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***Web Programming Fundamentals – Section 01***

***Activity: Problem Solving***

**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 seeds. Show how he can get all the passengers to the other side, without leaving the wrong ones alone together.

1. Define Problem:

1. Problem: Man is on riverbank and can only transport himself and one other item at a time without the bird and the seeds being together and without the bird and the cat being together.
2. Insight: That to accomplish out goal it is going to take multiple trips.
3. Overall goal: To transport all three items in his boats to the other side of the river without the cat eating the parrot and without the parrot eating the seeds.

2. Break Problem Apart:

1. Constraints? The boat only has room for the man and one other item and if left alone together, the cat could eat the parrot and the parrot could eat the bag of seeds.
2. Sub-goals? Figure out how and in what order to transport each item without the cat eating the parrot and without the parrot eating the bag of seeds.

3. Identify Potential Solutions:

1. Take the bag of seeds first and then go back and get the cat. After that go back and get the parrot.
2. Take the bag of seeds first and then go back and get the parrot. After that go back and get the cat.
3. Take the parrot first and then go back and get the cat. After that go back and get the bag of seeds.
4. Take the parrot first and then go back and get the bag of seeds. After that go back and get the cat.
5. Take the cat first and then go back and get the bag of seeds. After that go back and get the parrot.
6. Take the cat first and then go back and get the parrot. After that go back and get the bag of seeds.
7. Take the parrot first and then go back and get the bag of seeds. Then drop off the seeds, but you pick up the parrot and take him back. Then drop off the parrot and pick up the cat and then take him over and leave him with the bag of seeds. Lastly, you go back and pick up the parrot and then bring him back.

4. Evaluate each potential solution:

1. Not all solutions meet the goal.
2. Not all solutions will work for all cases due to the combination of what items are left behind.

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

1. The only solution for this problem that will work is G) from number 3.

Take the parrot first and then go back and get the bag of seeds. Then drop off the seeds, but you pick up the parrot and take him back. Then drop off the parrot and pick up the cat and then take him over and leave him with the bag of seeds. Lastly, you go back and pick up the parrot and then bring him back.

B) After looking at different ways to transport everything over this is the only way the man can accomplish it without the cat eating the parrot and without the parrot eating the seeds.

**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 – 4 socks

b) At least one matching pair of each color – 10 socks

1. Define Problem:

A) Problem: You need to select a pair of matching socks and a matching pair of each of the colors. It is dark; you can’t see the socks until after you have picked them. How can you get the socks you need since you can’t see them.

B) Insight: Based on the quantities of each of the colors, you can figure out the number of socks you need to select to guarantee you select what you need.

C) Overall goal: goal is to select the smallest number of socks and have at least one matching pair and then one matching pair of each color.

2. Break Problem Apart:

A) Constraints: it is dark and you can’t see the color of the socks in the drawer, and you can only select the minimum amount of socks to get what you need

B) Sub-goals: Figure out what percent of the socks are black, what percent are brown, and what percent are white. Based on that information, you can determine how many you need to select to get the pair and the pair of each color.

3. Identify potential solutions

A) Select all 20 socks.

B) Select 4 socks, then select 10 socks

4. Evaluate each potential solution

A) Even though it guarantees you get what you need, this solution won’t meet the goal of selecting the minimum amount of socks.

B) This solution will work based on the quantities you have per color.

5. Choose a solution and a plan to implement it.

50% of the socks are black, 30% of the socks are brown, and 20% of the socks are white. So, if you select 2 socks, 1 would be black. Selecting 4 would guarantee 1 pair of black socks. Using this same formula, if you select 10 socks you would get a pair of each color.

**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 – First finger

b) What if the girl counts from 1 to 100 – Ring finger

c) What if the girl counts from 1 to 1000 – First finger

1. Define Problem:

A) Problem: The little girl wants to figure out what finger she’ll end on if she counts to 10, 100 and 1000 respectively.

B) Insight: Counting the way she is counting will take a long time. The little girl should figure this out a different and shorter way.

C) Overall goal: To figure out what finger she’ll end on.

2. Break Problem Apart:

A) Constraints: Time.

B) Sub-goals: To Count to 10 and figure out what finger she’ll end on. To Count to 100 and figure out what finger she’ll end on. To Count to 1000 and figure out what finger she’ll end on.

3. Identify potential solutions

A) Count using her method (long method)

B) Find a pattern to solve it quicker.

4. Evaluate each potential solution

A) Each solution meets the goal.

B) Each solution will work for all cases.

5. Choose a solution and a plan to implement it.

When counting the first 1-10 you find that the even numbers fall on the first or the ring finger and you know that 10 ends on your first finger. Next count to a 100 by increments of 10 alternating between the first and the ring finger, starting with 10 on the first finger. Finally, count to 1000 by increments of 100 alternating between the ring finger and the first finger, beginning with 100 on the ring finger, which you solved in the previous step.