Wilson, Eric April 1st, 2015 Scalable Data Infrastructures Section 01 Problem solving

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

**1) Define the problem**

a) There are three things that need to make it to the other side; however certain combinations won’t work. Also, there is only room for the man and one item/thing to be transported at the same time.

b) You can’t, for example, transport things that will eat each other while waiting on the other side. Ex. You can’t transport the cat, go back, get the parrot, go back and get the seed because the cat would have eaten the Parrot while you were getting the seed.

c) What is the overall goal? I believe the overall goal is to get them all to the other side with the careful watch of the man at all times. Should one be left alone on one side, and then we need to make sure the Parrot doesn’t eat the seed and the Cat doesn’t eat the Parrot.

**2) Break the problem apart**

a) What are the constraints? As mentioned before, you can’t leave one with the other that might consume the other. The Cat eating the Parrot and/or the Parrot eating the seed. You also can’t transport two things at the same time; only the man and one thing can be in the boat at the same time

b) What are the sub-goals? To choose the right item across to the other side first.

**3) Identify potential solutions**

a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?

A possible solution is to travel without anything as a passenger. Such as leaving the seed and the Cat alone while transporting the Parrot, then return alone leaving the Parrot along the other side. Then return with nothing in the boat but the man. Grab the seed and take it to the other side, then return with the Parrot in the boat. Leave the Parrot and take the cat to the other side leaving the cat and the seed alone, go back alone and get the cat. Return to the other side with the Cat. Now, under the close supervision of the Man we have all three together and never was there the possibility of one thing eating another.

**4) Evaluate each potential solution**

a) Does each solution meet the goals? Yes

b) Will each solution work for ALL cases? There is only one solution mentioned.

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

a) *Explain the solution in full.*

Start: Cat, Parrot and Seed are on the left side of the bank of the river.

Goal: Transport them all to the right side of the bank of the river.

Sub Goal: Make sure one thing isn’t left alone to eat the other thing; such as Cat eats the Parrot or Parrot eats the Seed.

Step 1. Take the Parrot to the *right side* of the bank; leave the Cat and the Seed on the left side together (the Cat won’t eat the Seed).

Cat/Seed 🡺Parrot

Step 2. Return with just the man to the *left side* of the bank.

Cat/Seed 🡸Man Parrot

Step 3. Take the Seed to the *right side* of the bank.

Cat Seed🡺 Parrot

Step 4. Take the Parrot across to the left side of the bank and leave the seed alone.

Cat 🡸Parrot Seed

Step 5. Drop off the Parrot and take the Cat to the right side of the bank

Parrot Cat🡺 Seed

Step 6. Leave the Cat with the seed.

Parrot Cat/Seed

Step 7. Return with just the man to the left side of the bank for the Parrot.

Parrot 🡸Man Cat/Seed

Step 8. Take the Parrot to the right side of the bank and join it with the Cat and the Seed

Parrot🡺 Cat/Seed

Step 9. You have achieved your goal.

Parrot/Cat/Seed

Socks in the Dark:

**1) Define the problem**

a) **Do this in your own words.**

For both problems you are searching for the same color, yet you cannot see any color because you are in the dark. Finding the least amount of picks becomes a counting problem for both situations.

b) **What insight can you offer into the problem that is not immediately visible from the word problem alone?**

This counting problem is asking for a guarantee, so we can’t wildly assume anything such as picking the same color for both situations. While that is a possibility it is not a guarantee. We need to find the least amount of picks that comes with a guarantee.

c) What is the overall goal?

There are two

1. Pick at least one matching pair of socks
2. Pick at least one matching pair of socks for each color

**2) Break the problem apart**

a) What are the constraints? That you are in the dark and can’t tell what color you are choosing

b) What are the sub-goals? To find the least amount of tries (picks) to achieve the goals

**3) Identify potential solutions**

a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?

**4) Evaluate each potential solution**

a) Does each solution meet the goals? Yes

b) Will each solution work for ALL cases? Yes

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

a) *Explain the solution in full.*

For the first problem: Pick at least one matching pair.

The worst-case scenario is that you pick up one sock of each color at a time, so you pick one black, one brown and finally one white. If they are all different each time, then the minimum or “smallest number of socks you need” to get a pair is 4. The reason it is 4 is because in the case above you have all three colors on the first three tries, and the 4th sock ***will have to match*** one of those three.

For the second problem: Pick at least one matching pair for each color.

In this case, the problem is a counting problem like before, and we are looking for guarantee not a chance. So in order to guarantee you will get a pair for each color with the least amount of picks the answer is 18. The reason is you can ***only be sure*** only after 18 socks. There is a possibility that you pick all 10 black, then all six brown socks, so you are only left with white to pick from, so your next two picks have to be white. The ***least amount of picks*** is 18, because only white is left to choose from.

Predicting Fingers

**1) Define the problem**

a) Find out which finger the little girl will end up on when she counts with her left hand, reversing back and forth until she reaches the goal of 10, 100 and 1000.

b) What insight can you offer into the problem that is not immediately visible from the word problem alone? At first, it was easy to think that no matter which hand you use, counting from 1 to 10 ends up on the first finger, and so does 20, 30 and so on.

c) What is the overall goal? To find out which finger the little girl will end up on when she reaches 10, 100 and 1000.

**2) Break the problem apart**

a) What are the constraints? You only have one hand to use.

b) What are the sub-goals? To find any patterns

**3) Identify potential solutions**

a) For each of the sub-problems you’ve discussed in #2, what is a possible solution? To manually count to ten using the method mentioned.

**4) Evaluate each potential solution**

a) Does each solution meet the goals? Yes

b) Will each solution work for ALL cases? There is only one solution mentioned.

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

a) *Explain the solution in full.*

I counted on my left hand and reached 10 on my first finger. Then, after answering the first question (what finger will she stop on when she gets to 10) I continued until I got to 20 and found I was again on the first finger, the same result with 30,40 and so on. It became clear to me that the goal of 100 was just 10 times 10, so after 10 ‘rounds’ you will always end up on the first finger. But let’s get deeper into why this happens.

Since she is counting nine fingers, we have to divide each number by 9 and the result is the remainder of the division. In all three cases, dividing by 9, gives a remainder of 1, 11 and 111. Anything in the one’s column is the first finger.

9/10=1.1…(the first finger)

9/100=11.11…(again, the first finger)

9/1000=111.11…(and lastly, the first finger)

1 is the first finger when landing on 10, 100 and 1000.