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Scalable Data Infrastructures  
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Activity: Problem Solving

OVERVIEW:

Exercise your problem–solving skills with this collection of puzzles and word problems that are analogous to some of the problems you will have to understand and solve in programming.

OBJECTIVES:

Successful completion of this activity will show that you can: Define the goals and parameters of a problem. Break down complex problems into parts for a solution. Identify and apply methods for problem solving.

Explain how you arrived at a solution.

CRITERIA:

For each solution you will need the following: Create a solution for each of the problems below. You will need to commit this file to your Git repository. A minimum of 5 meaningful

commits are required, **or this assignment will receive and automatic 0.**

GETTING STARTED:

* Create a word processing document and place your name, date, class and assignment name in the document’s header.
* Place that file in your Git repository within a folder named **ProblemSolving**.  TURNING IT IN:  Archive your document as a zip file. Name that .zip file with the following:  o lastName\_firstName\_ProblemSolving.zip Submit it to the repo and FSO as directed by your instructor.

PROBLEMS:

For each of the problems be sure to identify each of the steps discussed in the problem-solving lesson.

* **1)  Define the problem**  a) Do this in *your own words.*b) What insight can you offer into the problem that is not immediately visible from  the word problem alone? c) What is the overall goal?
* 2)  **Break the problem apart**a) What are the constraints? b) What are the sub-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?  b) Will each solution work for ALL cases?
* **5)  Choose a solution and develop a plan to implement it.**  a) Explain the solution in full. 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).

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.) The man in this problem needs to get his cat, his parrot, and a bag of seed across the river in his boat. His boat only has enough room for the man and one of these objects, but he needs to get them all safely across. If left alone, some of the objects may consume one another.

2.) The man needs to figure out a way to separately transport the cat, the parrot, and the bag of seed without leaving any conflicting variables together. The cat can not be left with the parrot alone. The parrot can not be left with the seed alone. The seed can be left with the cat.

3.) The man could bring the parrot across the river in his boat first. This would leave only the cat and the seed. The cat would generally not desire to eat the seed, and the seed would not eat the cat. Therefore, this would work.  
Alternatively, the man could put the parrot in a cage. In this scenario, the man could take any individual across that he would desire because they would not be able to reach the other objects while left on their own side.   
The man could call for back up. He could recruit a friend to stay on the other side with the excess variables so that they will not consume eachother.  
Also, the man could get his parrot to fly across the river on its own. In this scenario, that would leave only the cat and the seed to be transported and would save on gas and other transportation costs.

4.) If the man brought the parrot across first, this would not be an effective solution. Although the parrot would be separated from the seed and the cat at first, when the man returned for the third variable the parrot would have to be left with one of the other two.  
Putting the parrot into a cage would be a consistently effective solution, except during the time required to go find said cages to begin with. Unless the man brought them with him, this would leave the cat, the parrot, and the seed together unsupervised.  
Calling for a friend would still be an inconsistent solution because at some point the parrot would be left alone with one of the others while the man boated his friend across.  
Forcing the parrot to fly across would only work if timed correctly. The boat would have to be 4x as fast as the parrot in order to get each of the other variables across before the parrot would reach the shore.

5.) The best idea in order to successfully get each variable across would be to contain the parrot within a cage or some other type of container. The man could take all of the variables with him to the store in order to buy these containers, and then contain the parrot that it would be successfully contained and waiting for the man on shore, regardless of who he brings across at what point. The cat could attempt to eat the parrot, but would only be blocked by the walls of its container. The parrot could attempt to eat the seed, but would be blocked by the walls of its container.

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:

1. At least one matching pair b) At least one matching pair *of each color.*

1.) You need to find matching pairs of socks from the 20 in your drawer. It is dark. It is not stated if you must put unused socks back or not. You need to find a pair of socks with matching colors, and eventually a matching pair from each color.

2.) There are 10 black socks, 6 brown socks, and 4 white socks total. You must make pairs from these without any light to see what you are pulling out. You need to decide the smallest number of socks you can select to guarantee you have pairs.

3.) In order to guarantee you get

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