

CSE 107

Lab Assignment 3

In this project you will simulate the process described in the problem from quoted below.

Joe Lucky plays the lottery on any given week with probability p , independently of whether he played on any other week. Each time he plays, he has a probability q of winning, again independently of everything else. During a fixed time period of n weeks, let X be the number of weeks that he played the lottery and Y be the number of weeks that he won.

Your goal is to determine, through means of simulation, the joint PMF $p_{X,Y}(x,y)$, the conditional PMF $p_{X|Y}(x|y)$ and the conditional PMF $p_{Y|X}(y|x)$, for all pairs (x,y) satisfying $0 \leq y \leq x \leq n$. You will present your experimental values for these functions in three tables, whose size and contents depend on the parameters n , p and q . Your report will be submitted as a pdf file named lab3.pdf. It will present results corresponding to parameter values **$n = 7$, $p = 0.6$ and $q = 0.7$** . The required output format is illustrated below, where of course you replace 0.0000 by your experimentally derived probabilities.

[illegible][illegible][illegible]

Each trial should simulate n weeks of play, as described above. Thus for each week, your simulation will flip a coin with probability p to decide if Joe plays that week. If so, increment the number of plays x , then flip another coin with probability q to decide if Joe wins that week. If so, increment the number of wins y . When the trial is over, increment the frequency of the pair (x, y) . Continue the simulation for 100,000 trials. When all trials are complete, compute the relative frequencies constituting your estimates of the values for the joint PMF $p_{X,Y}(x, y)$. By summing over appropriate rows or columns, you can determine the marginal PMFs $p_X(x)$ and $p_Y(y)$. By dividing $p_{X,Y}(x, y)$ by the appropriate marginals, you can determine the conditional PMFs $p_{X|Y}(x|y)$ and $p_{Y|X}(y|x)$. All of your table entries should be rounded to 4 decimal places.

In principle this project is no more difficult than prior assignments, but there is a lot more to compute in this case. Appropriate data structures will be needed to store the frequencies and relative frequencies to do your calculations. If you want advice on how to make these choices, feel free to bring it up in office hours or discussion sections. Since there is so much more to do here, be sure to start early.