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Section 2

Problem Solving

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Part I: 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 goat, and the goat would eat the cabbage. Show how he can get all the passengers to the other side, without leaving the wrong ones alone.

1. Defining the problem:

Obviously the main problem here is that the man has more items than he can fit in his boat. Beyond this, the riddle seems to be mixed up. It talks about a goat and cabbage. I assume this is a typo.

The goal obviously is to get the seed and animals across the river in one piece without them eating each other or the parrot eating the seed.

2. Breaking the problem apart:

The constraints in this problem are quite simple; each item can only be left with a specific item. If it is left with the wrong one, it will eat that item. The other constraint is the size of the boat, as it only fits one item or animal at a time.

The main sub-goal is to get the animals across the river without having them eating one another.

3. Identifying possible solutions:

For the constraints listed above, I think the obvious solution is proper ordering of moving the items. Also, the riddle doesn’t state anything about moving things back to the starting point being against the rules. That being said I think the proper solution is to carefully plan which items go back and forth to avoid any of them being eaten.

4. Evaluating solutions:

As there is only one foreseeable solution to the problem, there isn’t really much to evaluate. The only evaluation lies with the order of moving the animals and seed. As I stated, the only solution I can see is to move the animals and seed in a specific order. The riddle states (when corrected) that the cat will eat the parrot, the parrot will eat the seed, and the seed will do nothing.

5. Choosing a solution:

First, we move the parrot across the water and drop him off at the other side of the river. As he’s alone without seed, he has nothing to eat and will remain there, while on the other side, the cat will not eat the seed. Then, the man sails back to the other side, takes the seed, and sails back to the opposite side. He proceeds drop the seed off and then take the parrot back with him. He sails back to the opposite, drops the parrot off, and takes the cat to the other end. Again, as the parrot is alone, he cannot eat the seed, and the cat has no interest in the seed. The man then sails back, grabs the parrot and then sails back to the other end, drops the parrot off and disembarks from his boat, along with his seed and animals in tact.

Part II: 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. Defining the problem:

The main problem here is that we have several different colors and cannot actually see what socks we’re pulling out of the drawer until we’re done actually pulling them out.

The goal is to find the minimum number of socks that will provide one matching pair, and one matching pair of each color.

2. Breaking the problem apart:

The constraints here are as follows:

1. The assorted colors of the socks and;
2. The lack of light to see what our selection is
3. Pulling as few socks out as you can

I believe the sub-goals of this are to avoid pulling out no matched pairs of socks.

3. Identifying possible solutions:

There are a few solutions to this problem. The first solution is to pull all of the socks out, however this does not fit the “least amount” constraint. The second solution is to pull out the total amount of colors (3), plus one, to make sure you get at least one matching pair. This, however, does not provide a matching solution for part B of the problem, which is to provide a matching pair of each color. Using the same idea as my previous solution, if we take 2 socks of each color (6 total), plus one more of each color (3 more), we can be guaranteed to get a matching pair of each color.

4. Evaluating solutions:

As stated above, there are 3 possible solutions, but only one fits all the criteria of the problem, being the need to pull at least one matching pair of each color. The first solution, which is to pull all of the socks out, doesn’t match up with the constraint that we have to pull as few socks out as possible. The other solutions work fine.

5. Choosing a solution:

If the problem were to pull only one matching pair, the answer would be to pull 4 socks at random from the drawer. This would guarantee a single matching pair. However, for part B to be completed, we must pull 9 socks out of the drawer, 2 of each color, and 3 extras for good measure.

Problem III: 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 finger 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:

The goal of the problem is to predict what number she will land on at each given number, without actually counting it by hand in the manner she uses.

2. Breaking the problem apart:

The main constraint is that she can only use one hand to count. Obviously the process would be much faster with two hands. In addition, we have to predict, not count. The sub-goal would be repeating the process to get to the higher numbers.

3. Identifying possible solutions:

For this problem, we have a few solutions. The first solution would to actually count out the numbers as the little girl would on one hand. The second solution would be to use math to figure out the proper answer.

4. Evaluating solutions:

The first solution proposed would work, but it doesn’t follow the constraints that we are supposed to be predicting and not counting. It is also extremely time consuming to count all the way to 1000. The second solution seems to fit better, as it actually allows us to predict with a high degree of certainty which finger the girl will land on at each given number.

5. Choosing a solution:

As I stated in my evaluation of solutions above, the first solution proposed would be time consuming and wouldn’t match the constraints. Thus, the only valid solution is to use math. It’s relatively simple to figure out which finger she will land on at each given number.

As stated in the problem, if the girl counts to 10, she will land on her index finger. This allows us to accurately predict which finger she will land on at 100 and 1000. Since 100 and 1000 are both evenly divisible by 10, we know that it is a looped process and at both 100 and 1000, she will end counting on her index finger, as 100 is 10x10 and 1000 is 10x100.