**Assignment 06**

**Simulating a Single Channel Queuing Problem using a Programming Language**

CSE 424: Simulation and Modeling Sessional

Batch: CSE-424-14-D-A

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| **Background:** Random numbers are very important in discrete event simulation for generating event times. A chain of random numbers must hold two major properties-1) Uniformity 2) Independence. A stochastic simulation model requires one or more random variable as inputs. The random numbers can be generated from a random variable say X. P(X=x) is greater than zero and ranges between zero and one when the total number of possible outcomes is finite. In such a case, the random variable X is said to be discrete. P(X=x) is exactly zero when the total number of possible outcomes is infinite. In such a case, the random variable X is said to be continuous. So, in our study, we have now found two terms- Discrete Random Numbers and Continuous Random Numbers. There are many techniques to generate random numbers such as- Linear Congruential Method, Combined Linear Congruential Method etc. These generators can also be used to generate “seed” of a Random-Number streams since, generators tend to have repeats to a certain extent. But, in practice, a simulation analyst might not deal with random number generators or streams directly because of their insufficiency in usability, though they pass two important tests-1) Frequency Test and 2) Autocorrelation Test. Still some underlying patterns that might be taken into considerations. Once we have accepted a good random number generator that passes those two tests to assure its two attributes that is U[0,1) and independence, now we can switch to other distributions like Poisson, Exponential, Normal/Gaussian, Truncated Normal, Gamma and Weibull distribution and generate random variates from their probability density function(pdf). That means, random numbers are employed in generating random variates. Most common methods for generating random variates are- 1) Inverse Transform Technique, 2) Acceptance-Rejection Technique, and 3) Special Properties. Inverse Transform Technique is the underlying policy for sampling from an extensive family of discrete distribution.  **Simulation Strategies:** Now we extend towards the case of a single channel queuing system considering a bank as real-life example where the interarrival and service time of a customer are completely random i.e., probabilistic. It is very useful to follow a specific statistical distribution. The interarrival time of a customer in a single channel queuing system is assumed to be a Poisson process generally due to the customer's uncertainty in arrival but not limited to this extent. Service times are also considered to be exponentially distributed but sometimes a special case occurs when the event seems to follow normal probability distribution although the random variable is limited to a certain range. In this case, truncated normal distribution can be utilized. For generating interarrival and service times, gamma and Weibull distributions are also utilized depending on the model as the exponential distribution is said to be a special case of both of the gamma and Weibull distributions.  Now, simulate this bank problem having µ=5.6 customers/minute (arrival rate) and λ=5 customers/minute (service rate) for 20 customers. You should use exactly 19 to 20 random variates for generating the random variables(two). You don’t need to consider after precision values of decimal point for service times during simulation for the convenience. You can use any subroutine, object, or any built-in function of any relevant programming language. The average number of customer waiting, the average waiting time of a customer should be your statistical estimators for examining the true characteristics of the system. |  |