EECE.2160: ECE Application Programming

Programming Assignment #4: The “Drunken Sailor” Problem

Figures and Test Cases

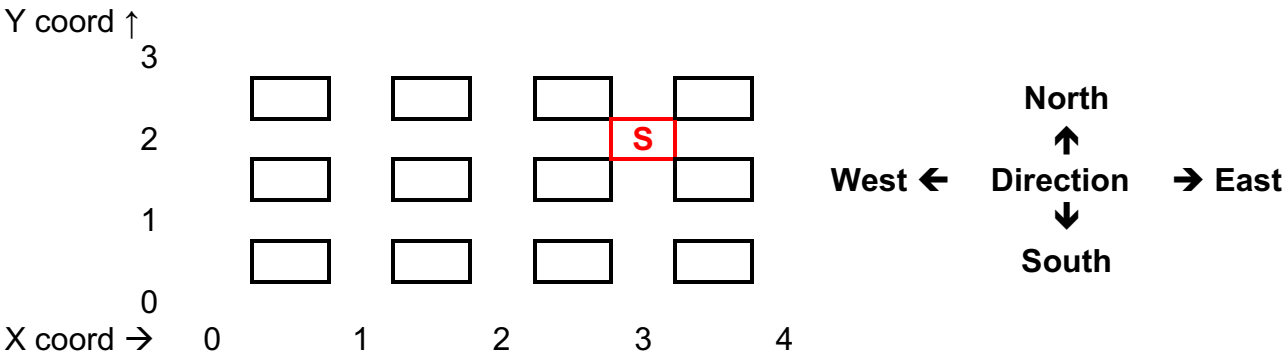

Figure 1: A 4 x 3 city (M = # X blocks = 4, Y = # Y blocks = 3), with the sailor at position (3, 2). The sailor can be at any (X,Y) position where $0 \le X \le M$ and $0 \le Y \le N$. The sailor must start inside the border, with the border defined as any position where X == 0, Y == 0, X == M, or Y == N.

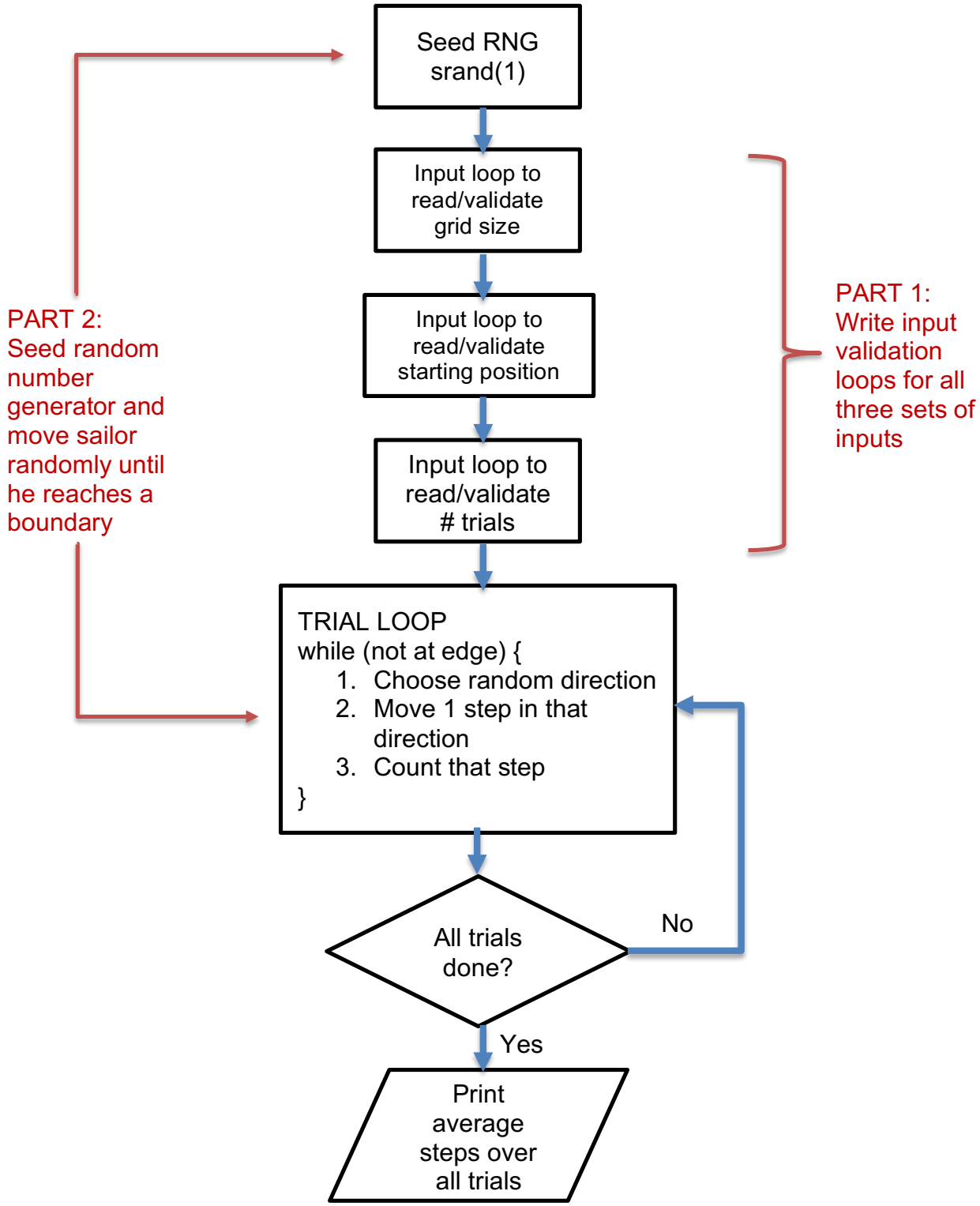

Figure 2: General program flowchart discussed in class. The "trial loop" is a while or do-while loop that runs until the sailor reaches the edge, and, as shown by the decision block near the bottom of the flowchart, that "trial loop" should be inside a for loop that iterates over the total number of trials.

