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Web Programming Fundamentals

Activity: Problem Solving

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

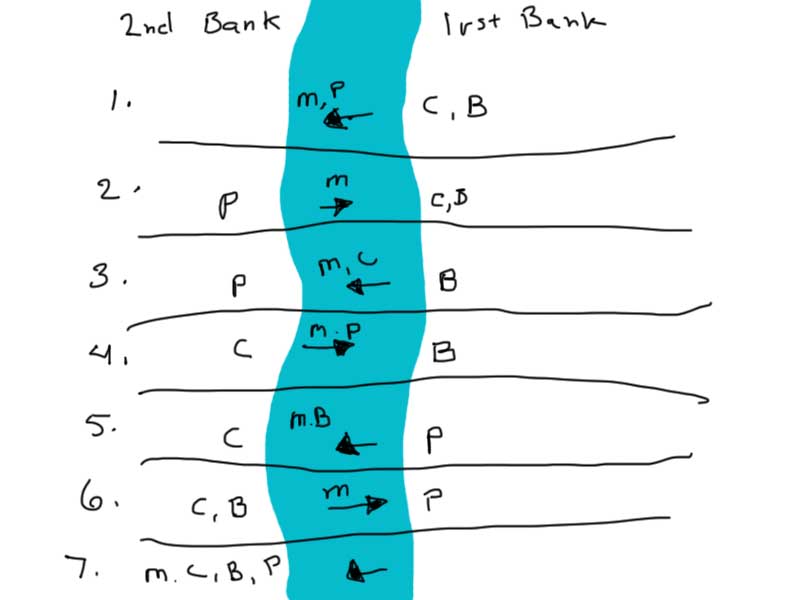
1. Define the problem
2. The problem in this situation is that the man on the riverbank with a cat, a parrot, and a bag of seed, needs to find a way to transport both the animals and the seed to the other side of the river. The man also has to do this, one at a time, because there isn’t enough room in the boat for more. So, the man has to choose which one to take, and which two to leave behind. Since the parrot would eat the seed, he can’t leave them together. Neither can he leave the cat and parrot together because the cat would eat the parrot.
3. Something that isn’t explained in the word problem is that as the man takes each one to the other side and leaves it, he must keep in mind that he can’t leave the wrong two together on the other side while he gets the third.
4. The overall goal in this case is to get the cat, the parrot, and the seed safely to the other riverbank one at a time without leaving the wrong two together at any time.
5. Break the problem apart
6. The constraints in this problem are:

* The cat must not be left alone with the parrot.
* The parrot must not be left alone with the bag of seed.
* The man only has room in the boat to take one at a time across the river.

1. The sub-goals in this case are:

* Choose the order that the cat, the parrot, and the bag of seed will be transported to keep from leaving the wrong two behind together.
* Choose the order that the cat, the parrot, and the bag of seed will be left on the opposite riverbank to keep from leaving the wrong two together.

1. Identify potential solutions
2. A potential solution for this problem is to make sure that the wrong two are not left together by keeping one of them in the boat during all trips to and from the opposite riverbank.
3. Evaluate each potential solution
4. This solution does meet the goals.
5. This solution will work for all cases.
6. Choose a solution and develop a plan to implement it.
7. First, the man will travel to the other side with the parrot, leaving the cat with the bag of seed. Then, he will leave the parrot on the second riverbank and return to the first riverbank. Next, he will take the cat across and drop it off on the second riverbank. He will then return to the first riverbank with the parrot, leaving only the cat on the second riverbank. Now he will leave the parrot on the first riverbank, and take the bag of seed to the second riverbank. After dropping the bag of seed off with the cat on the second riverbank, he will return to the first riverbank. Finally, he will take the parrot across to the second riverbank and join the cat and bag of seed.
8. The test case I used for this solution is that I took 4 post-it notes and wrote a letter on each of them. C for cat on the 1st one, P for parrot on the 2nd one, B for bag of seed on the 3rd one, and M for man on the 4th one. I then placed a piece of paper on the table to represent the river, and each side of the paper represented the banks. I moved each post-it that represented the cat, the parrot, or the bag of seed, one at a time along with the note for man. I made sure that the letters C and P were never left alone together as well as the letters P and B were never alone together. In the drawing below, you can see step by step how this solution was implemented.



