COIS 4470H: Modelling and Simulation
Winter 2017

Assignment 2

Due: Thursday, Mar. 2, 2017

1. **Inventory system:** An automobile dealership uses a weekly periodic inventory review policy. Assume the maximum space for cars is S=80 and the minimum inventory level is s=20. Operation costs are assumed as:

   - Holding cost (C_holding) - $25 per car per week
   - Shortage cost (C_Shortage) - $700 per car per week
   - Set up cost (C_SetUp) - $1000 per order
   - Unit cost (C_Unit) - $8000 each car ordered

(a) Modify the program **sis1.c** to compute all four components of the total average cost per week.

(b) Use your program to compute and complete the following table (S=80):

s	0	5	10	15	20	25	30	35	40
Average holding cost/week									
Average shortage cost/week									
Average setup cost /week									
Sum of the three costs/week									

(c) What could be the optimum value for *s*? Explain.

(d) Redo (a)-(c). Instead of reading the demands from the input file (sis1.dat), using random-variate generation techniques. Assume demands are uniformly distributed in the same range as the data in file sis.dat.

(e) Redo (a)-(c). Instead of reading the demands from the input file (sis1.dat), using random-variate generation techniques. Assume demands follow Geometric Distribution with the same mean as the data in file sis.dat.

(f) Compare results obtained for different demand distributions.

2. A random number generator can be developed by combining **two** Linear Congruential Generators using the following algorithm:

   The first generator has multiplier a_1 and modulus m_1,
   The second generator has multiplier a_2 and modulus m_2.

   Step 1: Select seed $X_{1,0}$ in the range of [1, m_1-1] for the first generator and seed $X_{2,0}$ in the range of [1, m_2-1] for the second generator. Set j=0.

Step 2: Evaluate each individual generator:

$$X_{1,j+1} = a_1 X_{1,j} \bmod m_1$$
$$X_{2\,j+1} = a_2 X_{2,j} \bmod m_2$$

Step 3:

$$X_{j+1} = (X_{1,j+1} - X_{2\,j+1}) \bmod m_1$$

Step 4:

Return $$R_{j+1} = \begin{cases} \dfrac{X_{j+1}}{m_1}, & \text{if } X_{j+1} > 0, \\ \dfrac{m_1 - 1}{m_1}, & \text{if } X_{j+1} = 0. \end{cases}$$

Step 5:

Set $j = j + 1$ and go to Step 2.

(a) Following this algorithm, develop a Combined Linear Congruential Generator. The seed $X_{1,0}$and $X_{2,0}$, parameters a_1, m_1, a_2, m_2, and number of random numbers generated should be given by the user at run time.

(b) Run your program using the input

$$X_{1,0} = 7, X_{2,0} = 8, a_1 = 11, m_1 = 16, a_2 = 3, m_2 = 32,$$

to generate 100 random variates between 0 and 1.

(c) Apply the Gap Test with the interval (0.2, 0.5) to determine if the random variates generated are independent (α = 5%.).

3. Apply the formulas discussed in class to develop a random variate generator for exponential distribution. Run the program using $\mu = 7$ and $\mu = 170$ to generate 1000 random variate respectively. Plot histograms for the obtained random variates.

4. Applying the Frequency Test to test the following sequence of numbers for uniformity, using s = 10 subintervals and α = 5%.

0.594, 0.928, 0.515, 0.055, 0.507, 0.351, 0.262, 0.797, 0.788, 0.442, 0.097, 0.798, 0.227, 0.127, 0.474, 0.825, 0.007, 0.182, 0.929, 0.852

Note:

Give all your answers and discussions in a pdf file named: yourLastName-A2. Submit both the answer file and all programs on Blackboard by 11:59pm on the due date.