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

**The Problem***:* A man needs to get a cat, a parrot, and a bag of seed from one side of a river to the other. The boat he is suing only has room for himself, and one other item. If the man should leave the cat with the parrot, the cat will eat the parrot. If the man should leave the parrot with the bag of seed, the parrot will eat the bag of seed.

**Insight:**My first initial thought is that he has the same problem on both ends of the river. If he leaves the cat with the seed and transports the parrot, the next item he transports will either feed the parrot or devour it.

**Goal:**The overall goal is to transport all three items from point A to point B without leaving the combination of the other two that will interact in a negative way.

**Breaking The Problem Apart**

**Constraints:**The obvious constraints are that he can only leave the cat with the seed to begin with, but will be forced to leave the parrot with either the cat or the bag of seed when he returns to transport the other item in question.

**Sub Goals:**The sub goal to the problem is to get one item across the river that will not negatively impact the ultimate goal by negative interaction.

**Potential Solutions**

**Possible Solutions to Sub Problems:** One out of the box way he can solve this is by making the parrot fly and circle above while he transports to cat and bag of seed. Then he could have the parrot land on the other side, but this is not a feasible solution.

A second way would be to find the right combination of transports that will allow a desirable outcome. By finding the best way to transport his items, he can avoid leaving the two items together that will result in failure.

**Solution Evaluation**

**Does Each Solution Meet Goals:** Both suggested solutions meet the ultimate goal of getting all items across the river. One will take some planning whilst the other is not that feasible.

**Will Each Solution Work For All Cases:** Each case scenario will work and function to complete the task at hand. As stated before, one will require careful and precise planning and the other (though not feasible) will allow for a speedier solution.

**Solution Implementation**

**Full Solution Explanation***:* This is my solution to the problem: The Man is to leave the cat with the bag of seed and transport the parrot to the other side. He is then to return to the cat and the bag of seed and transport the cat to the other side. Once he is on the opposite side with the cat and the parrot, he is to return the parrot to the first side of the river. Once there, the man is to transport the bag of seed in the boat and leave the parrot. He then returns to the other side and leaves the seed with the cat while he for the last time returns to the other side to transport the parrot back to where the cat and seed are waiting.

**Test Case Scenarios I Tried To Make Sure The Solution Works:** First I thought long and hard about the problem presented. I mentally ran different scenarios in my mind to find a solution and came close to finding the right combination of circumstances. I then drew out my ideas on paper to try and enhance my understanding of the situation. With the drawings supporting my ideas, I was able to find a solution to the problem.

**Socks in the dark**

**The Problem***:* I need to figure out what the smallest number of socks is that I can select in order to guarantee that I will select a matching pair (and matching color), of socks.

**Insight:**The immediate consideration that comes into play is that of analyzing this problem with math. If I can find the right formula to apply, I will be able to calculate a solution. I also need to understand that I can calculate this by formulating for individual socks (20) or pairs of socks (10).

**Goal:**The goal is to select at random (x) number of socks to find a like (y) and matching (z) pair of socks. In the end I will figure out the least amount of individual socks needed to find 1 matching pair of 10 matching pair (20 individual).

**Breaking The Problem Apart**

**Constraints:**The entire process of finding one matching pair must be done in the dark. This decreases the odds of finding a matching pair considerably. There are also 3 different sets of socks distributed into 10 pairs.

**Sub Goals:**After the problem is broken apart into smaller issues that need to be dealt with, I need to consider that I need to find 2 out of 20, and that they need to match.

**Potential Solutions**

**Possible Solutions to Sub Problems:** The easiest solution would be to turn the light on but that is not an option. Another solution would be to grab all the sox and then turn the light on but that also is not an option.

Finally, I could formulate the least amount of individual socks I would need to grab in order to insure that I will wind up with one single matching pair of 2 socks out of 10 total pair.

