

CS102 – Algorithms and Programming II
Programming Assignment 1
Fall 2023

ATTENTION:

- Compress all of the Java program source files (.java) files into a single zip file.
- The name of the zip file should follow the below convention:
CS102_Sec1_Asgn1_YourSurname_YourName.zip
- Replace the variables “Sec1”, “YourSurname” and “YourName” with your actual section, surname, and name.
- You may ask questions on Moodle and during your section’s lab.
- Upload the above zip file to Moodle by the deadline (if not, significant points will be taken off). You will get a chance to update and improve your solution by consulting with the TAs and tutors during your section’s lab.

GRADING WARNING:

- Please read the grading criteria provided on Moodle. The work must be done individually. Code sharing is strictly forbidden. We are using sophisticated tools to check the code similarities. The Honor Code specifies what you can and cannot do. Breaking the rules will result in disciplinary action

A Simple Board Game

You are going to implement a console game where players take turns rolling a six-sided dice to move on a rectangular board. The first player to reach the final cell becomes the winner of the game. The game should support up to 4 players, and at least 2 players are required to play the game. Each player should choose a unique letter of the alphabet to represent their place on the board. Before beginning the game, the order of play is determined by letting each player roll the six-sided dice; the player who has the higher number starts the first. In case there is a tie, assign a random order for the tying players.

Suppose we have the following players and the dice rolls at the beginning:

A: 5, B: 3, C:1, D: 3.

This means A will play first, and C will play last; we will break the tie between B and D randomly. Suppose the system determined B to be before D. Then the order is determined as A first, B second, D third, and C fourth.

The width and height of the game board should be determined by the user at the beginning of the game. The game board has cells on the boundary of this rectangle; the total cell count is $2 * (\text{width} + \text{height} - 2)$. The players start moving from the top left cell, go in the clockwise direction, and finish at the cell that is one below the starting cell.

An example 6 by 4 gameboard is given below:

| | | | | | |
|--------|---|---|---|---|---|
| Start | → | → | → | → | ↓ |
| Finish | | | | | ↓ |
| ↑ | | | | | ↓ |
| ↑ | ← | ← | ← | ← | ← |

Each cell can occupy up to 4 players; you should indicate which player is on which cell visually using different characters on the console. Cells may also have hidden traps that activate when a player ends up on that cell. At the beginning of the game, you should lay traps on randomly selected cells. These traps will not be visible to the players. The players can move over the traps, but if they stop their movement on a cell with a trap, then the trap activates. A trap pushes the player back until the player is on a corner cell. There cannot be any traps on the starting, finishing, and corner cells. Once a trap is activated, it is no longer dangerous, so the players can finish their move on a cell that previously had a trap in it. In other words, once it activates, there is no longer a trap on that cell.

Suppose the yellow cells have traps in them. If A moves 2 units, then there is no danger; the trap will not activate. But if A moves one unit, the trap will activate, pushing player A back to the starting cell. After the trap activates, any player can safely end their movement on that cell. For example, C can move 2 units, and there will be no problem. If B moves one unit and activates the trap, the trap will push player B to the top right corner. Traps are hidden from all players; you should display a message if any player activates a trap.

| | | | | | |
|--------|---|---|--|--|---|
| Start | C | A | | | |
| Finish | | | | | B |
| | | | | | |
| | | | | | |

On their turn, players roll six-sided dice to determine how many cells they can move. This randomly determined number shows the maximum number of cells the player can move. After

rolling the dice, the game should ask the player how many units they want to move. Suppose it is A's turn, and the dice roll is 3, then the game displays the following message:

Player A rolls 3, how many cells you move? (0-3):

The player may choose to move 0, 1, 2, or 3 units. So if they feel like there would be a trap, the players are free not to move. Any player who reaches or passes the finishing cell would be the winner. When we have a winner, the game ends and displays the total number of cells each player moved and the total number of traps each player activated.

A sample output is given below:

```
Welcome to the board game.
Please enter board width: 5
Please enter board height: 3
How many players? (2-4): 4
Please enter a character (symbol) for each player.
For player 1: A
For player 2: b
For player 3: u
For player 4: X
Players are rolling dice.
A: 1, b: 6, u: 6, X: 1
Breaking tie for: b u
Breaking tie for: A X
Playing order is: b u A X
```

```
#####
#bu#  #  #  #  #
#AX#  #  #  #  #
#####
#  #          #  #
#  #          #  #
#####
#  #  #  #  #  #
#  #  #  #  #  #
#####
```

Player b rolls 2, how many cells you move? (0-2): 2

```
#####
# u#  #b #  #  #
#AX#  #  #  #  #
#####
#  #          #  #
#  #          #  #
#####
#  #  #  #  #  #
#  #  #  #  #  #
#####
```

Player u rolls 6, how many cells you move? (0-6): 6

```
#####
# # #b # # #
#AX# # # # #
#####
# #       # #
# #       # #
#####
# # # # # u#
# # # # # #
#####
```

Player A rolls 1, how many cells you move? (0-1): 1

```
#####
# # #b # # #
# X#A # # # #
#####
# #       # #
# #       # #
#####
# # # # # u#
# # # # # #
#####
```

Player X rolls 6, how many cells you move? (0-6): 6

```
#####
# # #b # # #
# #A # # # #
#####
# #       # #
# #       # #
#####
# # # # # u#
# # # # # X#
#####
```

Player b rolls 6, how many cells you move? (0-6): 5

You moved into a trap!

You moved back to the closest corner!

```
#####
# # # # # #
# #A # # # #
#####
# #       # #
# #       # #
#####
# # # # # bu#
# # # # # X#
#####
```

Player u rolls 1, how many cells you move? (0-1): 1

```
#####
# # # # #
# #A # # #
#####
# #       # #
# #       # #
#####
# # # # u#b #
# # # # # X#
#####
```

Player A rolls 1, how many cells you move? (0-1): 1

```
#####
# # # # #
# # #A # # #
#####
# #       # #
# #       # #
#####
# # # # u#b #
# # # # # X#
#####
```

Player X rolls 3, how many cells you move? (0-3): 3

```
#####
# # # # #
# # #A # # #
#####
# #       # #
# #       # #
#####
# # # # u#b #
# # X# # # #
#####
```

Player b rolls 5, how many cells you move? (0-5): 5

Winner is b, congratulations!

| Player | Move | Trap |
|--------|------|------|
| b | 12 | 1 |
| u | 7 | 0 |
| A | 2 | 0 |
| X | 9 | 0 |

Play again? (Y/N): N

Bye...

Preliminary Submission: You will submit an early version of your solution before the final submission. This version should at least include the following:

- Creating the board and determining the order of players should be functional.
- Displaying the current board should be functional

You will have time to complete your solution after you submit your preliminary solution. You can consult the TAs and tutors during the lab. Do not forget to make your final submission at the end.

Even if you finish the assignment in the preliminary submission, you should submit for the final submission on Moodle.

Not completing the preliminary submission on time results in 50% reduction of this assignment's final grade.