

# Monte Carlo Simulation Using Vlookup

The first part of this method is virtually the same as the "by hand" method

## **Using given ("tabulated") random numbers to do simulation using Excel Vlookup:**

We will call the tabulated random numbers "r" and the numbers from the desired distribution (such as demand) "x"

lay out five columns on your spreadsheet

In the first column, put the various possible values of the desired random number x, like demand levels. in order from lowest to highest.

In the second column, put the probability of each possible value of x.

In the third column, put the probability that x is less than the number in the first column. For the lowest possible value, this is zero. The probability that the random value x is less than any particular possible  $X^*$  is the sum of the probabilities of the possible values of x lower than  $X^*$ .

In the fourth column, put the probability that the random number x is less or equal to than the number in the first column. For the lowest possible value of x, this is the same as the probability that x is equal to that value. The probability that the x is less than any particular possible value  $X^*$  is the sum of the probabilities of the possible values lower than  $X^*$ , plus the probability of  $X^*$  itself.

the fifth column is the same as the first column; this copy is the one that is used by the computer method.

Set up a cell to hold the uniformly distributed random number r. The formula in the cell is =RAND() an = sign followed by the letters RAND followed by a left parenthesis followed immediately by a right parenthesis, with no spaces.

Set up a cell to hold the value of the random variable X that corresponds to the randomly generated fraction r. Suppose the random number r is in cell K10 and the numbers in the last three columns of your five columns are in cells I5 through K9. Then the formula for the random variable X is =VLOOKUP(K10,I5:K9,3)

The Vlookup formula looks for the largest number in the first column of the lookup table (I5 through I9) to find the largest one of those numbers that does not go over the number in K10. Whatever row has the selected number in column I, the function returns the number in that same row that is in the third column of the lookup table, in this case column K,

In the Computer tab of the spreadsheet Ex18p218-Hand.xls, the possible values of x for Alameda are 3, 4, 5, 6, and 7 truckloads found in cells G5 through G9 and again in K5 through K9

The probability of each of these demand levels is found in cells H5 to H9. These probabilities are given in the book.

Look at the formulas in cells I5 through I9 to see how the lower bounds are computed.

Look at the formulas in cells J5 through J9 to see how the upper bounds are computed. Vlookup does not use the upper bounds, but they help us humans to understand what is going on.

The random number r for the Alameda demand is at K10 as above

The Vlookup formula to convert the random variable r from the uniform distribution into the random variable X from the distribution of demand at Alameda is in K11.

The Data table in cells E16 through F516 create 500 different random demands for Alameda. The numbers in column E were created by "edit / paste special / values" from the random functions in cells A17 to A516.