Laboratory Class

Recursion

Estruturas de Informação

1. Implement a recursive algorithm:

- **a)** That receives a string and returns another string with its characters in reverse order of the original string.
- **b)** To compute the product of two positive integers, m and n, using only the arithmetic operations: addition and subtraction.
- **c)** To calculate the greatest common divisor of two positive integers, for example m.d.c (48,30)=6, using the algorithm of successive divisions.
- **d)** To convert a string of digits into the integer it represents. For example, "13531" represents the integer 13531.
- **e)** To see if a number is palindrome that is, the number is the same when written forwards or backwards (examples: 99, 101, 111, 121, 1221, 21112, 10001, …).
- **f)** To compute the sum of all the elements in an n × n (two-dimensional) array of integers.

2. Develop a recursive method to demonstrate the backtracking through the search of a path in a labyrinth. Consider that only horizontal and vertical movements are allowed (diagonal are prohibited) and movements obey the following order: north↑, east→, south↓ and west ←. Represent the labyrinth by a matrix of zeros and ones, in which the walls represent zeros and ones halls. For example, for the following labyrinth 7x13:

0	1	1	1	0	1	1	0	0	0	1	1	1	1
1	1	0	1	1	1	0	1	1	1	1	1	0	1
2	1	0	0	0	1	0	1	0	1	0	1	0	1
3	1	0	0	0	1	1	1	0	1	0	1	1	1
4	1	1	1	1	1	0	0	0	0	1	0	0	0
5	0	0	0	0	1	0	0	0	0	0	0	0	0
6	0	0	0	0	1	1	1	1	1	1	1	1	1
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**

A recursive method that seeks a path between the source (0, 0) and the destination (6, 12) should mark the labyrinth path cells with **9** and cells accessed but which have not led to the solution with **2**. So the return positions (backtracking) can be viewed with **2** like in the following matrix.

9	9	9	0	2	2	0	0	0	2	2	2	2
1	0	9	9	9	0	2	2	2	2	2	0	2
1	0	0	0	9	0	2	0	2	0	2	0	2
1	0	0	0	9	2	2	0	2	0	2	2	2
1	1	1	1	9	0	0	0	0	1	0	0	0
0	0	0	0	9	0	0	0	0	0	0	0	0
0	0	0	0	9	9	9	9	9	9	9	9	9