**Solution Evaluation**

**Does Each Solution Meet Goals:** Each of my 3 solutions will meet the goal of finding a matching pair of socks. Two of the three solutions are not legitimate forms of finding a pair due to the constraints on the problem. The only alternative left is to formulate a mathematical solution.

**Will Each Solution Work For All Cases:** All current possible solutions will work for the problems. In the end, finding a pair of matching socks will be the outcome for each of the case scenarios.

**Solution Implementation**

**Full Solution Explanation***:* Grabbing at least 12 individual socks (60%), whilst aiming for the most prevalent kind (black (50%)) of available kinds will bring the odds of grabbing unwanted (white and brown) down considerably. The odd of grabbing a matching set increase when the odds of grabbing the other variables decrease.

Because I want to choose a sock type of high quantity, when I grab 60% of all available socks, I eliminate the possibility of not grabbing a black sock, therefore effectively grabbing at least one matching pair.

**Test Case Scenarios I Tried To Make Sure The Solution Works:** To test my theory, I conducted the experiment in question. I turned off the light and tried to find one matching pair of ten pair. I conducted the experiment more than one time and took 60% of all available socks. Each time I was able to retrieve a matching pair of black socks. I also calculated my formula for finding the proper amount on paper.

**Predicting Fingers**

**The Problem***:* The issue in this problem is figuring out on which digit a particular number will fall when counting on one hand in an unstructured manner. I will need to figure out the 3 digits that 3 numbers will fall on in multiples of 10.

**Insight:**The very first thing I realized is that this little girl does not know how to utilize all her fingers in the process of counting. Secondly, the easiest way to determine the answer for the solution lies in a mathematical formula that I must define and calculate. In order to find the answers to all three questions I will need to do some math.

**Goal:**The overall goal in this process will be to find the formula that will help find the solution to not one but all three questions for this problem.

**Breaking The Problem Apart**

**Constraints:**The only constraint placed upon this problem is that of following an irregular pattern to find a solution. Because the numbers overlap each other and travel both forward and backwards on the fingers, finding the key for the answer will be challenging.

**Sub Goals:**I believe that if I can find the equation that produces the answer to the first variable, I will be able to find the answer to the following two with simple mathematics.

**Potential Solutions**

**Possible Solutions to Sub Problems:** I can seek the help of someone with better mathematical understanding to aid me in finding a solution but because it is simple deducing that will fin the answer (and I enjoy the challenge), I will simply use my niece as an assistant to help with the task. I will formulate the variables, and the givens to find the missing component that will put me on the right path.

**Solution Evaluation**

**Does Each Solution Meet Goals:** No matter which path I choose to proceed with, I will find the answers to the questions being asked. I have elected to pursue finding a formula to use to obtain the needed information.

**Will Each Solution Work For All Cases:** Each solution depicted above will work. On one hand I can have a mathematician friend find the right answer relatively quickly, and on the other, having an assistant will help me better understand the problem which will in turn help me find the best if not the right solution.

**Solution Implementation**

**Full Solution Explanation***:* When I apply the numbers from 1 to 10 to the five locations (the digits on a finger) a pattern arises. This pattern is what I need to find the formula that will answer the questions. When the pattern is applied, the numbers 10, 40, 50, 80, and 90 all fall on the first finger. Consequently, the numbers 20, 30, 60, 70, and 100 all fall on the ring finger. Using this information it was just a matter of deducing that if the pattern continues in this manner, all numbers divisible by 100 0r 1000 will fall on the ring finger. So, to finally answer the questions:

From 1-10: first finger

From 1-100: ring finger

From 1-1000: ring finger

**Test Case Scenarios I Tried To Make Sure The Solution Works:** For this final problem, I used my niece Natalie as an assistant. Together we counted on her five left fingers from one to ten in the manner described in the problem. We then continued to count until we got to 20. When we got to 20, I had enough information to begin formulating a theory that the numbers I needed would either fall on the first or ring fingers. I then drew up some mock fingers, applied what I had discovered, then turned my findings into a graph that lead me directly to the answers I needed for this problem.