**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.

1. **Define the Problem**

The problem is this…there is a man with a boat on one side of the river. Accompanying him is a cat, a parrot and a bag of seed that he need to get to the opposite side of the river, but how to do so without each of his passengers dining on the other (with exception to the bag of seeds). Some things I considered before breaking this problem down were some general ideas like: Can the parrot fly? Just how big is the bag of seeds and can the cat sit on top of it? Also, just how big is the boat? The overall goal is to get all 3 items (cat, parrot, seeds) to the other side without the cat eating the bird or the bird eating the seeds.

1. **Break the problem apart**

By breaking the problem apart, I determined that obviously if he leaves the cat with the bird, the bird is history. If he leaves the birds with the seeds, the seeds are history. Obviously there isn’t enough room in the boat for all three to go with the mighty sailor, leaving him with the issue of getting all of them across the river in one piece.

1. **Identify potential solutions**

To accomplish the sub-goal of not allowing the cat to eat the parrot or the parrot to eat the seeds, I determined that several trip are going to need to be made.

1. **Evaluate each potential solution**

There is really only one potential solution to this problem that I could determine, considering the limitations of the boat. Originally, I thought *can the parrot fly*? If so, let’s consider that we place the bag of seed in the free seat on the boat and place the cat on top of the bag of seed as he stared at the parrot flying freely behind the boat. Unfortunately, there isn’t enough room on the boat. Therefore, the following solution is what I came up with.

1. **Choose a solution and develop a plan to implement it**

Several trips need to be made in order to accomplish the goal of getting the cat, parrot and bag of seeds safely across the river without one devouring the other. We begin by taking the parrot across the river because that separates the cat from the parrot. We then return across the river alone and collect the cat to take him to

the other side. Upon arrival, we take the parrot back across the river to collect the bag of seeds. When the seeds are collected, we return to the other side, leaving the parrot behind and dropping off the seeds with the cat. Finally, we return back to the other side, alone, to collect the parrot. Once we return with the parrot, all is well on the other side of the river.

**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:

1. At least one matching pair = 4 Socks
2. At least one matching pair of each color = 18 Socks
3. **Define the Problem**

The problem here is that it is dark and I have a drawer full of unmatched socks, of which I need a matching pair. The possibility of selecting one pair of matching socks is less than 4. You could obviously get lucky and select a matching pair with just two picks. However, to guarantee that you get a matching pair you would want to select no more than 4 socks. In order to get at least one matching pair of each color, again, if you are lucky you could simply select 6 socks and hope for the best, but in order to guarantee at least one matching pair of each color, you would need to select at least 18 of the 20 socks available.

1. **Break the problem apart**

Breaking the problem apart, one can clearly see that this is a difficult task finding matching socks in the dark. I mean it’s difficult enough with the lights on…

1. **Identify potential solutions**

Not really many potential solutions that I could identify with this problem other than breaking down the number of socks and the potential of selecting a particular color. However, the “guarantee” part made it more difficult…

1. **Evaluate each potential solution**

Again, I didn’t have but one potential solution, which was to break down the number of each color sock and base it off that. Obviously, you can get lucky enough to only have to select two socks in order to get one matching pair, but the odds are high…by selecting 4 socks, you are guaranteed at least one matching pair. More to follow in the solution…

1. **Choose a solution and develop a plan to implement it**

With the selection of the socks, in order to get a guaranteed matching pair, you have to select at least 4 socks. The first three picks could at least give you one of each color (black, brown and white), leaving the fourth pick to give you at least one matching pair. However, according to my calculations, in order to get a matching pair of each color, you would need to grab 18 of the 20 socks in the drawer. This could potentially give you one pair of each. Again, this is a guarantee and not a probability. You could get lucky and select a matching pair in only 6 socks, just as with getting one matching pair you really only need to select 2 socks. However, we are discussing a “guaranteed” match, not a “possible” match.

**Problem 3:**

**Predicting Fingers:**

A little girl counts using the finger of her left hand as follows: She starts by calling her thumb 1, the first finger 2, middle finger 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?

1. What if the girl counts from 1 to 10 = First Finger
2. What if the girl counts from 1 to 100 = Ring Finger
3. What if the girl counts from 1 to 1000 = First Finger
4. **Define the Problem**

This wasn’t as difficult of a problem to solve as the previous two problems encountered in this activity. It was more a matter of learning a pattern. The situation involved a little girl counting on her fingers from thumb to pinky and then reversing. The problem was, what finger would she end up on when she got to 10, 100 and 1000. Initially, I thought that the direction her hand was facing would play into the correct solution to the problem; however, I soon realize that it didn’t. The overall goal is to determine what finger the little girl will stop on upon reaching the numbers 10, 100 and 1000.

1. **Break the problem apart**

Basically, by breaking the problem down, you can eventually discover a pattern and determine the answer to the problem. I actually began by counting them all out, which allowed me to identify each of the fingers for the 10, 100 and 1000 position.

1. **Identify potential solutions**

Potential solutions are to count to 10, 100 and 1000 respectively, or to eventually determine a pattern. Interestingly enough, I identified a few patterns along the way.

1. **Evaluate each potential solution**

My initial solution was to count to each of the numbers. Upon counting to 100, I noticed that the ring finger and the index finger were all multiples of 10. The index being the number 10, and the ring finger being the number 20. From there I noticed that the ring finger was again the next 10 (30). Then the index was 40 and then 50…the ring 60 and 70…the index 80 and 90…and so on…therein lies the pattern…each finger next to the middle finger represents a 10 and the following 10. Then I discovered an easier way to identify the correct fingers…

1. **Choose a solution and develop a plan to implement it**

My end solution came from the realization that if you go in opposite directions you can quickly some to a solution. Let’s start with 10…thumb 1, index 2, middle 3, ring 4, pinky 5, ring 6, middle 7, index 8, thumb 9, **index 10** (again, proving that the index is a multiple of 10). However, if you then switch and go backwards, beginning with the pinky rather than the thumb and count by 10 instead of ones, you get the 100 result (the ring finger). Pinky 10, ring 20, middle 30, index 40, thumb 50, index 60, middle 70, ring 80, pinky 90, **ring 100**. Finally, starting over back at the thumb and counting by 100’s you end again on the index finger just as if you counted it all the way out like the little girl. Thumb 100, index 200, middle 300, ring 400, pinky 500, ring 600, middle 700, index 800, thumb 900, **index 1000**. Whew!!