Problem 1:

Defining the problem:

A man needs to escort a parrot, cat, and a bag of seeds across a river. The boat he is using can only hold one of the three. While he is crossing the river, the cat can eat the parrot and the parrot can eat the bag of seeds.

Looking at the problem, I can tell immediately that taking the parrot across first should be the first step because the cat won’t eat the bag of seeds.

The overall goal of this problem is to find a solution that will allow the man to take all three of the items across without the cat eating the parrot or the parrot eating the seeds.

Breaking apart the problem:

The constraints are not being able to leave the cat alone with the parrot or the parrot alone with the bag of seeds.

The sub-goal is to not allow the cat to eat the parrot or allowing the parrot to eat the bag of seeds.

Potential Solution:

1. Take the parrot across the river first.
2. Take the cat across the river second.
3. Pick up parrot and bring back across the river.
4. Switch the parrot of the bag of seeds.
5. Bring bag of seeds across the river.
6. Go back and pick up the parrot and bring the parrot across the river.

Evaluating the solution:

This solution meets the sub-goal of not allowing the cat to eat the parrot or allowing the parrot to eat the bag of seeds. This solution would work for the all the goals of this problem.

Choosing a solution and implementing it:

Since the cat and the parrot cannot be alone together, the first step is to take the parrot across the river. The cat will not eat the bag of seeds if left alone with it. You would then leave the parrot on the other side of the river.

The next step would be to take the cat across the river. Since the cat and the parrot cannot be alone with each other, you would then leave the cat and take the parrot back across the river.

Since you can only take one item across the river at a time, you would switch the parrot for the bag of seeds. You would then carry the bag of seeds across the river and leave it with the cat.

Then you would go back and pick up the parrot and bring it back across the river.

I acted out the problem with toys. I set up the toys as follows: a river, a boat, a man, a cat, a parrot and a bag of seeds sitting on one side of the river. I then looked at the problem and thought about what the problem was. I knew that the boat could only carry the man and one other item. I also knew that I could not leave the cat with the parrot or the parrot with the bag of seeds.

I knew that the first item I needed to take across was the parrot because the cat would not eat the bag of seeds. So that was one part of the solution. I then took the cat across the river. But I couldn’t leave the cat with the parrot to go back across the river because the cat would eat the parrot. So I knew that I would have to bring one back.

I brought the parrot back across the river because the cat would not eat the bag of seeds. I then switched out the parrot for the seeds. Now the parrot was on one side of the river, the bag of seeds was in the boat and the cat was on the other side of the river. I placed the bag of seeds next to the cat, and since the parrot was the only one left to bring over, I sat the bird next to the bag of seeds.

Now all three had been brought across the river without leaving the wrong ones alone together.

Problem 2:

Define the problem:

There are 5 pairs of black socks, 3 pairs of brown socks, and 2 pairs of white socks in a drawer, equaling a total of 20 socks. You choose the socks in the dark and can only look at the socks after you have picked the socks. What is the minimum amount of socks you would need to pick to get one matching pair and what is the minimum amount of socks to get one matching pair of socks of each color?

Breaking the pairs of socks into individual socks such as 10 black socks, 6 brown socks and 4 white socks helps to make finding a solution easier.

The overall goal is to find how many socks you would have to pick before finding one pair of socks and how many socks you would have to pick before finding a pair of socks of each matching color.

Breaking apart the problem:

The constraints of this problem are only being able to pick the socks in the dark and to only check the socks after you have chosen them.

The sub-goals would be:

1. Minimum amount of times to pick socks for one matching pair
2. Minimum amount of times to pick socks for a matching pair of each color.

Identifying potential solutions:

1. Minimum amount of times to pick socks for one matching pair.

Possible solution: There are three different colors so if you pull out a different color three times, the fourth sock will match one of the other three that have already been chosen.

1. Minimum amount of times to pick socks for a matching pair of each color.

Possible Solution: There are 10 black, 6 brown, and 4 white socks in the drawer. So if you pull 18 socks, which will guarantee that, you will have one of each pair. Even if you pull only black for the first ten and only brown for the next 6 times.

Evaluating each solution:

Each solution meets the goal, it shows what the minimum amount of socks have to be picked to find one matching pair of socks and one matching pair of each color.

The solution will work for all cases.

Choosing a solution and implementing it:

For the minimum amount of socks for one matching pair the solution is 4 socks. Because since there are three different colors, if you pull out a different color sock three times, the fourth time is going to match one of the other three.

For the minimum amount of socks for one matching pair of each color the solution is 18 socks. Because there are 10 black socks, 6 brown socks, and 4 white socks, pulling 18 socks will give you one pair of each color. Even if you pull 6 brown socks and then 10 black socks, you still have 4 white socks left; the next 2 socks that are pulled will be a matching pair.

I used colored pencils in a bag to test this solution. I put 10 black pencils, 6 brown pencils, and 4 white pencils in a bag. I then pulled 4 pencils out of the bag. I got a white, black and brown pencil. Since there were only three colors of pencils in the bag, the next one I drew was a brown pencil; I was guaranteed a matching pair of pencils because I had already drawn all three colors.

For the minimum of times for one matching pair of each color, I used the colored pencils and the bag again. I drew 18 times out of the bag. I drew 6 brown, and 10 black. The next two that I drew were white. I then had a matching set of each color.

Problem 3:

Defining the problem:

A little girl counts using the fingers on her left hand as follows. 1 on her thumb, two on her first finger, 3 on her middle finger, 4 on her ring finger and 5 on her little finger. Then she reverses order as follows: 6 on her ring finger, 7 on her middle, 8 on her first and 9 on her thumb. Then she reverses again with 10 on her first finger etc.

If she continues to count in this manner which finger will she stop on if she counts from 1 to 10, from 1 to 100 and 1 to 1000?

The answer for 1 to 10 is already given to you in the problem.

The overall goal is to find the pattern to tell which finger is stopped on when reaching 10, 100 and 1000.

Breaking the problem apart:

The constraints of the problem are you can only count on your left hand by reversing direction when you reach the little finger or the thumb.

The sub-goals are finding the pattern for each final number.

Evaluating potential solutions:

1. Which finger do you stop on for 10?

Possible solution: The answer is already given to you in the problem, the first finger.

1. Which finger do you stop on for 100?

Possible solution: The pattern for this solution is the finger that you stop on changes every 10 so it would land on either the first finger or the ring finger.

1. Which finger do you stop on for 1000?

Possible solution: The pattern for this solution is the every 100 switches from ring finger to first finger.

Evaluating the potential solutions:

The solutions will work for all cases and meets all the goals of the problem.

Choosing a solution and implementing it:

Since the answer for 1 to 10 is already in the problem, the solution for 1 to 100 is finding the pattern for 10s. The pattern is that each set of 10 will end on either the first finger or the ring finger.

For 1 to 1000 the pattern is every set of 100 changes from ring finger to first finger.

I tested this solution by counting on my left hand. The pattern for 10s showed up as landing on the ring finger and as I was counting the pattern for 100s landed on the first finger.