1. **1)  Define the problem**

a) Do this in *your own words.*b) What insight can you offer into the problem that is not immediately visible from

the word problem alone? c) What is the overall goal?

1. 2)  **Break the problem apart**a) What are the constraints? b) What are the sub-goals?
2. 3)  **Identify potential solutions**a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?
3. **4)  Evaluate each potential solution**

a) Does each solution meet the goals?

b) Will each solution work for ALL cases?

1. **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 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 man needs to transport the 2 animals and the bag of seed to the other side, but only has room for himself and one item. If he leaves the 2 animals together, the cat will eat the bird, and if he leaves the bird and seed together the bird will eat the seed.

**Break the Problem Down:**

Constraints: We cannot leave the bird and cat together and we cannot leave the bird and seed together.

However the problem says that the cat “could” eat the bird, not “would” eat the bird. That being said, the problem does say that the bird “would” eat the seed. So we have a better chance of leaving the bird and cat alone at any given time.

**Identify Potential Solutions:**

We can possibly take the bird to the other side first, leaving the cat and seeds on the other side. But then any item taken after that would be affected when taken onto the other side.

If we take the cat the bird “**will**” eats the seed.

If we take the seed, the cat **“may”** the bird

If we take the bird it is safe, everything is safe until you choose what to take next. Then either the bird **may** be at risk if you take the cat, or the seed **is** at risk if you take the seed across after the bird.

**Evaluate:**

There is no potential way to get everything across safely at a 100% probability unless the man is able to put an item on his own person. For example inside of his pocket he can put the seed if it is small enough.

However, according to how the question is worded we may be able to take the bird first, leaving the seed and cat with no risk to each other. Then we should take the cat second because it is not with certainty that the cat will eat the bird. The problem clearly states that the cat “**may”** eat the bird. That tells us that the cat may or may not eat the bird. However the problem does clearly state that the bird “**would”,** or absolutely for certain eat the seed.

**Choose a Solution:** I believe with the given constraints, the method with the least probability of failure is first taking the bird across, and then the cat, and then the seed. This is because it will have the least probability of failure since the bird will only be at risk while we go back for the seed.

**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.*

**Define the Problem:** This sock problem and its questions is a probability problem

**Break the Problem Down:**

First in order to make sense of the problem, we have to break our sock pairs up into separate sets.

Let the universal set = S:S has a value of 10 pairs of socks

Let B = 5 pairs of Black socks or 10 Black socks

Let Br = 3 pairs of Brown socks or 6 Brown socks

Let W = 2 pairs of white socks or 4 White socks

Our constraints are that we can only where one pair of socks at a time.

**Identify Potential Solutions:**

For question a.) We are asked What is the smallest number of socks that you need to select to guarantee getting at least one matching pair. Well we can figure that out by getting the probability of each color.

Well I know that there are 10 out of 20 Black socks which = 50% of all socks

I know there are 6 out of 20 Brown socks which is = 30% of all socks

And there are 4 out of 20 White socks which is = 20% of all socks

I’m not very good at math, but I know that for both of these problems we need to use the values that we have established in sets in order to discover the exact or highest probability numbers for anwers A and B.

**Evaluate:** By using probability with permutations and combinations in finite math, we should be able to figure out answers A and B rather easily if we do the math correctly.

**Choose a Solution:** If I had the ability to perform the proper math operations, I know that I would be able to figure out answers to A and B through probability and then turning that probability into approximate number values.

**Question 3:**

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:** We want to know what finger the little girl will stop at depending on the value we have her count to.

**Break the Problem Down:** There are different approaches that one can take in order to figure out this problem. With the information provided we can either take a mathematical approach, or count just as the little girl does.

**Identify Potential Solutions:**

a.) has a small target number we can count on our hands with the described method.

b.) This part asks for the number 100 which is bigger but still doable through counting

c.) At this point we are being asked bigger numbers, and although we could continue counting on our hands, one could take a mathematical approach.

**Evaluate:**

1. The value on this question is small so we can count it on our hand as described and it is a sufficient solution.

It ends on the pointer finger.

1. This value 10 times bigger, but can still be counted to even though it is not the most optimal solution. If one could figure out a pattern, one could just use mathematics to figure out the answer.
2. Counting at this point has become irrelevant so mathematics would be the only optimal solution

**Choose a Solution:** If we could figure out a mathematical way to find a pattern in the little girls counting method, we would be able to quickly find which finger she would stop at while counting to any number.