we will fill the 5-litter drum and pour it to 8 litter drum, we left with 3 litters in 8 litter drum. Now we will fill 5 litter drum again and fill the three-litter space in 8-litter drum and we left with the 2 litters which we can give to costumer.
* Now we have 2 litters oil in 5-litter drum, we will pour this to 8-litter drum and fill the 5-litter tank again and add to the 8-litter drum in which we have already 2 litters so (5+2=7), here we have 7 litters.
* Now we will fill 5-litter tank and add to the to the 8-litter tank in which we have 7 litters already,1 litter will be filled and we left with the 4 litters in the 5-litter drum which we can give to the costumer.
* For 6 litters, first we fill the 8-litters drum and pour into 5-litters drum. Left with the 3 litters and we will free the 5-litters drum, now we put these 3 litters to 5-litters drum. The we will fill 8-litters drum again and pour into the 5-litters drum which has 3 litters already and now 2 will be added to it and we will left with the 6 litters in 8-litters drum. Which we will Hand over to costumer.
* Now we have 6 litters in 8-litters drum, we will put these 6 litters to the blank 5-litters drum and we will left with the 1 litter. Which we will give to costumer.

### **(1.2)**

* It gives only 3 and 6 as it is 6-litter and 9-litter drum so it will give only two values so we can not find all those quantities.
* Because their product is equal.
* We can only measure 3 and 6 litters.

### **Problem 2**

* If there are 20 students, First student shake hand with 19 students, second one shake hand with 18 students and third one shake hand with 17 and so on till 1.
* According to the above sequence

19+18+16+15+14+13+12+11+10+9+8+7+6+5+3+2+1 = 190

* So, there are total 190 handshakes.
* In the case of N, it will follow this formula

(n-1) +(n-2) +(n-3) …….3+2+1

### **Problem 3**

* There is total 204 no of squares on 8 by 8 chessboard.
* We calculate the possible no of squares which can be made by combining rows and columns.
* We can also make 2-by-2 4-by-4 squares within the chess.
* Add all the single square boxes and the pairs of squares we make by joining rows and columns.

### **Problem 4**

* In 9, 16, 21, 27, 30, 50, 81 we are applying the same algorithm
* First we divide the number into three parts and then we will compare two parts with each other if they are imbalance so the heavier ball is in these parts otherwise it is in the third part. Then the part in which the heavier ball is again divided and weigh to find the heavier ball.
* For instance, for **9 balls:** In this case, we can find the heavier ball in two weighing. Make 3 pairs of 9. First, weigh 3 balls against 3 balls. If they balance, then the heavier ball is in the remaining 3 balls, and we can identify it in one more weighing. If they don't balance, then the heavier ball is in one of the two groups of 3 balls. Weigh any two balls from one of these groups against each other, and we can identify the heavier ball in one more weighing.
* So, for N balls, we will divide into three parts(N/3) and compare two parts with each other if they are imbalance so the heavier ball is in these parts otherwise it is in the third part. Then the part in which the heavier ball is again divided and weigh to find the heavier ball.

### **Problem 5**

* We will divide the 100-story building into 10 equal segments, each containing 10 floors.
* We will take one of the eggs and start dropping it from the 10th floor. If it breaks, then the highest safe floor is between 1 and 9. If it does not break, then the highest safe floor is between 11 and 20.
* If the egg breaks on the first drop, then we use the second egg to test each floor from 1 to 9, starting from the first floor and going up until the egg breaks. The highest safe floor is the one immediately below the floor where the egg broke.
* If the egg does not break on the first drop, then we move up to the 20th floor and drop the egg from there. If the egg breaks, then the highest safe floor is between 11 and 19. If it does not break, then the highest safe floor is between 21 and 30.
* Repeat steps 3 and 4 until the highest safe floor is identified.
* In this scenario we will have to make 19 drops for 100th floor building.
* 10 drops for the first egg and 9 drops for the second egg (10+9=19).

### **Problem 6**

* To find the minimum number of bags needed, we can start with the largest power of two that is less than or equal to $277$, which is $2^8 = 256$.
* We left with (277-256=21), Now $21$ as a sum of powers of two as follows: $21 = 16 + 4 + 1$.
* we will make $4$ bags: one bag with $256$, one bag with $16$, one bag with $4$, and one bag with $1$.
* For example, to give $52$, we can give one $16$ bag, one $4$ bag, and four $1$ bags.
* Therefore, the minimum number of bags needed is $4$.

### **Problem 7**

* The first cube should have the numbers 0, 1, 2, 3, 4, and 5 on its faces.
* The second cube should have the numbers 0, 1, 2, 6, 7, and 8 on its faces.
* For the numbers 01, 02, 03, ..., 09, the first cube will show 0 and the second cube will show the number.
* For the numbers 10, 11, 12, ..., 19, the first cube will show 1 and the second cube will show the unit digit.
* For the numbers 20, 21, 22, ..., 29, the first cube will show 2 and the second cube will show the unit digit.
* For the numbers 30, 31, the first cube will show 3 and the second cube will show 0.

### **Problem 8**

* Let's start with the number of black and white beans in the pot: 75 white and 150 black beans.
* If the cook removes two white beans, they will be discarded, and he will put one black bean from the pile into the pot.
* This means the number of white beans will decrease by 2, and the number of black beans will decrease by 1.
* Since the number of black beans is initially larger, it will always be greater than or equal to the number of white beans.
* Therefore, the last remaining bean in the pot must be black.

### **Problem 9**

* Ask someone if they are a liar. If they say "yes", they are a liar. If they say "no", move to step 2.
* Ask them to point to a liar. If they point to someone, they're truthful. If they refuse, they're a liar.
* Ask the truthful person to point to another truthful person.
* Repeat step 3 until all truthful people are identified.
* Assume the rest are liars.
* Verify by asking a truthful person to point to a liar.
* This approach should allow you to determine who is a liar and who always tells the truth using the fewest number of questions possible.

### **Problem 10**

* With one line, we have two regions.
* With two lines, we have four regions.
* With three lines, we have seven regions.
* With four lines, we have eleven regions.
* With each new line, the number of regions increases by the number of times the line intersects with the existing lines, plus one.
* The maximum number of regions that n lines can create is given by the formula R = (n^2 + n + 2)/2.
* This formula works because the total number of intersections between n lines is given by the sum of the first n natural numbers, which is n(n+1)/2. Adding the two initial regions gives the maximum number of regions.
* So, the maximum number of regions that n lines can create is given by R = (n^2 + n + 2)/2, with the number of regions increasing each time a new line intersects with the existing lines.