**Socks in the Dark:**

1. Define the problem
2. The problem in this scenario is that there are 20 socks in a drawer. 10 of the socks are black, 6 socks are brown, and 4 socks are white. The room where the drawer is located is dark. I have to decide what the smallest number of socks I would need to blindly select to guarantee getting at least one matching pair of socks. Also, I need to know what the smallest number is that I need to select to guarantee at least one matching pair of each color of socks. I can only check the socks after I have made a selection.
3. This problem can be solved using math.
4. The overall goal is to select the least amount of socks necessary to satisfy the requirements.
5. Break the problem apart
6. The constraints are that I have to make a blind selection, and I cannot check the socks until I finish my selection.
7. The sub-goal is to determine the method for finding the smallest selection possible.
8. Identify potential solutions.
9. Using math, I could determine the smallest amount of socks necessary to fulfill the requirements.
10. Evaluate each potential solution
11. This solution will meet the goals.
12. This solution will work for all cases.
13. Choose a solution and develop a plan to implement it.
14. To select at least one matching pair it is necessary to select 4 socks. There are 3 different colors of socks. If we choose 1 of each color it will give us 3 socks and then the 4th sock that is selected is guaranteed to be a match to one of the 3 chosen colors.
15. To select at least one matching pair of each color of socks, it is necessary to select 18 socks. In order to guarantee that there are 3 different colored pairs, we have to select enough socks to eliminate possibility of leaving one color out of the selection. To do this we add the two largest groups of socks together, black and brown, to get 16 socks. Then, we can select the smallest number needed to make a pair with the 3rd color, which is 2. The total now becomes 18.
16. I used 10 ink pens, 6 pencils, and 4 markers to represent socks, and a brown paper bag for the dark room in my test cases. For the first problem I mixed up the pens, pencils, and markers in a paper bag and randomly selected 4 of them. I performed this 10 separate times to prove that my results were consistent.

For the second problem, I used the same setup with the pens, pencils, markers, and bag. I selected 2 of the mixture out of the paper bag and then, checked the results. I performed this 10 times to verify that I always had at least one pair of each. Then, I did the same experiment, only I selected 3 of the mixture out of the bag and then observed the results. On the 9th iteration of the test, I did not have 3 pairs. This confirmed for me that 18 are needed.

**Predicting Fingers:**

1. Define the problem
2. In this problem a girl is using her fingers in a peculiar way to count. She starts with her thumb as number 1, and continues to count across her hand to her pinky. Her pinky represents the number 5. Instead of starting over at her thumb to count past 5, she reverses the direction that she counts on her hand so that her ring finger is counted as the number 6. She continues to count across her hand in reverse, to her thumb, which represents the number 9. She then reverses direction again and counts her first finger as the number 10. She will continue this method of counting for all of the 3 problems in which we have to determine which finger she will stop on if she counts to 10, 100, or 1000.
3. As the girl continues to count in this way, a pattern begins to emerge that will help in solving the problem. Also, the answer to the first problem is given in the explanation.
4. The overall goal is to find out how we can tell which finger that she will stop counting on at different values.
5. Break the problem apart
6. The constraint in this problem is that the girl must continue counting back and forth across her fingers.
7. One sub-goal in this situation is to determine the pattern that occurs in the girl’s counting. Another sub-goal is to determine how often this pattern occurs.
8. Identify potential solutions
9. Since all 3 of the problems are in multiples of 5, we could continue to have the girl count to 5 repeatedly and chart the number of which finger she stops on, until a pattern emerges and starts to repeat. Also since all 3 of the problems are in multiples of 10, we could continue to have the girl count to 10 repeatedly and chart the number of which finger she stops on, until a pattern emerges and starts to repeat.
10. Evaluate each potential solution
11. Each solution does meet the goals.
12. Each solution will work for all cases.
13. Choose a solution and develop a plan to implement it.
14. The answer to the first question is her first finger. The answer to the second question is her ring finger. The answer to the third question is her first finger. The answer to the first problem is given in the explanation to the problem. If we continue to count in multiples of 10, we can observe that the girl will always stop on either her first finger, or her ring finger. Every time she counts to 10 twice, the finger she stops on will alternate. So, 20 would be her ring finger, 40 would be her first finger, 60 her ring finger, and so on. To simplify this even further for the last question, we can notice that another repeating patter occurs every 200. Counting to 200 would land on the first finger, at 400 the entire pattern repeats so she lands on her first finger again. Since 1000 is divisible by 200, she will stop on her first finger.
15. To test this solution I counted my own fingers and charted each stopping point at intervals of 10. After stopping at 100, I observed the outcome and recognized that a pattern emerged where every 20 the fingers would alternate. I then continued counting to 200 and observed the outcome. I noticed that a second pattern emerged where a giant loop occurred at 200. All of these findings can be seen in the chart below.Macintosh HD:Users:ericrogers:Desktop:fingerChart.pdf