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WPF Section 01

Problem Solving

**1. A Cat, A Parrot, and A Bag of Seed**

Original problem: 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

a. The problem here is that the man needs to cross the river in a boat that is only big enough for him and one small item but he has three items; a cat, parrot, and bag of seed. He cannot leave the parrot and cat alone and he cannot leave the parrot and bag of seed alone.

b. Some insight that I have for this problem is that the parrot is not in a cage, otherwise how would the cat eat the parrot? The bag of seed must be opened, otherwise how would the parrot eat the seed since it cannot open the bag.

c. The overall goal is for the man to get to the other side of the river with his 3 items, a cat, parrot and bag of seed, without any of them perishing.

2) Break the problem apart

a. The constraints in this problem is that the man has three items but the boat is only large enough to fit himself and one of the items.

b. The sub goals are to not leave the parrot and bag of seed alone together and to not leave the cat and parrot alone together while the man crosses the river.

3) Identify potential solutions

a. A solution to leaving the cat alone with the parrot or the parrot alone with the bag of seed is to carry one or all of them together.

4) Evaluate each potential solution

a. This solution does meet the goal by allowing them all to cross the river safely together.

b. This solution works for all cases because the cat will not be able to eat the parrot and the parrot will not be able to eat the bag of seed.

5) Choose a solution and develop a plan to implement it

a. The solution would be to take them all onto the boat with him. Since there is only room on the boat for the man and one other item, he can simply carry the parrot on his shoulder and either the cat or bag of seed on his lap with the other on the boat floor. This way, he would not have to worry about anything getting eaten.

b. Some things I thought of were to take one at a time. The man could bring the parrot first and then come back for the seed or the cat, but in order to go back for the last item the man would either need to leave the parrot with the seed or the parrot with the cat, which is what the man is trying to avoid.

**2. Socks in the Dark**

Original problem: 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

Answer: 6 socks  
b) At least one matching pair *of each color.*

Answer: 12 socks

1) Define the problem

a. The problem is that I am looking for a matching pair of socks by blindly choosing them in the dark.

b. An insight that I have is that all 20 socks are not already paired with their matching counterparts, which means that all 20 socks are loosely and messily stored in the drawer.

c. The overall goal is, given that there are 20 pairs of socks, I need to figure out the probability of choosing one pair of matching socks in one color and then the probability of choosing one pair of matching socks in each of the 2 remanding colors.

2) Break the problem apart

a. The constraints in this problem is that it is too dark to see the socks I am choosing, also the fact that the socks are not already paired with their matching counterparts.

b. The sub-goals are to find two socks that match and to determine how long that may take.

3) Identify potential solutions

a. Possible solutions to these problems would be to turn on a light or flash light, if those options are unavailable I could wear shoes that don’t require socks such as flip flops or sandals, and if that option is not available I could make sure that next time I put my socks away I could pair them with their matching counterparts; however since I cannot do either of those things I would have to pick them out one at a time and keep picking them out until I find a matching sock to the one I am holding.

4) Evaluate each potential solution

a. Only the last solution of choosing one sock at a time until I find a match would meet the overall goal.

b. The chosen solution will work for all cases because the overall goal is the same.

5) Choose a solution and develop a plan to implement it

a. The plan is to choose one sock at a time until I get the desired match; during which, I would not be putting the socks I am taking out back into the drawer because that would make the process harder and take longer than it needs to be.

b. If I were to take one sock out at a time and place it back into the drawer of socks if it has been denied as a match then the chances of choosing that same exact sock again is very likely; whereas, if I were to keep the undesired socks out of the drawer it will greatly lower the chance of choosing an un-matching sock and greatly higher the chance of choosing a matching sock to the one I am already holding.

**3. Predicting Fingers**

Original problem: 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?

a) What if the girl counts from 1 to 10?

Answer: First finger or “pointer finger”

b) What if the girl counts from 1 to 100?

Answer: Ring finger

c) What if the girl counts from 1 to 1000?

Answer: First finger or “pointer finger”

1) Define the problem

a. The problem is that the little girl doesn’t know which finger she will end on after counting from 1 to 10, 1 to 100, then 1 to 1000.

b. I can determine that the little girl has 5 fingers on her left hand, as well as the fact that she is able to count from 1 to 1000.

c. The overall goal is to figure out which finger she is going to end on after counting from 1 to 10, 1 to 100, and 1 to 1000 starting with her thumb and counting up and down her fingers in order from front-to-back, back-to-front and so on.

2) Break the problem apart

a. The only constraint is that she is only using five fingers to do her counting up to 1000.

b. The sub goals are to count from finger to finger in a specific order.

3) Identify possible solutions

a. A possible solution to this is to count in the specified order, one finger at a time starting with the thumb, going down to the pinky, then through the fingers back up to the thumb, and to determine a pattern to calculate which finger she will end on every time she is done counting.

4) Evaluate each potential solution

a. The solution does meet the goal because a set pattern will help to determine which finger she ends on when she is finished counting on 100 and 1000.

b. The solution will only work when counting to 50 or higher because in order to find the pattern you would have to count to at least 40.

5) Choose a solution and develop a plan to implement it

a. My solution would be to count in the specified order to 10 and determine the ending point, which is the pointer finger. Then count up to 20, which ends on the ring finger. If you continue counting to 30 you will notice it ends on the ring finger, and then to 40, which ends back on the pointer finger. If you go back and forth between those two fingers, counting by 10 every time, by the time you get to 100 you will land on the ring finger. To get to 1000, instead of doing this and counting by 10s you will count by 100. This will leave you on the pointer finger again.

b. In order to prove this solution I practiced the technique on my own fingers as well as trying different counting techniques and getting the same results.