Problem 1: A Cat, a Parrot, and a Bag of Seed

A man finds himself on a riverbank with a cat, a parrot and a bag of seed. He needs to transport all three to the other side of the river in his boat. However, the boat has room for only the man himself and one other item (either the cat, parrot or seed). In his absence, the cat could eat the parrot, and the parrot would eat the bag of seed. Show how he can get all the passengers to the other side, without leaving the wrong ones alone together.

Define the problem:

The problem is that a man has a boat that is too small to transport all his belongings across a river at once. He can only transport one of three items at a time and if he takes the items out of order he may end up with an empty bag of seeds or a dead parrot. The goal is to get all items to the other side without compromise.

Break the problem apart:

The constraints are that only the cat and the bag of seed can be left alone together or else something bad may happen (or another way to say this is that the bird cannot be left with the other items). The goal is clear and there are no sub-goals to this problem.

Identify Potential solutions:

First solution: The man will take the bird with him first. He will then take the cat to the other side. He will take the bird back with him to the starting side and leave it there as he takes the seed. He will then go back finally for the bird. Second solution (similar to the first but the order of the cat and seed transfer reversed): Bird first. Then take the seed (instead of the cat this time). Bring the bird back on the trip for the cat (instead of the seed). Leave the bird again and take the cat to the destination and leave it with the seed. Finally go back for the bird.

Evaluate each potential solution:

Both solutions meet the goal. At no time will the bird be left alone with another passenger. No compromise will be made and all three items will be transferred successfully.

Choose a solution and develop a plan to implement it:

I will choose the first solution. The solution, in detail, is as follows: The man will take the bird with him, leaving the cat and seed, to the destination. He will then travel back alone to the starting side. He will then take the cat with him to the destination. He will then take with him the bird to the starting side, leaving the cat alone. He will then leave the bird alone as he takes the seed to the destination. He will leave both the cat and the seed alone as he goes back to the starting side. He will take the bird with him to his destination. All three passengers will now be at the final destination. This will work without fail because the potential problems will be avoided. At no time will the bird be left alone with another item.

Problem 2: Socks in the Dark

There are 20 socks in a drawer: 5 pairs of black socks, 3 pairs of brown and 2 pairs of white. You select the socks in the dark and can check them only after a selection has been made. What is the smallest number of socks you need to select to guarantee getting the following: a) At least one matching pair b) At least one matching pair of each color.

Define the problem:

There are two problems to be solved. Firstly, what is the smallest number of socks you need to select to guarantee getting at least one matching pair. Secondly, what is the smallest number of socks you need to select to guarantee getting at least one matching pair of each color. The overall goal is to find the number of socks that would need to be picked to guarantee a solution with only one chance to check them.

Break the problem apart:

The constraints are that only one check can be made and the solution must be correct. There are two problems that require different solutions and neither problem has a sub-goal.

Identify potential solutions:

The first solution would be to pick 4 socks. The second solution would be to pick 18 socks. You have a possibility of solving the problems with less socks but this would be the required amount to absolutely guarantee a solution every time.

Evaluate each potential solution:

Each of these solutions will meet the goals. Even though you have a possibility of solving the problems with less socks, these solutions guarantee the problem is solved because it looks at the worst case scenario.

Choose a solution and develop a plan to implement it:

The first solution goes like this: to guarantee a pair of one color every time, 4 socks are necessary because two socks picked could be of different colors. Also, 3 socks picked could still be one of each color and the absence of a pair because there are three colors of socks to be possibly chosen. A fourth sock will guarantee solution because the fourth sock must be one of the three colors already picked. The second solution uses the same ideology to come up with another guaranteed solution. This time, the worst case scenario would be that you pick 17 socks up and they are 10 black, 6 brown, and only one white sock. The next pick would have to be another white sock and would solve the problem. Thus, 18 socks must be picked to guarantee a pair of each color is picked every time.

Problem 3: Predicting Fingers

A little girl counts using the fingers of her left hand as follows: She starts by calling her thumb 1, the first finger 2, middle finder 3, ring finger 4, and little finger 5. Then she reverses direction, calling the ring finger 6, middle finger 7, first finger 8 and thumb 9, after which she calls her first finger 10 and so on. If she continues to count in this manner, on which finger will she stop? a) What if the girl counts from 1 to 10 b) What if the girl counts from 1 to 100 c) What if the girl counts from 1 to 1000

Define the problem:

The problem is that we don’t already have a method to predict what finger she will stop on after counting to 100 and 1000 (the finger for 10 is given in the problem itself). The goal is to have a way of predicting the finger stopped on at any given number.

Break the problem apart:

There are no constraints that need to be considered. The sub-goals are to have and effective method that will work with any given number.

Identify potential solutions:

First solution: create a massive chart the would display a column of each possible finger and then a row showing what numbers are counted for that finger. Second solution: create a mathematical formula that will help figure out which finger the count will stop on.

Evaluate each potential solution:

Each solution would meet the goals. Each solution will both work in any and all cases.

Choose a solution and develop a plan to implement it:

I will choose the second solution. The solution for finding the 100th, and 100th digit will be as follows: The thumb is counted as 1 and continues to be counted as every additional 8. 1+8(x) = will always be a number counted on the thumb. I can use this to find a number close to 100 and 1000 and then simply count forward. Doing simple math I found that a number that can be plugged into the formula to get close to 100 would be 12. 1+8(12)=97. 97 is counted on the thumb. Then you can count 98 (first) 99 (middle) and 100 (ring). It will be counted on the ring finger. If using a math function in a programming language like javascript you could use the formula Math.floor(y/8) where y is the number you are trying to search for (we’ll use 100). This would return the number 12. 1+8(Math.floor(100/8))=97. Now we’ll use this formula again to find what finger will be stopped on counting to 1000. 1+8(Math.floor(1000/8))=1001. 1001 is 1 over our number desired so we can simply count back one finger. The previous finger (1000) would have been the first, or pointer, finger. Using this solution, we find that the answers to the problems are 1.) 100=Ring finger and 2.) 1000=First finger