CATH CON 2021 Reference Questions - Senior Category

[There are a total of 5 questions in this document]

1. Pyramid

   The given table corresponds to a N (rows) by 2N-1 (columns) array, in which all empty spaces are 0. You must calculate a path from the top to the bottom of the pyramid, starting from the topmost number from which you can go diagonally left / right at each row. The value of the path is the sum of the numbers. Return the value of the path with the lowest value.

			5			
		-4		2		
	12		3		-5	
11		3		1		9

   This is an example pathway and the value returned is 3.

			5			
		-4		2		
	12		3		-5	
11		3		1		9

2. Product Subset

   Your input will be a single array. You will have to find the subset of the array for which the product of all the numbers is the closest to the maximum number of the array. The output should be the subset in the format:number(space)number(space)...

   You can assume the array will be such that there is only one answer.

   Eg: Input=[2,6,4,9,16,43,21]
   Output:2 21

3. All X

   You will be given a 2D-array containing only 'x's and 'o'. A game exists such that each time you press an 'x' or 'o', that element along with its four adjacent

elements switches either from 'x' to 'o' or from 'o' to 'x'. The aim is to convert all the elements to x using the fewest number of moves.

For example:

x	o	x
o	x	o
o	x	x

If the centre x were to be pressed this would be the outcome:

x	x	x
x	o	x
o	o	x

Your input will be the 2-D array containing 'x' and 'o'. Your output should be the number of moves required to transform every element to 'x' as per the rules of the aforementioned game.

4. Snake Length
   The output of the code must comprise a single-dimension array with the sizes of snake in the array.

   eg.

   [1, 1, 1, 1, 0,
     1, 0, 0, 0, 1,
     0, 1, 0, 1, 0,
     0, 0, 0, 1, 0]

   Output: [1, 1, 2, 5]

   Note:
   1's that are connected diagonally are not counted
   The output array must be arranged in ascending order

5. Image Processing
   The input is a 10*10 integer array in which each position in the array contains a 9 digit number. Each position of the array is thought of as a pixel, with the 9 digit number depicting the colour stored in that pixel, in the RGB format. For example, if the number is 123207095; The red component (corresponding to the first three digits) is 123, green component(corresponding to the middle three digits) is 207, blue component (corresponding to the last three digits) is 095. In the RGB system, each component has a minimum value of 0, and maximum value of 255, hence these components will be numbers within this range.
   The program must calculate the section in this array which has the maximum average greenness. The size of a section is a 2*2 square. To calculate the average greenness, add up the values of all the green components in that section, and divide by 4 (2*2).
   The program must print out this maximum average greenness.