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 his 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, such as (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

Physical Real Estate within the boat: 1 man & 1 cargo item

The cat will attack the parrot if left together unsupervised

The parrot will consume the bag of seed if left together unsupervised

Sub Goals

Get the bag of seed to the other side of the river intact without being molested by the parrot.

Get the parrot to the other side of the river intact without being molested by the cat.

1. Identify potential solutions

Here are a few solutions I would use to the problem.

***The Athletic Solution:*** Knowing the boat can fit 1 man and 1 piece of cargo, I make the assumption it would fit 2 pieces of cargo then. So knowing that, I would have the man load the boat up with the bag of seed and the cat, and then jump into the water, and swim across pushing the boat while he swims to the opposite shore. He would then unload the boat, leaving said cat and bag of seed at that coast, and pull himself into the boat. After getting back into the boat, I would have him operate the boat in its intended manner, since the parrot is still on the coast of the river, he would then be obligated to pick up said parrot and maneuver him to the opposite coast, thus reuniting them with the bag of seed and the cat on their magical journey to God knows where.

***The Hard Work Approach:*** The man must ferry one object at a time and make sure not to leave potential disasters at either side of the river. He would first ferry the Parrot over leaving the cat and the seed on the original coast of the river, he would then ferry himself back over by himself to pick up the cat, he would then ferry the cat over to the final destination, thus he would pick up the parrot while leaving the cat returning to the original coast that now only has the bag of seed on it. Now he would drop the parrot off, pick up the bag of seed, ferry it across to where the cat is, and he would drop the bag off to be with the cat, return himself to pick up the parrot ferry him and the parrot across, disembark the boat with the parrot and then continue on their journey.

***The Boat Dealer Approach:*** The man realizes his equipment (his boat) is inadequate, so he decides to call The Tracker Boat Manufacturer on his cell phone, he ends up talking to Rick in sales, who analyzed his problem, realizing the man is in the cargo shipping business he convinces the man to buy Tracker’s latest and greatest cargo ship that fits 100,000 pieces of cargo (cats, dogs, bags of seed, parrots, etc.) on credit and trading in of his original boat. The man negotiated with Rick, that he would purchase said cargo ship if he would deliver it to him immediately and on the side of the river him, the cat, the parrot, and the bag of seed are waiting. So Rick agrees and the man’s new boat is there in a short time, and the cat, the parrot, the bag of seed and him cross the river in 1 trip, easily.

1. Evaluate each potential solution

***The Athletic Solution,*** DOES NOT meet all the technical requirements of the question. The solution though does achieve the goal of the problem though, but the man does not cross the river every time in his boat, he sometimes swims across the river. This only causes more questions needing to be asked to solve the question then producing a simple complete answer.

***The Boat Dealer Approach:*** This is my personal favorite solution. The man would be taking my approach to solving it. He’s someone who sees this as potentially repetitive problem in the future, and decides to grow his cat, parrot, and bag of seed smuggling operation with the solution to. This solves many problems in addition to just the problem at hand. The question is, does he really cross the river in his boat or since the fact that the boat’s title is in the hands of the bank, does it meet that requirement of the problem? Because honestly he finds the way to negate all negative isolated situations between the cargo items with this.

***The Hard Work Approach:*** This requires no waiting for Rick, not getting wet, it doesn’t create new problems, and it solves all the worries of potential molestation events that could occur. Also it gets everyone to the other side of the river with easy.

1. 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

Constraints

There is a finite amount of socks of broken down into 5 black pairs, 3 brown pairs, 2 white pairs

Have to make the sock selection in the dark

Disorganized Sock Drawer

Sub Goals

Minimize the amount of socks I must select to pick 1 pair of matching socks

Minimize the amount of socks I must select to pick one pair of each sock

Organizing the Drawer and Socks properly

1. Identify potential solutions

***The Folded Sock Solution:*** This solution takes preplanning, I fold my socks in specific shape patterns based upon their color when they are washed or unpacked into my drawer. I fold black socks into squares, my brown socks into a sock ball, and I tie a knot with my white socks. Thus in the dark I can identify color without sight.

***The Wash Solution:*** I dye all my socks black, the next time I wash my socks, and thus leaving the solution to be that any pair I select will be black.

***The Random Selection:*** This solution is just randomly selecting a large amount of socks.

***The Drawer Organizing Solution:*** This solution also requires preplanning, you organize the socks placement in the drawer based upon color.

***The Tactile Sock Solution:*** Each color of sock has a different feel because they are different type of fabric to be made into socks, your black socks are silk, your whites are cotton, and your browns are a nylon/cotton mix. So you can just decide what socks you want in the dark by feel.

***The Hybrid Solution:*** You combine The Folded sock solution, the Tactile Sock Solution and the Drawer Organized Solution. They are combined into the ultimate, redundant sock solution.

1. Evaluate each potential solution

***The Random Selection:*** This is the most inefficient, time consuming, and relies on statistical probability to solution to the questions, how many pairs it would take to get 1 specific pair, and 1 specific pair of each type.

***The Wash Solution:*** This solution does not truly solve the problem, it just creates a new problem of all black socks, and thus you really can’t address the question at hand how many pairs it takes to get to one of each color type.

***The Folded Sock, Drawer Organizing, & Tactile Sock Solution:*** These functions all work off the same idea that the blind implement in organizing, be it via touch, or geographical place you can be confident that your selection is correct. When combined in ***The Hybrid Solution***, you lower the potential for error, creating an ideal situation.

1. 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

Constraints

Working with a child (who may or may not have a physical disability as she can only count on her left hand)

Working with potentially a partially identified counting pattern of said child.

Sub Goals

Identify the full counting pattern of the child.

Then Identify the solution to the counts of 1-10, 1-100, 1-1000 based upon logical patterns

1. Identify potential solutions

***The Finger Test:*** Count out 1-10, 1-100, and 1-1000 on your own hand, as a physical solution to the question. Identifies the pattern the child works on, and

***The Excel Spreadsheet Solution:*** A digital version of the Finger Test, and it’s easier to catch a pattern.

***Mathematical Solution:*** I’m missing the tools to figure this solution, but there is one.

1. Evaluate each potential solution a) Does each solution meet the goals? b) Will each solution work for ALL cases?
2. Choose a solution and develop a plan to implement it.
3. 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).