

**CS365 Mathematics of Computer Science**  
**Spring 2007 – Dr. George Bebis**  
**Course Project**  
**Due Date: 5/8/2007**

**Problem Description**

Gold coins are spread in different cells of an NxM matrix platform. These coins are to be collected by robots, which enter the platform at the top-left cell, and leave from the bottom right cell. The robots are aware of where the coins are. The robots can only move in one of two directions at a time: down and right, i.e., a robot can step either horizontally to the cell on its right or vertically to the cell below. Upon visiting a cell with a gold coin, the robot collects the coin in that cell. A robot can collect as many coins as it encounters on its path through the platform. The objective is to collect all the coins with a minimal number of robots under any configuration of coins placement.

**Example**

For an 7x8 grid shown below, we have placed golden coins in the following cells: (2,6), (3,2), (3,8), (4,3), (4,5), (5,2), (5,5), (6,8), (7,5), and (7,6). The solution to this particular layout involves using 3 robots.

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**Program Specifications**

Program input: N, M and the locations of the gold coins  
Program Output: (a) Minimal number of robots required to collect all the coins.  
 (b) The path of each robot involved in the solution

**Deliverables**

- **A HARDCOPY REPORT – should include the following:**
  - (a) Describe in your own words the problem.
  - (b) Discuss related issues in solving the problem.

- (c) Present your solution and provide pseudo-code.
- (d) Present examples to illustrate the correctness of your solution.
- (e) What configuration of coin placement would make your algorithm work the hardest?
- (f) What is the maximal number of robots that you would need?
- (g) Provide an analysis of the running time of your algorithm
- (h) Other issues/Comments

**Reports must be typed and carry a high percentage of your grade.** Write your report carefully; explain things as clearly as possible, check for spelling errors. Answer the questions in the order presented. Use meaningful titles for each subsection and figure captions to explain any figure that you might want to include in the report. Also, figures should be numbered and must be in the same section where they are discussed.

- **AN ELECTRONIC COPY OF YOUR CODE.** Submit the source code and sample input/output scripts. If you have several files to turn in, then please submit them in a **rar** file by email. Provide instructions how to compile and run your code. Please note that *I do **not** want a hardcopy of your code, your raw output, or a log of your program's execution.*

## **Contribution Statement**

Provide a **detailed** statement about the contribution of each group member in completing this assignment. In particular, comment on positive and negative aspects of working together with your partner on this assignment. Please, note that in the event that you cannot work together with your partner on this assignment, you should inform me as soon as possible. Individual solutions **will not** be accepted unless there is a good reason.