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## **Problem Solving**

### **A Cat, a Parrot, and a Bag of Seed**

1. Define the Problem:
  - The problem is that each item would eat the other if the man leaves the wrong combination together at the same time.
  - The goal is to get all three items to the other side of the river.
2. Break the Problem Apart:
  - The constraints for this problem are to make sure that the man does not leave the wrong combination of items alone at the same time.
  - The sub-goals consist of getting each item across the river one at a time and making sure that none of the items are eaten while he is gone.
3. Identify Potential Solutions:
  - You must take each item in the correct order even if you have to take an item back to the original spot in order to keep each item safe.
4. Evaluate Each Potential Solution:
  - The solution meets the goals of the problem.
5. Choose a Solution and Develop a Plan to Implement It:
  - To solve this problem, I will define Side A as the starting point with all three items and Side B as the ending point. First, the man must take the bird to Side B. He then goes back to Side A and takes the seed to Side B. When he arrives on Side B with the bird and the seed, he must take the bird back to Side A. He then drops the bird off on Side A and takes the cat to Side B. From there the man must travel back to side A, pick up the bird, and take it to Side B.

## **Socks in the Dark**

**A: At Least One Matching Pair.**

**B: At Least One Matching Pair of Each Color.**

1. Define the Problem:

- A: You have to get at least one matching pair of socks from a drawer with three different colors and you can't see what color they are.
- B: You have to get at least one matching pair of each color sock from a drawer with three different colors and you can't see what color they are.

2. Break the Problem Apart:

- The constraint is that you can't see the color of the socks you are picking.
- The sub goals are to get one matching pair for problem A and a matching pair for each color for problem B.

3. Identify Potential Solutions:

- The solution to problem A is to draw enough socks to guarantee that you will have at least one matching pair of socks.
- The solution to problem B is the same, but you must draw even more socks in order to guarantee that you have a matching pair for each color.

4. Evaluate Each Potential Solution:

- The solution for each problem meets the goals of the overall problem and will work for all cases.

5. Choose a Solution and Develop a Plan to Implement It:

- Problem A Solution: The person must draw four socks in order to guarantee they will have a matching pair. This is because they could draw three times and get a different color each time. But they will always get a matching color on the fourth draw. This totals to four socks (worst case).
- Problem B Solution: This problem is far worse than the first. In order to guarantee that you will draw a pair of each color sock, you must draw a total of 18 socks. This is because it is possible to draw all 10 black socks and then all six brown socks. Then you are left with only white socks, so you must draw two more to guarantee that you have a pair of each color. This totals to 18 socks (worst case).

## Predicting Fingers

**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:

- The problem is to be able to tell what finger the girl will be on when she arrives at a set number. At first, the problem is simple. You can just count it out on your own hand. But when the numbers begin to be too large, you must find a pattern in the counting.
- The overall goal is to be able to predict what finger the girl will be on for any given number.

2. Break the Problem Apart:

- The girl starts at 1 on her thumb.
- She ends at 5 on her pinky.
- She then continues counting but skips the finger she was just on.

3. Identify Potential Solutions:

- The solution comes from realizing that the count increases by five initially. And from there on, increases by four each time. You can use this information to make a formula to determine what finger she will be on no matter what number she stops on.

4. Evaluate Each Potential Solution:

- The solution meets the goals and will always work.

5. Choose a Solution and Develop a Plan to Implement It:

- Formula: Use long division and take the remainder of the following formula.
  - $x = (n - 5) / 8$ , where  $x$  is the number that corresponds to a set finger and  $n$  is the final number counted to.
  - This formula is derived from the fact that you are using increments of 8 each time you cycle through your fingers not including the first 5 you count at the beginning (and that's where the minus 5 comes into play with the formula).
- Where remainder 0 is her pinky and all other remainders start at her ring finger with remainder 1 and you count up from there.
- For example, take the final number 1000. If you count all the way up on your

fingers, you finish on your pointer finger. By using this formula, you get 124R3. That means you have a remainder of 3. So in order to figure out what finger that correlates to, you start counting at 1 for your ring finger, 2 for your middle finger, and finally 3 for your pointer finger. The formula returns the same finger you would be on if you counted all the way up using just your fingers.