For each of the problems be sure to identify each of the steps discussed in the problem-solving lesson.

1. Define the problem
   1. Do this in *your own words*.
   2. What insight can you offer into the problem that is not immediately visible from the word problem alone?
   3. What is the overall goal?
2. Break them apart
   1. What are the constraints?
   2. What are the sub-goals?
3. Identify potential solutions
   1. For each of the sub-problems you’ve discussed in #2, what is a possible solution?
4. Evaluate potential Solution
   1. Does each solution meet the goals?
   2. Will each solution work for ALL cases?
5. Choose a solution and develop a plan to implement it
   1. Explain the solution in full.
   2. 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 communication the solution).

Problems:

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
   1. The problem here is the man has a boat that will only fit him and 1 item/animal. If he leaves the parrot and the cat to bring the seed first the cat will eat the parrot. If he leaves the parrot and the seed to bring the cat over first the parrot will eat the seed.
   2. An insight that is not immediately visible in the problem is if he brings the parrot first and then goes back to get either the cat or the seed, he will have the same problem when he leaves the drop off side to go back and get the last item/animal.
   3. The overall goal is to get the get the parrot, the cat and the seed over to the other side without the parrot eating the seed or the cat eating the parrot.
2. Break them apart
   1. The constraints are that if you leave the parrot alone with the bag of seed, the parrot will eat the seed. If you leave the cat alone with the parrot, the cat will possibly eat the parrot.
   2. Sub-goals?
      1. Get the parrot on the other side without being eaten
      2. Get the cat on the other side
      3. Get the bag of seed on the other side without being eaten
      4. Make sure parrot stays alive while waiting on the other side for the man to come back
      5. Make sure the bag of seed is not eaten while the man is coming back
3. Identify potential solutions
   1. Solutions to sub-goals
      1. Bring parrot over first
      2. Bring cat over 2nd
      3. Bring bag of seed last
      4. Bring parrot over on his shoulder along with the cat in the boat so he can watch them then (with parrot still on shoulder) go back and get the bag of seed
      5. Bring parrot over on shoulder with bag of seed then (with parrot still on shoulder) bring cat over.
4. Evaluate potential Solution
   1. Does each solution meet the goals? Yes
   2. Will each solution work for ALL cases? No
5. Choose a solution and develop a plan to implement it
   1. Explain the solution in full.
   2. 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 communication the solution).

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.
2. At least one matching pair of each color.

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?

1. What if the girl counts from 1 to 10
2. What if the girl counts from 1 to 100
3. What if the girl counts from 1 to 1000