

**MA 201**  
**Tutorial 1**  
**(02/09/2024)**

Q1. Linear congruential generator (Class Work)

Using LCG generate uniformly distributed random numbers in interval  $[p, q]$ . Plot Histogram and Cumulative Distribution Function of the same. LCG is defined by the recurrence relation:

$$X[n] = (a \cdot X[n-1] + c) \bmod m$$

$$X[0] = 100 \text{ (seed)}$$

$$a = 7^5 \text{ (multiplier)}$$

$$c = 0 \text{ (increment)}$$

$$m = 2^{31} - 1 \text{ (modulus)}$$

$$u[n] = X[n] / m \text{ (random in the interval } [0, 1])$$

$$r[n] = p + (q - p) u[n] \text{ (Scaling to interval } [p, q])$$

**Note:** Make a function on a Matlab file **lcg.m** . This will be used in subsequent classes for other problem simulations.

Q2.

Two dice are rolled.

$A$  = 'sum of two dice equals 3'

$B$  = 'sum of two dice equals 7'

$C$  = 'at least one of the dice shows a 1'

(a) What is  $P(A|C)$ ?

(b) What is  $P(B|C)$ ?

(c) Are  $A$  and  $C$  independent? What about  $B$  and  $C$ ? Are they Mutually Exclusive?

Q3.

A multiple choice exam has 4 choices for each question. A student has studied enough so that the probability they will know the answer to a question is 0.5, the probability that they will be able to eliminate one choice is 0.25, otherwise, all 4 choices seem equally plausible. If they know the answer they will get the question right. If not they have to guess from the 3 or 4 choices. As the teacher you want the test to measure what the student knows. If the student answers a question correctly what's the probability they knew the answer?