

Due: 29.03.2013, 23.00

## BIL 105E -Intr to Sci&Eng Comp (C)

### Homework 2: Crossing the Bridge

In this homework we will calculate probabilities empirically using simulations.

Suppose scientists came up with a model that specifies the effect of alcohol level on how humans walk on a bridge. The model is as follows:

- With each step the person moves 1 unit forward independent of the alcohol level. But depending on the alcohol level, this step may be a straight step forward or shifts 1 unit towards left or 1 unit towards right. Figure 1 shows 3 possible moves.
- If the person is horizontally on the center of the bridge, the probability of:
  - o a straight step is  $1 - 2p/3$
  - o Shifting towards either side is  $p/3$ .
- If the person is not on the center, the probability of:
  - o Shifting towards center is  $(5 - 3p)/6$ .
  - o Stepping straight is  $(1 + p)/6$ .
  - o Shifting towards the edge is  $p/3$ .

Here  $p$  denotes the alcohol level in blood stream and it is a real number between 0 and 1, inclusive ( $p \in [0, 1]$ ).

**You have to step on the land here**

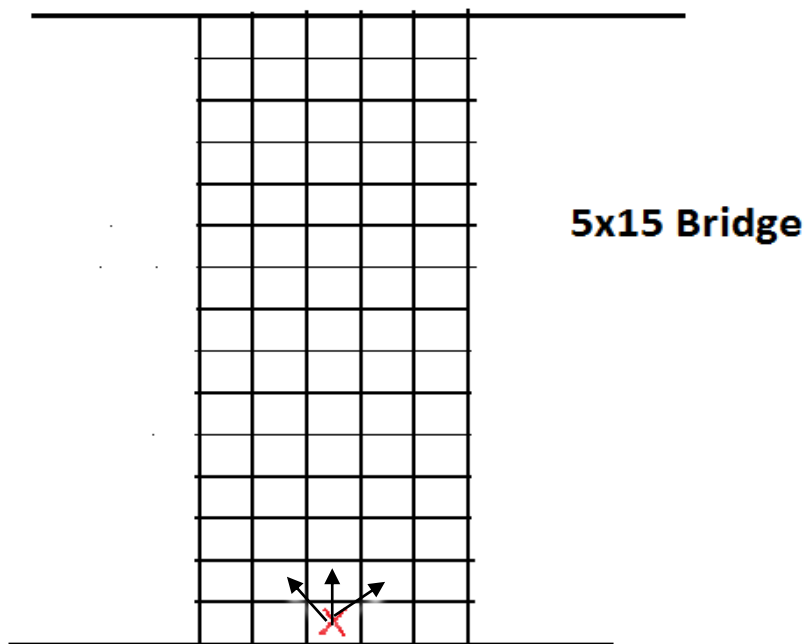


Figure 1. You always start at the red cross. Three moves are possible: straight, towards left and towards right.

What you are required to do is to write a program to calculate the probability of a person successfully crossing an **NxM** bridge where **N** is the width and **M** is the length of the bridge. You can assume that **N** and **M** are integers and **N** is always an odd number. The person starts crossing the bridge from the center. If, at any step, he steps out of the bridge on one of the sides, he is assumed to fall down because there are no bars at the sides of the bridge. You have to perform **M** steps to pass the bridge successfully. Even if you step out of the bridge on exactly the **M<sup>th</sup>** step, you don't fall because you step on the land.

Your program will read 4 inputs from the user. Besides **N**, **M** and **p**, you will read **S**, number of tries that will be performed. The probability successfully passing the bridge can be calculated as the ratio of number of successes to the number of tries ( $\frac{\# \text{ of successes}}{\# \text{ of tries}}$ ). You will print 3 digits after the decimal point for the probability.

### Sample Run:

Note that red text denotes the input from user and black text is what you print on screen.

```
$ ./bill105hw2
Enter bridge size (N and M): 5 20
Enter the alcohol level ([0-1]): 0.45
Number of tries/simulations (S): 200
178 out of 200 tries was successful at crossing the bridge
Probability = 0.865
```

### Important:

Please strictly stick to the input and output specifications. Print nothing more and nothing less than the required.

### Submission:

You are going to submit your homework and its report through Ninova (Sample report is uploaded to "Ninova Class Files"). You have to use g++ on LINUX while compiling your homework.