Xiang Peng

7/7/15

SDI

Day 1

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 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) Do this in your own words.  
  
Move everything to the other side of the river under several conditions.  
  
 b) What insight can you offer into the problem that is not immediately visible from the word problem alone?   
  
It’s really just a sequence problem, which combines different possibilities.  
  
 c) What is the overall goal?   
  
They all arrive the other side without breaking any rules.

**2) Break the problem apart**  
 a) What are the constraints?   
  
Cat and Parrot, Parrot and Seed, they cannot stay together alone; one object per travel.   
  
 b) What are the sub-goals?   
  
Move just one object, for example, the Cat.

**3) Identify potential solutions**  
 a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?   
  
Combining different possibilities, such as, Cat and Seed. Then list out all possibilities.

**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.  
  
The conditions are Cat and Parrot, Parrot and Seed cannot be together alone.  
Based on these, say that we got starting point A and destination B.   
1. Transport Parrot first from A, Parrot is at B. Cat and Seed are at A.  
2. Transport Seed from A, then Take Parrot back.  
3. Leave Parrot at A, then take Cat to B.  
4. Now we got Cat and Seed at B, Parrot at A.  
5. Take Parrot finally.  
6. Cat, Parrot, and Seed are now all at B. Problem solved.  
  
 b) Describe some test cases you tried out to make sure it works. (You can include drawings and diagrams as part of your explanation as long as they are clearly communicating the solution).   
  
I just made some simple sequence combination.

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.   
  
**1) Define the problem**   
 a) Do this in your own words.  
  
Three kinds of object: black, brown and white.  
Total of 20, 10 blacks, 6 browns and 4 whites.  
Randomly select one object each time.  
Find out the smallest numbers of objects that you pick, to make a guaranteed pair, and a pair for each kind.  
  
 b) What insight can you offer into the problem that is not immediately visible from the word problem alone?   
  
This is another math problem, with sequence combination and probability.  
  
 c) What is the overall goal?   
  
Making a pair, and a pair for each color.

**2) Break the problem apart**  
 a) What are the constraints?   
  
The condition is to pick randomly.  
Has to be 100% chance to getting a pair.  
  
 b) What are the sub-goals?   
  
Getting the first sock out.  
Check the color.  
Picking out another one.

**3) Identify potential solutions**  
 a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?   
  
Listed all possibilities and find out matches.

**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.  
  
Picking out a sock first.  
Take another sock out.  
Check the color to see if they match a pair.  
Keep picking until got all the pairs out.  
  
 b) Describe some test cases you tried out to make sure it works. (You can include drawings and diagrams as part of your explanation as long as they are clearly communicating the solution).   
  
For at least a pair, the least number of socks is **four**, picking out three socks first, if they are all in different color, the fourth one is 100% making a pair.  
  
For a pair for each color, it would require at least 18 socks to do so. So if we picked out 10 socks out first, and they are all black, then we picked out 6 more, they are all brown. That leaves us four white socks. Then we do the 17th picking, which is 100% white, then the 18th is also 100% white.

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 to 1000

**1) Define the problem**   
 a) Do this in your own words.  
  
There are five dots: A, B, C, D, E. Counting number starts 1 at dot A. Then goes rotation of ABCDEDCBA. Which dot you will be at after counting through 1 to 10, 1 to 100, and 1 to 1000.  
  
  
  
 b) What insight can you offer into the problem that is not immediately visible from the word problem alone?   
  
I just need to find out the pattern of it, and how rotation goes.  
  
 c) What is the overall goal?   
  
Find out where is the stop.

**2) Break the problem apart**  
 a) What are the constraints?   
  
The rotation goes A B C D E D C B A.  
As the number goes 1 2 3 4 5 6 7 8 9.  
  
 b) What are the sub-goals?   
  
Find out where 10 stops.  
Find out where 20 stops.  
etc.

**3) Identify potential solutions**  
 a) For each of the sub-problems you’ve discussed in #2, what is a possible solution?   
  
Find out where 10 stops first, then write it done. Keep counting, until find out the pattern.

**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.  
  
List out the counting table, then figure out the pattern.  
A B C D E D C B A **B** C D E D C B A B C **D**  
1 2 3 4 5 6 7 8 9 **10**  11 12 13 14 15 16 17 18 19 **20**  
  
  
  
 b) Describe some test cases you tried out to make sure it works. (You can include drawings and diagrams as part of your explanation as long as they are clearly communicating the solution).   
  
As the table listed, keep counting and record the rotation until find out the final pattern.  
  
A1 B2 C3 D4 E5 D6 C7 B8 A9 **B10**    
C11 D12 E13 D14 C15 B16 A17 B18 C19 **D20**    
E21 D22 C23 B24 A25 B26 C27 D28 E29 **D30**    
C31 B32 A33 B34 C35 D36 E37 D38 C39 **B40**A41 B42 C43 D44 E45 D46 C47 B48 A49 **B50**Then we figured out the pattern.  
It goes BDDB for each 40 adds up.  
  
So solutions are:  
  
 from 1 to 10: Stops at B, which is the first finger.  
  
 from 1 to 100: Stops at D, which is the ring finger.  
  
 from 1 to 1000: At 800, it stops at B, adds 200 more, which splits to five 40s adds up, then it will stops at B as well eventually. Which is her first finger.