OPER 441: Modeling and Simulation
Exercises Sheet #3

U(0,1) seeds

0.2379	0.7551	0.2989	0.247	0.3237
0.2972	0.8469	0.4566	0.6146	0.6723
0.9496	0.2268	0.8699	0.9084	0.5649
0.3045	0.6964	0.1709	0.3387	0.9804
0.1246	0.842	0.6557	0.9672	0.3356
0.3525	0.8075	0.9462	0.9583	0.3807
0.1489	0.5480	0.9537	0.9376	0.8364
0.5095	0.4047	0.9058	0.3795	0.6242
0.5195	0.6545	0.1117	0.3258	0.8589
0.6536	0.3427	0.6653	0.7864	0.5824

Question1:

Consider the following uniformly distributed random numbers:

U_1	U_2	U_3	U_4	U_5	U_6	U_7	U_8
0.9559	0.5814	0.6534	0.5548	0.5330	0.5219	0.2839	0.3734

a) Generate a uniformly distributed random number with a minimum of 12 and a maximum of 22 using U_8.

b) Generate 1 random variate from an Erlang(r = 2, β = 3) distribution using U_1 and U_2

c) The demand for magazines on a given day follows the following probability distribution

x	40	50	60	70	80
$P(X = x)$	0.44	0.22	0.16	0.12	0.06

Using the supplied random numbers for this problem starting at U_1, generate 4 random variates from this distribution.

Question 2:

Suppose that customers arrive at an ATM via a Poisson process with mean 7 per hour. Determine the arrival time of the first 6 customers using the data given in the top (starting with the first row). Use the inverse transformation method.

Question 3:

The demand, D, for parts at a repair bench per day can be described by the following discrete probability mass function:

D	0	1	2
$p(D)$	0.3	0.2	0.5

Generate the demand for the first 4 days using the sequence of (0,1) random numbers in the top (starting with the first row).

Question 4:

The service times for an automated storage and retrieval system has a shifted exponential distribution. It is known that it takes a minimum of 15 seconds for any retrieval. The parameter of the exponential distribution is = 45. Using the sequence of (0,1) random numbers in the top (starting with the first row) generate 2 service times for this situation.

Question 5:

The time to failure for a computer printer fan has a Weibull distribution with shape parameter $\alpha = 2$ and scale parameter $\beta = 3$. Using the sequence of (0,1) random numbers in the top (starting with the first row) generate 2 failure times for this situation.

Question 6:

The time to failure for a computer printer fan has a Weibull distribution with shape parameter $\alpha = 2$ and scale parameter $\beta = 3$. Testing has indicated that the distribution is limited to the range from 1.5 to 4.5. Using the sequence of (0,1) random numbers in the top (starting with the first row) generate 2 failure times for this this truncated distribution.

Question 7:

The interest rate for a capital project is unknown. An accountant has estimated that the minimum interest rate will between 2% and 5% within the next year. The accountant believes that any interest rate in this range is equally likely. You are tasked with generating interest rates for a cash flow analysis of the project. Using the sequence of (0,1) random numbers in the top (starting with the first row) generate 2 independent interest rate values for this situation.

Question 8:

Customers arrive at a service location according to a Poisson distribution with mean 10 per hour. The installation has two servers. Experience shows that 60% of the arriving customers prefer the first server. By using the first row of (0,1) random numbers given in the top, determine the arrival times of the first three customers at each server.

Question9:

Consider the triangular distribution:

$$F(x) = \begin{cases} 0 & x < a \\ \dfrac{(x-a)^2}{(b-a)(c-a)} & a \le x \le c \\ 1 - \dfrac{(b-x)^2}{(b-a)(b-c)} & c < x \le b \\ 1 & b < x \end{cases}$$

a) Derive an inverse transform algorithm for this distribution.

b) Using the first row of random numbers from Exercise 2.10 generate 5 random numbers from the triangular distribution with a = 2, c = 5, b = 10.

Question 10:

Consider the following probability density function:

$$f(x) = \begin{cases} \dfrac{3x^2}{2} & -1 \le x \le 1 \\ 0 & \text{otherwise} \end{cases}$$

a) Derive an inverse transform algorithm for this distribution.

b) Using the first row of random numbers from the top generate 2 random numbers using your algorithm.

Question 11:

Consider the following probability density function:

$$f(x) = \begin{cases} 0.5x - 1 & 2 \le x \le 4 \\ 0 & \text{otherwise} \end{cases}$$

a) Derive an inverse transform algorithm for this distribution.

b) Using the first row of random numbers from the top generate 2 random numbers using your algorithm.

Question 12:

Consider the following probability density function:

$$f(x) = \begin{cases} \dfrac{2x}{25} & 0 \le x \le 5 \\ 0 & \text{otherwise} \end{cases}$$

a) Derive an inverse transform algorithm for this distribution.

b) Using the first row of random numbers from the top generate 2 random numbers using your algorithm.

Question 13:

Consider the following probability density function:

$$f(x) = \begin{cases} \dfrac{2}{x^3} & x > 1 \\ 0 & x \le 1 \end{cases}$$

a) Derive an inverse transform algorithm for this distribution.

b) Using the first row of random numbers from the top generate 2 random numbers using your algorithm.