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**Web Programming Fundamentals**

**Activity: Problem Solving**

**5 Step Problem Solving Guide**

1. Define the Problem
2. Break the problem apart
3. Identify potential solutions
4. Evaluate each potential solution
5. Choose a solution and develop a plan to implement it.

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| **Problem 1**  **A Cat, a Parrot, and a Bag of Seed:** |
| 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 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. |

**5 Step Problem Solving**

1. **Define the Problem**

A man needs to get three things across the river on his boat that only has space for himself and 1 of his 3 items: a Cat, a Parrot, and a bag of seed. However, he cannot leave the bag of seed with the parrot or the parrot with the cat alone. The problem is how will this man do this without leaving either pair alone with one another. At first it seems that this would be an impossible issue. I even considered that perhaps it would be okay that the parrot could eat the bag of seed, but ultimately found that would not solve the problem, but was actually a part of it. The overall goal is to get these 3 items across the river without leaving them alone with one another.

1. **Break the problem apart**

*The constraints are the following:*

1. There are 3 items with only 1 space available on the boat
2. Parrot and Seed can’t be left together
3. Cat and Parrot can’t be left together

*Sub Goals are as follows:*

1. Make sure not to leave the 2 pairs alone with each other
2. Figure out how to transfer all 3 items successfully without having one eat the other
3. **Identify potential solutions**

Potential solutions could include the following:

1. The man could transfer one at a time.
2. The man could take 1 item at a time, then bring back one of them with him on the boat, and pick up the third and take it with him across the river.
3. **Evaluate each potential solution**
4. *Thought Process:* If the man takes one item at time: The parrot would be transported first to make sure that the cat stays with the seeds. However, if I then go back, I can leave neither the cat nor seed with the parrot. Solution not Successful.
5. *Thought Process:* The man could also be safe by not leaving any items alone together at all including: parrot/cat - parrot/seed - cat /seed

He would do this by first taking the cat and parrot on the boat with him. He would then leave only the cat across the river and take the cat back with him. Then he would go back and pick up the bad of seed and take transport it along with the parrot. This would also make it possible to transfer all 3 without ever leaving any 2 alone together.

1. **Choose a solution and develop a plan to implement it.**

First take the parrot across the river. Go back and take the cat across the river. On your way back take the parrot with you. Next take the bag of seed to the side where the cat is. Go back and transport the parrot to where the cat and seed are.

**Solution Process:**

1. Man takes only Parrot with him across the river.
2. He leaves the Parrot and returns to where the cat and seed are.
3. He takes the Cat across the river to where the parrot is.
4. He leaves the Cat and takes the Parrot.
5. He drops the Parrot off on the original side and transports the bad of seed across the river to where the Cat is.
6. He then goes back to where the original site and picks up the parrot to transport it across the river to where the Cat and Seed are.

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| **Problem 2**  **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. |

**5 Step Problem Solving Guide**

1. **Define the Problem**

I need to select a pair of socks from a drawer that contains 10 Black, 6 brown, and 4 white socks. However, I must select them in the dark and only find out the results after selecting them. The issue is how many must I choose to at least match one pair and how many must I choose to at least have one pair that does not match.

1. **Break the problem apart**

The probability of drawing the right socks would lessen with the fewer number of socks I draw. I noticed that the Problem asked for the least amount of socks needed. This means my answer must just aim to find the least probable amount of socks.

1. **Identify potential solutions**

*Matching socks are the following:*

1. Draw 10 so that you are at a 50% probability of drawing a pair of black socks.
2. Draw 3 so that you have the chance to pair at least 2 socks together.

*Mix matching Socks:*

1. Draw at least 12 to make sure you have more than the 10 black socks. Increasing chances of getting a different color sock.
2. Draw at least 3 socks to have the probability selecting Black, White, or Brown.
3. **Evaluate each potential solution**

*Matching Socks:*

1. *Thought Process:* The problem with this is that it wouldn’t be the least amount of socks needed to at least select a pair. It would actually be the amount to exactly get the matching pair. Solution Fail.
2. *Thought Process:* I find that this Solution accurately answers the Problem 2’s question. Although the Probability of it is low, this really IS the smallest number of socks needed to draw a matching pair.

*Mix Matching Socks:*

1. *Thought Process:* The issue with this is that it wouldn’t be the least amount of socks needed to at least select a mix matching pair, but actually the opposite. It would actually be a highly probable amount of being able to get a mix matching pair.
2. *Thought Process:* I find that this Solution accurately answers the Problem 2’s question. Although the Probability of it is low, this really IS the smallest number of socks needed to draw a mix matching pair.
3. **Choose a solution and develop a plan to implement it.**

Matching Socks: I chose Solution B because it gives me a chance of picking between 3 different colors socks in hopes to get a matching pair.

Mix Matching Sock: I chose Solution B as well because this gives me the least amount of probability of choosing from the 3 different colors in the drawer.

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| **Problem 3**  **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 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?  b) What if the girl counts from 1 to 100?  c) What if the girl counts from 1 to1000? |

**5 Step Problem Solving Guide**

1. **Define the Problem**

The problem is that the girl switches the direction in which she is counting and numbering her fingers. The goal is to identify which she finger she would land on if she kept counting until 10, 100, and 1000.

1. **Break the problem apart**

After doing the math I found that every 50 fingers you landed on the First Finger or the Ring Finger:

1 – 50: First

51 – 100: Ring

101 – 150: First a

And so on.

I am a very visual person, so I used a paper and a pen to manually draw out the numbers and patterns.

1. **Identify potential solutions**
2. First Finger
3. Ring Finger
4. Ring Finger
5. **Evaluate each potential solution**

I manually counted my own fingers to make sure that 10 and 100 landed on my First and Ring Finger.

After finding a pattern between the First and Ring Finger for every 50 counts, I decided to multiply 1000 by 50 and got 20. From here I just started listing, which was with which finger and ended up with Ring Finger.

1. **Choose a solution and develop a plan to implement it.**
2. First Finger on the 10th count: If you manually count your fingers, you will get the First Finger on the 10th count
3. Ring Finger on the 100th count: I decided to write down the numbers that would always fall on my First Finger. This would make it easier for me to guide myself if I got lost in the counting. I found that the closest to 100 that the First finger reached was 96. I then just counted up to 100 and landed on my Ring Finger.
4. Ring Finger on the 1000th count: I certainly didn’t think I could count until 1000 and actually get an accurate result so I decided that I would try to find a pattern in the counting. I ultimately found that every 50 fingers would land on either the First Finger or the Ring Finger. So I divided 1000 by 50 and got 20. I then varied between the Right and Ring finger and ultimately concluded that the Ring Ringer would be count 1000.