Fred Morrison
CSC-366

Task One: Define the Heuristics

Heuristic 1
1.) Number / Name - H1/Zeros
2.) English - If the goal is zero and zero is among the numbers, then multiply all of the numbers together.
3.) Pseudocode - if (the goal is zero) and (zero is among the numbers) then [multiply the numbers together]
4.) Examples
    a.) numbers = {5,4,0,8,9} goal = 0 solution = (5*(4*(0*(8*9))))
    b.) numbers = {0,5,3,5,8} goal = 0 solution = (0*(5*(3*(5*8))))
    c.) numbers = {7,6,7,1,0} goal = 0 solution = (7*(6*(7*(1*0))))

Heuristic 2
1.) Number/Name - H2/Zero and Goal
2.) English - If the goal is nonzero and zero and the goal are among the numbers, then add the goal to the result of multiplying all of the remaining numbers together.
3.) Pseudocode - If (the goal is not zero) and (zero is among the numbers) and (the goal is among the numbers) then [add the goal to the product of the remaining numbers together]
4.) Examples
    a.) numbers = {7,0,9,2,6} goal = 9 solution = (9+(7*(0*(2*6))))
    b.) numbers = {5,4,3,1,0} goal = 4 solution = (4+(5*(3*(1*0))))
    c.) numbers = {0,2,3,5,3} goal = 3 solution = (3+(0*(2*(3*5))))

Heuristic 3

1.) Number/Name - H3/Zero Goal and Pair
2.) English - If the goal is zero and a pair exists among the numbers, then multiply the difference between the pair of numbers by all of the remaining numbers.
3.) Pseudocode - if (the goal is zero) and (a pair exists among the numbers) then [multiply the difference between the pair of numbers by all of the remaining numbers]
4.) Examples
   a.) numbers = {4,5,6,4,9} goal = 0 solution = ((4-4)*(5*(6*9)))
   b.) numbers = {5,0,6,0,7} goal = 0 solution = ((0-0)*(5*(6*7)))
   c.) numbers = {1,0,1,2,3} goal = 0 solution = ((1-1)*(0*(2*3)))

Heuristic 4

1.) Number/Name - H4/One Goal with Pair and Zero
2.) English - If the goal is one and a pair exists among the numbers, and a zero exists among the numbers, then add the quotient of the pair of numbers with the product of zero and the remaining numbers.
3.) Pseudocode - if (the goal is one) and (a pair exists among the numbers) and (zero exists among the numbers) then [multiply the quotient of the pair of numbers with the product of zero and the remaining numbers]
4.) Examples
   a.) numbers = {5,4,0,5,3} goal = 1 solution = ((5/5) * (0*(4*3)))
   b.) numbers = {0,3,2,7,7} goal = 1 solution = ((7/7) * (0*(3*2)))
   c.) numbers = {5,6,8,0,8} goal = 1 solution = ((8/8) * (0*(5*6)))

Heuristic 5

1.) Number/Name - H5/Pair and Goal
2.) English - If the goal is among the numbers, and a pair exists among the numbers, subtract the pair to get zero, then multiply it by the remaining numbers except for the goal number. Finally add the goal number to that product.

3.) Pseudocode - if (the goal is among the numbers) and (a pair exists among the numbers) then [subtract the pair from eachother, multiply the difference by the remaining numbers except for the goal, and add the goal to the product]

4.) Examples

    a.) numbers = {2,3,3,6,7} goal = 6 solution = (6 + ((3-3)*(2*7)))

    b.) numbers = {2,3,1,8,8} goal = 1 solution = (1 + ((8-8)*(2*3)))

    c.) numbers = {5,6,4,4,2} goal = 2 solution = (2 + ((4-4)*(5*6)))

Heuristic 6

1.) Number/Name - H6/All Same

2.) English - If all numbers, including the goal, are the same, then add one number with the difference of two added to the difference of the other two.

3.) Pseudocode - if (all numbers including the goal are the same) then [add one number with the difference of two added to the difference of the other two]

4.) Examples

    a.) numbers = {1,1,1,1,1} goal = 1 solution = (1 + ((1-1) + (1-1)))

    b.) numbers = {3,3,3,3,3} goal = 3 solution = (3 + ((3-3) + (3-3)))

    c.) numbers = {7,7,7,7,7} goal = 7 solution = (7 + ((7-7) + (7-7)))

Heuristic 7

1.) Number/Name - H7/TwoX,ZeroX,Two More than Goal

2.) English - If the number set contains two numbers which can make a two with some expression, and two numbers that can make a zero with some expression, and also a number that is two more than the goal, then subtract the two expression from the number that is two more than the goal, and add the zero expression.

3.) Pseudocode - if (two numbers can make two) and (two numbers can make zero) and (there is a number two more than the goal) then [subtract the two expression from the number that is two more than the goal and add the zero expression]

4.) Examples
      a.) numbers = {2,2,3,5,9} goal = 7 solution = ((9 - (5-3)) + (2-2))
      b.) numbers = {5,5,7,9,7} goal = 5 solution = ((7 - (9-7)) + (5-5))
      c.) numbers = {5,7,4,8,8} goal = 2 solution = ((4 - (7-5)) + (8-8))

Heuristic 8

1.) Number/Name - H8/Two Pairs and Two More than Goal
2.) English - If there exists two pairs of numbers and a number which is two more than the goal, sum the quotients of both the pairs, and subtract that sum from the remaining number.
3.) Pseudocode - if (there is a pair of numbers) and (there is another pair of numbers) and (the remaining number is two more than the goal) then [sum the quotients of both the pairs, and subtract that sum from the remaining number]
4.) Examples
      a.) numbers = {2,2,4,4,9} goal = 7 solution = (9 - ((2/2)+(4/4)))
      b.) numbers = {5,5,7,7,3} goal = 1 solution = (3 - ((5/5)+(7/7)))
      c.) numbers = {6,3,8,3,8} goal = 4 solution = (6 - ((3/3)+(8/8)))