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)  How can the man get himself, the cat, the parrot, and the bag of seed to the other side of the river?
  + b)  The problem really isn’t getting across the river, but getting all three across the river intact.
  + c)  The overall goal is to get everything across the river, intact.
* 2)  **Break the problem apart**a) What are the constraints?   
  The cat and the parrot cannot be alone together.   
  The parrot and the seed cannot be alone together.   
  The boat has only room for the man and one other “item.”   
    
    
  b) What are the sub-goals?  
   Keeping the cat and the parrot apart.  
   Keeping the parrot and the seed apart.
* 3)  **Identify potential solutions**

a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?  
  
The solution is to bring one or more of the items on more than one trip, so that he does not leave each item alone individually.

* **4)  Evaluate each potential solution** 
  1. a) Does each solution meet the goals?    
     1. Yes.   
          
        b) Will each solution work for ALL cases?   
          
        Yes.
* **5)  Choose a solution and develop a plan to implement it.** a) Step one – The man brings the parrot across and then rows back alone to the 1st shore.  
    
  Step two – The man brings the seed across and then rows back to the 1st shore with the parrot  
    
  Step three – the man leaves the parrot on the 1st shore and brings the cat back, leaving it on shore with the seed before rowing back alone.   
    
  Step four – The man gets the parrot on the 1st shore, and rows back to the 2nd shore, getting himself, the parrot, the cat, and the seed there successfully.
* b) Describe some test cases you tried out to make sure it works.   
  My testing consisted solely of examining each step to ensure that each fit the rules of the situation, and that in no case were non-compatible items left alone together. These being achieved, it was determined that the situation worked.

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** 
  + a)  There are an uneven number of socks, in three colors, that must be selected in the dark so to provide A) One matching pair, and B) one matching pair of each color.
  + b)  There are 10 black socks, 6 brown socks, and 4 white socks in the drawer. To accomplish both goals, a minimum of six socks must be selected. The problem does not suggest that it is outside of the problem’s parameters to put back
  + c)  What is the overall goal?   
    To determine the minimum number of socks required to guarantee that you have, in the end, selected a pair of white socks, a pair of black socks, and a pair of brown socks.
* 2)  **Break the problem apart**
* a) What are the constraints?   
  The pairs must be selected in the dark, and checked until both socks are selected.
* b) What are the sub-goals?

Repeat the above process until first a matching pair has been selected, and then repeat the above process until a pair of each color has been selected.

* 3)  **Identify potential solutions**

a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?  
  
Choose two socks, check them to see if they’re a pair, return one if it is not until you have a pair of one color.   
  
After having a pair of one color, repeat this process until a pair of each color has been found.   
  
Repeat this to determine average necessary number of socks chosen to determine “minimum” socks selected.

* **4)  Evaluate each potential solution**
* a) Does each solution meet the goals? Yes.
* b) Will each solution work for ALL cases? Yes.
* **5)  Choose a solution and develop a plan to implement it.**
* a) Step one: Select two socks in the dark.
* Step two: Determine if they are a pair.   
  Step three: If not, keep one sock, put one back, and select another.   
  Step four: Determine if they are a matched pair.   
  Step five: If not, repeat step three and four. If so, put matched socks aside.   
  Step Six: Select two new socks once first pair is found.   
  Step Seven: Determine if they are a matched pair of new color.  
  Step eight: If not, keep sock of one of the colors that is needed and select another.  
  Step nine: Determine if it is a needed matched pair.   
  Step ten: If not, repeat steps eight and nine.   
  Step eleven: Once the next pair is found, select two new socks.   
  Step 12: Determine if either sock is of needed remaining color.   
  Step: 13: If so, keep both and celebrate, or return one (or both) and select another sock (or two).   
  Step 14: Determine if the next chosen sock(s) are a matched pair. If not, repeat step 13.   
    
  The process is repeated to determine an average minimum of socks selected, while the unlikely, but probable answer has always been a chance of selecting six socks and getting three matched pairs as necessary.
* b) Describe some test cases you tried out to make sure it works. Testing for this to ensure that it works consists of lengthy evaluation of the plan to ensure that it contains logical steps, each of which guarantee the successful outcome of the original problem’s goal.

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** 
  + a)  Determine the easiest way to determine which finger the girl will end on when counting.
  + b)  The girl is counting of units of ten, and each sub-goal of the problem is also in increments of ten.
  + c)  The overall goal is to create an easier way of determining which finger the girl lands on than simply counting on each finger.
* 2)  **Break the problem apart**
* a) What are the constraints? The girl is counting from one to five and then reverses back to ten, beginning on the thumb and ending on the little finger – all counting is done on one hand.   
    
  b) What are the sub-goals? Determining which finger she will land on from 1-10, 1-100, and 1-1000 without actually doing the counting. A pattern must therefore be established to eliminate counting in higher increments.
* 3)  **Identify potential solutions**

a) Determine the pattern so as to know where it restarts, allowing one to calculate where exactly her counting ends in larger increments. In this case, 1-10 end on the first finger, then 11-20 end on the ring finger, then 21-30 end on the ring finger, and then 31-40 end on the first finger before counting restarts at the thumb, ending again at the first finger at 50. Thus every 50 counted digits ends on the first finger. Continue with this to determine the finger landed upon for each subgoal.

* **4)  Evaluate each potential solution**  a) Does each solution meet the goals?  b) Will each solution work for ALL cases?
* **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).