A Cat, a Parrot, and a Bag of Seed:

1. Define the problem:   
   a. The problem is figuring out how to transport the cat, parrot and seed across the water one at a time without the parrot being eaten by the cat or the seed being eaten by the parrot while two of the objects are left alone.  
     
   b. The word problem does not state it, but the parrot is able to fly so transporting the parrot via boat would not be necessary. The problem also does not state that it is required that the man be transported to the other side of the river. The man could also take one object back across with him to his starting point.  
     
   c. The overall goal is to get the cat, the parrot and the bag of seed to the other side of the river.
2. Break the problem apart:  
   a. The constraints include:  
    1. Not being able to leave the cat with the parrot  
    2. Not leaving the parrot with the seed.  
    3. There’s only room for the man and one of the objects in the boat at a time.  
     
   b. The sub goals include:  
    1. Prohibiting the cat from eating the parrot.  
    2. Prohibiting the parrot from eating the seed.
3. Identify potential solutions:  
   a. Having the parrot fly across to the other side of the river.  
     
   b. Return the parrot to the opposite side of the river in the boat after transporting the cat and the seed.
4. Evaluate each potential solution:  
   a. Assuming that the parrot is compliant and obeys direction, allowing the parrot to fly back and forth across the river as the man makes multiple trips to transport the cat and the bag of seed, this solution does meet the overall goal and sub-goals of this problem.  
     
   If the man took the parrot back and forth with him in the boat to the opposite sides of the river in between the trips transporting the cat and the bag of seed, the overall and sub-goals of this problem are met.   
     
   b. Each solution appears to work in theory; the only hiccup would be if the parrot did not follow directions to fly across. That would be learned when testing that solution to know for sure. Otherwise, transporting the parrot back and forth with the man would be successful.
5. Choose a solution and develop a plan to implement it:  
   a. First, take the parrot across the river (side B) in the boat with the man.  
   Next, take the boat back across the river (side A), pick up the cat and take the cat to the opposite side (side B).  
   On the way back to side A, take the parrot (from side B) back with the man.  
   Next, drop off the parrot on side A and pick up the bag of seed. Take the bag of seed with the man to side B where the cat is.  
   Take the boat back to side A to pick up the parrot.  
   Finally, take the parrot to side B to be with the cat and the bag of seed.   
     
   b. As long as the parrot is not left alone with either the cat or the bag of seed, the solution works out. By moving the parrot back and forth, this solution is achieved. Taking items found around my home that represented each object in this problem, I was able to visually work out this scenario by moving the object representing the parrot back and forth like in the explanation.

Socks in the Dark:

1. Define the problem:   
   a. The problem is figuring out the smallest number of socks that can be selected in the dark in order to come up with a at least one matching pair and also at least one matching pair of each different color socks.  
   b. Information that is not immediately visible from this problem is that the socks are assumed to be separate and not in pairs already. The problem states: “There are 20 socks in a drawer”.  
   c. The overall goal is to select the fewest number of socks possible in the dark to complete at least one matching pair and also at least one matching pair of each color out of the drawer.
2. Break the problem apart:  
   a. The constraints include:  
   Only being able to look at the sock selection after it has been chosen.  
   b. The sub goals include:  
   Guaranteeing at least one matching pair.  
   Guaranteeing at least one matching pair in each color.
3. Identify potential solutions:  
   a. In the best-case scenario, a person would need 4 socks to come up with a guaranteed matching pair. The first sock they drew plus the potential to draw one more of each color (black, brown or white) before they received a guaranteed pair.  
   b. In the best- case scenario, a person would need a total of 18 socks to come up with a guaranteed matching pair of socks in each color. Multiple pairs of either the black or brown could be drawn before a white pair was drawn. Since there are only 4 white socks total and 2 of them need to be selected for a pair, all of the colored socks plus 2 of the white could potentially be selected prior to getting a matching white pair.
4. Evaluate each potential solution:  
   a. Based on the mathematical probability, it would seem that each scenario would meet what the goal of the problem is.   
   b. The solutions are for the least amount of socks needed to make each statement’s guarantee. Theoretically it seems that these solutions would work for all cases.
5. Choose a solution and develop a plan to implement it:  
   a. To select at least one matching pair: all of the socks would be combined in a drawer. A person would draw one sock. To be able to guarantee a match, a total of 3 more socks would need to be drawn. It is possible that fewer than 3 would need to be drawn, but by drawing 3 more it is guaranteed that one of those 3 additional socks would be a match for the first one.  
     
