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Web Programming Fundamentals

Problem Solving

Problem 1

1a. A man needs to get his cat, parrot and a bag of seed across a river using a boat that will only hold himself and one passenger. The problem is that the cat can’t be left alone with the parrot, and the parrot can’t be left alone with the seed.

1b. It doesn’t say anything about how many trips it has to take and there is no way to only make 3 trips without leaving an incompatible pair together on one side or the other.

1c. The overall goal is to get everything to the other side of the river and keep it all intact.

2a. The constraints for this problem would be the fact that the man can only take 1 other item with himself in the boat at a time and that the cat cannot be left with the parrot and the parrot cannot be left with the seed.

2b. The sub-goals would be to not just get everything across the river, but to not have the cat eat the parrot or the parrot eat the seed.

3a. The possible solutions for the sub-problems that were previously identified would be to not leave the cat and the parrot alone and to not leave the parrot and the seed alone. You could take the parrot across first and the cat and the seed would be fine together, until your second trip then you would end up with a pair that would not work. Another solution would be to take the parrot across, followed by the seed, but then bring the parrot back with you and take the cat across next. On the final trip you would then bring the parrot back.

4a. The first solution would not meet the goals because after making two trips you would be left with an incompatible pair on one side. The second solution, however, would work out well because by moving the parrot across twice, none of the incompatible pairs would be left alone together.

4b. The first solution will not work at all. The second solution will work for all cases.

5a. The solution is to take the parrot across the river. Then return and bring the seed across the river. On departing from that trip, take the parrot back across the river to the starting side. Then take the cat across the river. The cat will be alone with the seed, which will cause no problems. Make one final trip to retrieve the parrot and the problem will be solved.

5b. Some test cases would be to take the cat first, which wouldn’t work because the parrot would be left to eat the seed. Similarly, if you were to take the seed first, then the cat would be left to eat the parrot. This leaves the solution that we ended up using which starts with taking the parrot first.

Problem 2

1a. The problem at hand is to figure out the fewest number of socks that you would have to grab to ensure that you had a matching pair of any color and also a matching pair of every color.

1b. Since there are 3 different colors, you will need to definitely grab more than that number of socks.

1c. The goal here is to find out the fewest number of socks that you would have to grab out to get a pair of any color and a pair of every color.

2a. The constraints to this problem would be that even though it would be possible to grab the proper quantity of pairs with out grabbing extra socks, having to do it in the dark means that you can’t be sure what colors you already have.

2b. The sub-goals to this problem would be to find out how many socks of each color there are and then see how many you would have to grab to get a pair of one color and pairs of every color.

3a. One possible solution would be to just grab all of the socks out, and then you would definitely succeed in finding the pairs you were looking for. Another solution would be is to figure out how many colors there are and then grab one more sock than color.

4a. The first solution would meet all of the goals, with the exception of finding the required pairs by grabbing as few socks as possible. The second solution will meet the goals because you will be as efficient as possible and not grab too many socks.

4b. The first solution will not work if you want to solve the problem in the most efficient way possible. The second solution however would work for all cases. It would not matter how many different colors of socks that were in the drawer, it would only matter that you knew how many different colors that there were.

5a. The solution for finding out how many socks it would take to get one pair is to grab one more sock than there are colors of socks. In this case there are 3 colors so you would need to grab 4 socks to get at least 1 pair of any color. In order to ensure that you get a pair of every color, you would need to grab at least 18 socks since it would be possible to grab 16 socks and still only have 2 of the colors.

5b. In order to get only one matching pair you could only grab 2 socks, but you would not be guaranteed to get a pair, it would be left up to chance. You could also grab 10 socks and guarantee that you have a matching pair since the largest quantity of matching socks in the drawer are 10 black ones. You would be guaranteed to have a pair of one of the three colors.

Problem 3

1a. For this problem we need to figure out what finger you would end on when counting on the fingers of one of your hands up to 10, 100 and 1000. You would begin with number 1 on your thumb, get to 5 on your pinky and then go back down to your ring finger and so on.

1b. As far as insight into this problem, I would say that you should definitely be able to come up with a pattern or an equation to help in solving this, so that you won’t need to just use brute force and count all the way to 1000 on your hand.

1c. The goal of this is to find a way to easily figure out what finger you would land on at any given number.

2a. The constraints for this problem would probably be that it would just not be practical to do all counting on your hand to try to figure it out. Also, the fact that the pattern reverses when you count up your fingers and then back down lends a little bit more of a complication to the problem.

2b. I think that the sub-goals for this would be to start small and try to figure out a pattern and then expand on that to figure out what the larger numbers will be.

3a. One possible solution would be to try to figure out an equation that would work for each finger so that by applying it you could determine what finger you would land on for any number. Another solution would be to make a small chart to determine what patterns were developing and then to take those patterns and incorporate them on a larger scale to find the larger numbers.

4a. The first solution does meet most of the goals, but I could only figure out equations for the thumb and pinky fingers and not the other 3. The second solution would meet all of the goals, however, for some of the fingers it is not quite as efficient as using an equation to solve the problem.

4b. Both of the solutions will not work for all cases.

5a. The solution that I ended up using was to make a chart showing what numbers would fall on what fingers. I figured out equations for the thumb and the pinky and I also knew that since all of the numbers that I was looking for were even numbers, so they had to found either on the index or ring fingers. I expanded my chart for those two fingers until I got up to 100 and then made note of where the 10’s fell. I then took this and figured out where the 100’s would fall and then on to the 1000’s.

5b. I found the following results for the index and ring fingers:

Index finger tens fall on: 10, 40, 50, 80, 90, 120, 130, 160, 170, 200, 210, 240, 250, 280, 290

Ring finger tens fall on: 20, 30, 60, 70, 100, 110, 140, 150, 180, 190, 220, 230, 260, 270, 300, 310

Index finger hundreds fall on: 200, 400, 600, 800, 1000

Ring finger hundreds fall on: 100, 300, 500, 700, 900