This diagram also shows two of the three assignment parts—Part 1 handles input validation, Part 2 covers the sailor's random movement, and Part 3 integrates those two parts with a loop for multiple trials.

Test Cases

Test cases are below for each part of the program. In all cases, user input is underlined. Remember, when running the program in zyBooks, user inputs are not shown.

Part 1: Input Validation

The test cases below show how your program for Part 1 should handle two different sets of inputs—one with absolutely no errors, and one that tests most of the input error conditions.

Part 1: Program run #1:

```
City size in X, Y  (# blocks >= 2 and <= 10): 2 2
Starting position (X Y): 1 1
Number of trials: 3

City size: 2 by 2 blocks
Starting position: 1 1
Number of trials: 3
```

Part 1: Program run #2:

```
City size in X, Y  (# blocks >= 2 and <= 10): 1 1
# X blocks must be >= 2 and <= 10
# Y blocks must be >= 2 and <= 10
City size in X, Y  (# blocks >= 2 and <= 10): 12 3
# X blocks must be >= 2 and <= 10
City size in X, Y  (# blocks >= 2 and <= 10): 10 10
Starting position (X Y): 0 10
Starting X position must satisfy (1 <= X <= 9)
Starting Y position must satisfy (1 <= Y <= 9)
Starting position (X Y): 2 8
Number of trials: 0
Number of trials must be > 0 and <= 10
Number of trials: 15
Number of trials must be > 0 and <= 10
Number of trials: 1

City size: 10 by 10 blocks
Starting position: 2 8
Number of trials: 1
```

Part 2: Random Walk

The sample run below shows the only possible output of running this part of the program in zyBooks. Remember, Part 2 requires no input because the grid size and starting position are fixed.

```
Trial Start: 2 2
  South: 2 1
  North: 2 2
  East: 3 2
  South: 3 1
  East: 4 1
  South: 4 0
Trial total steps = 6
```

Part 3: Full Program

The results of two full program runs are shown below, with user inputs underlined. Remember, when running the program in zyBooks, user inputs are not shown.

Part 3: Program run #1:

```
City size in X, Y  (# blocks >= 2 and <= 10): 2 2
Starting position (X Y): 1 1
Number of trials: 3
Trial # 1 Start: 1 1
  South: 1 0
Trial # 1 total steps = 1
Trial # 2 Start: 1 1
  North: 1 2
Trial # 2 total steps = 1
Trial # 3 Start: 1 1
  East: 2 1
Trial # 3 total steps = 1
Average # of steps over 3 trials: 1.00
```

Part 3: Program run #2:

```
City size in X, Y  (# blocks >= 2 and <= 10): 1 1
# X blocks must be >= 2 and <= 10
# Y blocks must be >= 2 and <= 10
City size in X, Y  (# blocks >= 2 and <= 10): 12 3
# X blocks must be >= 2 and <= 10
City size in X, Y  (# blocks >= 2 and <= 10): 10 10
Starting position (X Y): 0 10
Starting X position must satisfy (1 <= X <= 9)
Starting Y position must satisfy (1 <= Y <= 9)
Starting position (X Y): 2 8
Number of trials: 0
Number of trials must be > 0 and <= 10
Number of trials: 1
Trial # 1 Start: 2 8
  South: 2 7
  North: 2 8
  East: 3 8
  South: 3 7
  East: 4 7
  South: 4 6
  North: 4 7
  West: 3 7
  East: 4 7
  East: 5 7
  North: 5 8
  South: 5 7
  North: 5 8
  South: 5 7
  South: 5 6
  North: 5 7
  West: 4 7
  North: 4 8
  West: 3 8
  West: 2 8
  South: 2 7
  West: 1 7
  South: 1 6
  East: 2 6
  North: 2 7
  North: 2 8
  North: 2 9
  South: 2 8
  South: 2 7
  South: 2 6
  East: 3 6
  North: 3 7
```

Program run #2 (continued):

```
  North: 3 8
  North: 3 9
  East: 4 9
  South: 4 8
  East: 5 8
  West: 4 8
  South: 4 7
  North: 4 8
  East: 5 8
  East: 6 8
  East: 7 8
  South: 7 7
  West: 6 7
  East: 7 7
  North: 7 8
  West: 6 8
  South: 6 7
  North: 6 8
  East: 7 8
  North: 7 9
  South: 7 8
  West: 6 8
  West: 5 8
  East: 6 8
  North: 6 9
  North: 6 10
Trial # 1 total steps = 58
Average # of steps over 1 trial: 58.00
```