Question 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.***

1. Define the Problem:

A man has obligation to transport 3 valuable pieces of cargo (a cat, a parrot, and a bag of seed) across a river in a boat with only enough space for himself and 1 piece of cargo. If he’s not chaperoning the cargo, they tend to interact in a negative manner. Major complications arise when (1) the cat and parrot are left together; the cat will eat the parrot; (2) the parrot and the bag of seed are left together; the parrot will gorge himself on the seed, leaving no seed left. So how does the man, the cat, the parrot, and the bag of seed get, all get across the river?

1. Break the problem apart

Constraints

* + - 1. Physical Real Estate within the boat: 1 man & 1 cargo item
      2. The cat will attack the parrot if left together unsupervised
      3. The parrot will consume the bag of seed if left together unsupervised

Sub Goals

1. Get the bag of seed to the other side of the river intact without being molested by the parrot
2. Get the parrot to the other side of the river intact without being molested by the cat
3. Identify potential solutions a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?
4. Evaluate each potential solution a) Does each solution meet the goals? b) Will each solution work for ALL cases?
5. Choose a solution and develop a plan to implement it.

a) Explain the solution in full.  
b) Describe some test cases you tried out to make sure it works. (You can include drawings and diagrams as part of your explanation as long as they are clearly communicating the solution).

Question 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.***

1. Define the Problem:

I have 20 socks in my sock drawer. I have 10 socks (5 pairs) that are black, 6 socks (3 pairs) that are brown, and 4 socks (2 pairs) that are white. I only select the socks out in the dark and can only check them after my selection has been made, how many socks do I have to select out of my drawer to guarantee at least a matching pair of socks, and also at least 1 matching pair of each of the color?

1. Break the problem apart (a) What are the constraints? b) What are the sub-goals?)

Constraints

* + - 1. There is a finite amount of socks of broken down into 5 black pairs, 3 brown pairs, 2 white pairs
      2. Have to make the sock selection in the dark

Sub Goals

1. Minimize the amount of socks I must select to pick 1 pair of matching socks
2. Minimize the amount of socks I must select to pick one pair of each sock
3. Identify potential solutions a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?
4. Evaluate each potential solution a) Does each solution meet the goals? b) Will each solution work for ALL cases?
5. Choose a solution and develop a plan to implement it.
   1. Explain the solution in full.  
      b) Describe some test cases you tried out to make sure it works. (You can include drawings and diagrams as part of your explanation as long as they are clearly communicating the solution).

Question 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***

1. Define the Problem:

There is a young female child, who uses here hand to count. The pattern in which she counts goes as follows. She calls 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. Now if she continues to count, what finger will she stop when she counts from 1 to a) 10 b) 100 c) 1000?

1. Break the problem apart (a) What are the constraints? b) What are the sub-goals?)

Constraints

* + - 1. Working with a child (who may or may not have a physical disability as she can only count on her left hand)
      2. Working with potentially a partially identified counting pattern of said child.

Sub Goals

1. Identify the full counting pattern of the child.
   1. Then Identify the solution to the counts of 1-10, 1-100, 1-1000 based upon logical patterns
2. Identify potential solutions a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?
3. Evaluate each potential solution a) Does each solution meet the goals? b) Will each solution work for ALL cases?
4. Choose a solution and develop a plan to implement it.
5. Explain the solution in full.  
   b) Describe some test cases you tried out to make sure it works. (You can include drawings and diagrams as part of your explanation as long as they are clearly communicating the solution).