Student Information

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Descriptions

First, I decided the size of the Monte Carlo study. As we had no "intelligent guess", I used the general method. Margin of error $\epsilon = 0.03$, $\alpha = 1 - 0.98 = 0.02$, and $z_{\alpha/2} = z_{0.01} = 2.326$. The general inequality is: $N \geq 0.25(\frac{z_{0.01}}{\epsilon})^2 = 0.25(\frac{2.326}{0.03})^2 = 0.25(6011.4) = 1502.9$. Therefore the size of the Monte Carlo study (N) is 1503.

In the Monte Carlo simulation we use the same lambda value in both of the experiments, but we use different p values. In both experiments we allocate two arrays with the size N x 1. One of them holds the total number of triangles formed in each simulation, and the other one holds the ratio of, number of triangles to number of triplets in each simulation.

Number of good types processed within a day is a Poisson variable, therefore we generate this number with poissrnd(lambda) function. We form a square matrix which has a size of $Poisson\_X$ x $Poisson\_X$. This is a symmetric matrix therefore we just fill the lower triangle. We traverse the lower triangle element by element. For every element we generate an uniform random variable U. If this variable is within the range of p (U ¡ p), we set the element to 1, otherwise it is 0. We actually generate a Bernoulli variable for each element. When end our traversal, we take the transpose of our matrix and add it to itself, therefore we obtain an adjacency matrix.

We calculate the total number of triangles by using this matrix, and we calculate the number of triplets by using the combination function (we try to find the subset of all components with the size of 3). Then we save the number of triangles and the ratio to the corresponding arrays.

a)

The source code for this experiment is hw4_q1.m . In this experiment our p = 0.012. As we try to find the probability that at most 1 shipment can be made, we check the values of Total_Triangles matrix is less than or equal to 1. Then we obtain a matrix of 1s and 0s. Then we take its mean to find the probability. The answer is saved in the variable answer_a. From the simulation that I conducted, I observed that answer_a = 0.67665.

b)

The source code for this experiment is hw4_q2.m . In this experiment our p = 0.79. We check the values of All_Ratios matrix is greater than 0.5, then we obtain a matrix of 1s and 0s. Then we take its mean to find the probability. The answer is saved in the variable answer_b. From this simulation that I conducted, I observed that answer_b = 0.15103.

c)

To estimate the numbers X and Y, we take the mean of the arrays Total_Triangles, and All_Ratios. We do these operations at the end of both experiments therefore these operations are included in both hw4_q1.m and hw4_q2.m.

For experiment a, mean X = 1.1983, mean Y = 0.0000018.

For experiment b, mean X = 338482.47, mean Y = 0.49312.

d)

To estimate the standard deviations of X and Y, we take standard deviations of the arrays Total_Triangles, and All_Ratios. We do these operations at the end of both experiments therefore these operations are included in both hw4_q1.m and hw4_q2.m.

For experiment a, std X = 1.1883, std Y = 0.00000175.

For experiment b, std X = 80197.57, std Y = 0.00679.

For experiment a, we found mean X = 1.1983, and std X = 1.1883. Therefore number of distinct choices can be lower or equal to 1 in a day, but also there is still a probability that it can be more than 1. The p = 0.67665, value is an accurate estimator as the probability of having at most 1 distinct item is higher than the having more than 1. (but still having more than 1 distinct item, has a high probability)

For experiment b, we found mean Y = 0.49312 and std Y = 0.00679. We found the probability of this ratio to exceed 0.5 threshold is equal to p = 0.15103. We can easily observe that mean value is less than 0.5 threshold and when we check the confidence interval with std Y, it is not very likely to exceed this threshold. As this probability is a low value as-well we can state that this is an accurate estimator.