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

1. Defining the Problem
   1. There is only room to transport the man and one of the 3 items. The man intends on returning for the other 2 items. All three items must survive.
   2. My questions would include: Is there a second trip guaranteed? Is the cat in a kennel to prevent it from running away? Is the parrot in a cage to prevent it from flying away? Is there a trustworthy person to leave the bag of seed with for temporary safekeeping?
   3. The overall goal is to transport the man, the cat, the parrot, and the bag of seed, all intact, to the other side.
2. Breaking Apart the Problem
   1. There is room for only the man and 1 item per trip. The cat must not be left with the parrot. The parrot must not be left along with the bag of seed.
   2. The parrot must survive. The bag of seed must remain intact. The parrot cannot be left along with the bag of seed. The cat cannot be left along with the parrot.
3. Potential Solutions Identified
   1. Take parrot across, return alone. Take bag of seed across, return with parrot. Take cat across, return alone. Take parrot across.
4. Potential Solution Evaluated
   1. The solution meets all of the goals.
   2. The solution will work for all cases.
5. Solution
   1. The man can transport all three items from one side of the river (A) to the other side (B) through the following trips. The man must first take the parrot across, leave the parrot on side B and then return to side A alone. He must then take the bag of seed across, leave the bag of seed on side B; and then take the parrot on his trip back to side A. The man will then leave the parrot on side A and transport the cat from side A where he has been waiting this whole time over to side B. The parrot will be left behind to wait on side A. The man delivers the cat to side B; then he returns alone to side A to pick up the parrot and make his last trip to side B. All three items are now safely on side B.
   2. All other test cases resulted in a violation of the sub-goals.

**Socks in the Dark**

1. Defining the Problem
   1. How many socks do I need to select in order to find one matching pair in a drawer of 20 socks (4 white, 6 brown, 10 black)?
      1. How many socks do I need to select in order to find one matching pair of each color in a drawer of 20 socks (4 white, 6 brown, 10 black)?
   2. This is a probability problem; but can also be reasoned out simplistically.
   3. There are two goals. 1) Find a matching pair. 2) Finding a matching pair of each color.
2. Breaking Apart the Problem
   1. The constraint is that there are 20 socks: 4 white, 6 brown, 10 black
   2. 1) Finding out the probability of finding one matching set. 2) Figuring out the probability of finding one pair of each color.
3. Potential Solutions Identified
   1. There are 3 different colors so I will need to grab at least 4 socks to make 1 matching pair. Black/Brown, White/Brown + 1 of any color will make 1 matched pair
   2. If I need to make a matching pair of each color then I will multiply 4 socks minimum to make 1 matching pair, times 3 colors; which makes 12 socks to make 1 matching pair for each of the 3 colors.
4. Potential Solutions Evaluated
   1. The solution meets the goal of finding 1 matched set. The solution works for all cases.
   2. The solution meets the goal of finding a matched set of each color. The solution works for all cases. There may be a smaller number of socks that could guarantee meeting the goal.
5. Solution
   1. If I am in the dark and need at least one matching pair of socks from a drawer with 2 pairs of white, 3 pairs of brown, and 5 pairs of black; I will select 4 socks to guarantee at least one matching pair. Either each color will be represented and one of the colors would be duplicated (resulting in a match); or I will get all 4 black socks (still resulting in a match); or all brown socks (still resulting in a match); or all 4 white socks (still resulting in a match).
   2. If I want to find a match for each of the colors, I will take 12 socks from the drawer. I am multiplying the minimum number of socks to make 1 match (4) by the number of colors (3) to arrive at 12 socks.

**Predicting Fingers**

1. Defining the Problem
   1. Figure out the finger that the little girl will land on when she gets to 10, 100, and 1000 by using the following method: Forward on one hand where Thumb=1, Pointer=2, Middle=3, Ring=4, Little=5; then backwards on the same hand where Ring=6, Middle=8, Pointer=9, Thumb=10; then forward again and so on.
   2. My insight would be to use an Excel spreadsheet to discover a pattern.
   3. The overall goal is to figure out which finger she will land on when she gets to 10, 100, and 1000.
2. Breaking Apart the Problem
   1. The constraint the forward and backward method of counting and whether counting in this form all the way to 100 and 1000 is feasible.
   2. Figuring out a pattern to the counting that can be applied to find all of the answers.
3. Potential Solutions Identified
   1. Physically count forward on one hand where Thumb=1, Pointer=2, Middle=3, Ring=4, Little=5; then backwards on the same hand where Ring=6, Middle=8, Pointer=9, Thumb=10.
   2. Make an excel spreadsheet with the aforementioned information and count all the way to 100 using the sheet. The counting pattern rises as you count away from the thumb and back toward the thumb from the thumb. Between each thumb, there are always 8 digits. So adding 1+8=9; 9+8=17; 17+8=25 and so forth all the way to 97. Then the pattern increases as it moves away from the thumb so that 100 is the ring finger and 1000 falls on the pointer finger.
4. Potential Solutions Evaluated
   1. Both of the solutions meet the goals.
   2. Only the second solution of using an Excel spreadsheet would work for all cases.
5. Solution
   1. Manually typing the counting pattern into an Excel spreadsheet reveals a pattern for the thumb where there are always 8 digits in between moving away from the thumb and returning back to the thumb. If the thumb equals 1, then 1+8=9; 9+8=17; 17+8=25, and so forth all the way to 97. Continuing the count away from the thumb and then back toward the thumb makes 100 land on the ring finger. Similarly, using Excel to add 8 digits to the thumb number each time all the way to 993; then continuing the count away from the thumb and back toward the thumb would make 1000 land on the pointer finger.