CSC 323 Algorithm Design and Analysis, Spring 2015
Instructor: Dr. Natarajan Meghanathan

Project 5: Coin Collection Problem using Dynamic Programming
Due date: March 26, 2015 Max. Points (without Bonus): 100 Bonus Points: 50

Construct a grid (2-dimensional array) of size n x m. Randomly distribute P coins (P < n * m) among the cells of the grid. There can be only at most one coin per cell. Set the contents of the cell [i, j] to a 1 if the cell ends up having a coin or 0 otherwise (i.e., if the cell does not have a coin).

Assume a robot starts from top leftmost cell [0, 0] and has to trace a path to the bottom rightmost cell [n-1, m-1] through a sequence of movements. During every movement, the robot can either move only one cell down or one cell to the right.

Use the dynamic programming algorithm discussed in class for the coin collection problem to determine the optimal number of coins that can be collected by the robot.

Input: Your program should input the number of rows (n), number of columns (m) and the number of coins (P). The table in Page 2, shows the values of n, m and P assigned to each of you.

Output: Your program should output the contents of the grid (n rows and m columns) with each cell displaying either 0 or 1 depending on whether there is coin in the cell. Your program should output the maximal number of coins that can be collected by the robot. A sample output is displayed here.

```
C:\Big3-Laptop-Sep2014\3300-laptop\0-res\NetworkSci-Research\SentenceAnalysis>ja
va coinCollection
Enter the number of rows: 6
Enter the number of columns: 7
Enter the number of coins: 12

Distribution of the coins in the grid
0  0  0  0  1  1  0
1  1  0  1  0  0  0
0  0  1  1  0  0  0
0  0  0  0  0  0  0
1  1  0  0  0  1  1
0  1  0  0  0  0  0

Optimal number of coins collected: 6
```

Bonus Points: You will get bonus points if you could trace the path from cell [0, 0] to cell [n-1, m-1] printing out the sequence of cells that the robot can visit to collect the optimal number of coins. Your path should be the sequence of cell indexes [i, j] that need to be traced starting from cell [0, 0] and ending at cell [n-1, m-1]. Note that there will not be any partial credits for bonus points. You either get all of the bonus points (in case you are able to print out the trace of the path) or zero.

Submission:
(1) Video: Record a video explaining the various sections of your project code. Focus more on explaining the following: Your logic to randomly distribute the assigned number of coins to the cells in the grid and the implementation of the dynamic programming algorithm to compute the optimal number of coins.
In case you implement the part for bonus points, you should explain your logic to trace the path from cell [0, 0] to [n-1, m-1] and its implementation.
(2) Softcopy (email to natarajan.meghanathan@jsums.edu): The report should include your entire code, your explanation of the logic to randomly distribute the coins in the grid and the logic to trace back the path (in the case of bonus points). Your report should also display the grid and the optimal number of coins as output, along with the sequence of cell indexes for the path trace (in case of bonus points).

Assignment of Input Values

Student Name	# rows (n)	# columns (m)	# coins (P)		Student Name	# rows (n)	# columns (m)	# coins (P)
Anderson, Leon	10	12	40		Triplett, Raymond	12	10	40
Taylor, Jeffery	10	12	35		Clovis, Fred	12	10	35
Dallas, Jonathan	10	12	30		Villarrubia, Andrew	12	10	30