   To select a matching pair for each color: all of the socks would be combined in a drawer. A person would draw one sock and then 3 more to guarantee its match. The same would be done for each additional color. Because there are only 4 white socks, it is possible that all 16 colored socks could be drawn before the 4 white socks are left. Therefore in order to guarantee a match of each color, a minimum of 18 socks would need to be drawn. Again, it is possible that fewer than 18 would solve this problem, but it is not a guarantee.   
   b. In order to test this, the above instructions were followed to see what the guarantee is. It is possible that the probability is less than the guarantee, however the probability can change and therefore is not a guarantee.

Predicting Fingers:

1. Define the problem:   
   a. The problem is figuring out which finger the little girl will stop counting on if she counts from 1 to 10, 1 to 100, and 1 to 1,000. She only counts using 9 fingers since she is only using one hand and does not count her thumb or pinky twice when going back and forth.   
     
   b. The insight not readily stated in this problem is that the little girl is not reusing her thumb or little finger as multiples of 5. Instead the multiples of 5 land on other fingers as she counts.   
     
   c. The overall goal is to find out which fingers the little girl stops on when she counts to various numbers.
2. Break the problem apart:  
   a. The constraints include: Not being able to multiply or divide by 5s since the little girl is not counting by 5s or 10s with her fingers.   
     
   b. The sub goals include:  
    1. Figuring out what finger the little girl lands on if she counts from 1 to 10  
    2. Figuring out what finger the little girl lands on if she counts from 1 to 100.  
    3. Figuring out what finger the little girl lands on if she counts from 1 to 1,000.
3. Identify potential solutions:  
   a. The answer to figuring out what finger the little girl lands on when counting from 1 to 10 is actually given in the instructions for this problem and is listed as the index finger in accordance with the counting information given.   
     
   b. The answer to counting to 100 is her ring finger.   
     
   c. The answer to counting to 1000 is her index finger.
4. Evaluate each potential solution:  
   a. Each solution does meet the goals and is testable and accurate.  
   b. Each one hundred alternates between either the ring finger or the index finger. By counting between those 2, one is able to determine which finger the little girl will stop at.
5. Choose a solution and develop a plan to implement it:  
   a. Explain the solution in full:  
    1. The solution to counting to 10 is given in the instructions and is testable by counting on your own fingers using the same set of instructions that the little girl uses. Because she does not use her little finger or thumb twice when counting, only 9 fingers are being used to count rather than 10, which causes the little girl to stop on “odd” fingers rather than at the end of her hand with either the little finger or thumb.   
    2. The solution to counting to 100 is reached by alternating between the index and ring finger. After reaching 10, the ring finger is landed on twice (equally 20 and 30), then the index finger is landed on twice (equaling 40 and 50). This pattern continues as long as the counting does. So because the counting by 20s starts at 10 and is therefore odd, the number 100 would be reached and landed on by the ring finger.  
    3. The solution to counting to 1000 is reached by alternating between the index and ring finger. For every 100 counted, the opposite finger is landed on. We know that 100 landed on the ring finger so by counting by 100’s alternating between the ring and index finger, the solution is reached and 1000 is found to land on the index finger.   
   b. Test cases used for this activity include actually counting out the long way on my own fingers to test the theories and patterns. The patterns were found to hold up and be predictable so that the given answers are true.