U.T.B.M
K. Deschinkel

2013-2014
AG44

Ariadne's thread

1 Context

Your friend, a fan of video games, asks you to help him. He noted that many games consist of moving a character in a particular environment. This character moves from place to place and may revisit a place or may not when you cross such a level of play (elevator, secret passage, etc.,...). Its objective is after playing a game for hours and after carefully numbered places encountered and the possible passages from one place to another, to establish a small map of the game, which includes only the different levels of play and opportunities to move from one level to another. Each level corresponds to a set of accessible places from other place by any path.
He provides his observation as a binary matrix A (composed of 0 and 1) of size $n \times n$ where the indices of rows and columns correspond to different numbers of places encountered. A 1 at the location (i, j) of the matrix means that there is a direct passage from the place i to the place j. If there is no direct passage from the place i to j, then $A(i, j) = 0$. He asks you to provide :

- the list of the different game levels with the places inside each level
- the map of game levels, presented in a square matrix N. $N(i, j) = k$ if there is k direct passage (possibly $k = 0$) from level i to level j.
- a longest path from level including place 1 (input of the game) to the level including place n (output of the game)

2 Questions

1. Which classical problem of graph theory do you recognize to deal with the first point ? Write a program for this algorithm. Data may be read in a file where the matrix A is given below :

0	1	1	0	0	0	0	0	0	0	0	0	0
0	0	0	1	1	0	0	0	0	0	0	0	0
0	1	0	1	0	0	0	1	0	0	0	0	0
1	0	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	0	1	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	1	0	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	1	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	1
0	0	0	0	0	0	0	0	0	1	0	0	0

2. Your program should give the different game levels and the places including in each level (for instance, there are four game levels : {1,2,3,4}, {5,6,7}, {8,9}, {10,11,12,13}).
3. Your program should give the reduced matrix N with the different game levels and the number of direct passages.
4. What is the longest path that your friend asks you to find ? Implement an algorithm to identify such a path.

5. Write a brief report (2 pages) which gives : resume of the project, choice of data structures, choice of appropriate algorithms, answers to questions.