Item 1

Implement a pseudorandom number generator class in Java. The class should contain methods:nextInt():int,nextDouble():double, nextDouble(double low, double high):double, exponential(double lambda):double. The first generates random numbers in the interval [0, 100), the second in the interval [0, 1.0), and the third in the interval [low, high). To implement the first method, please use a mixed linear generator:

$$x_n = ax_{n-1} + b \; mod \; M.$$

Use the first method in the second method.
In the third method, use the second method (to generate un) and the formula:

$$x_n = low + (high - low) \cdot u_n$$

In the fourth method, use the second method (to generate un) and the formula:

$$x_n = -\frac{\ln (1 - u_n)}{\lambda}$$

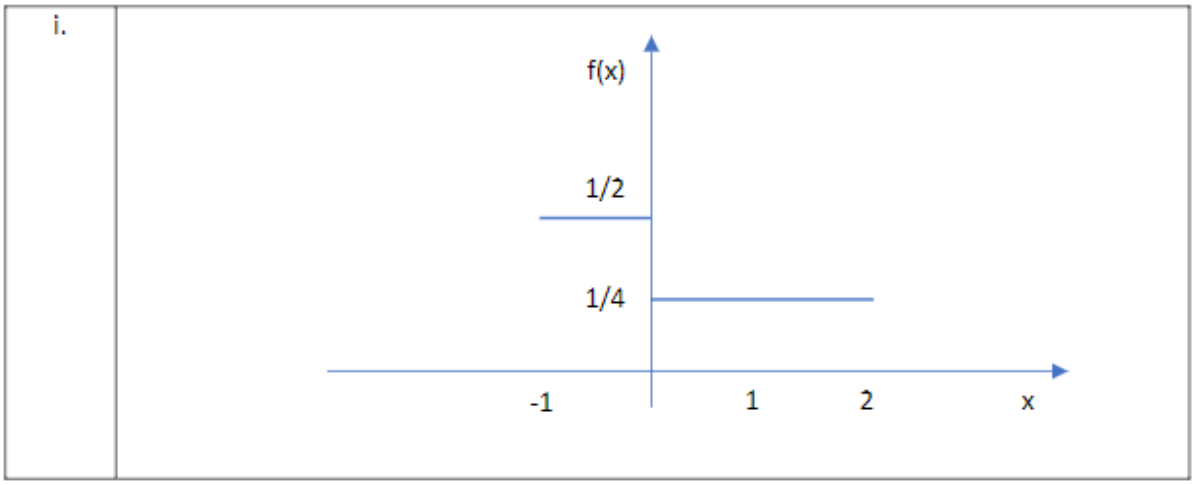
The generator class should have a parametric constructor to initialize the object correctly (store the generator parameters and the seed).Demonstrate the operation of the program for parameters a=97, b=11, M=100 or as indicated by the instructor.

Item 2

1. Using the method of inverse distribution, determine a formula for generating a number with a given probability distribution in the form of a density function (choose one of the functions in the table according to the instructor's guidelines).

2. Extend the class of pseudorandom number generator with the method decomposition1():double generating random values according to the above distribution (use the determined formula). To generate a number with uniform distribution from the interval [0,1)-values un-use the method from point 1) i.e. nextDouble():double.

i.



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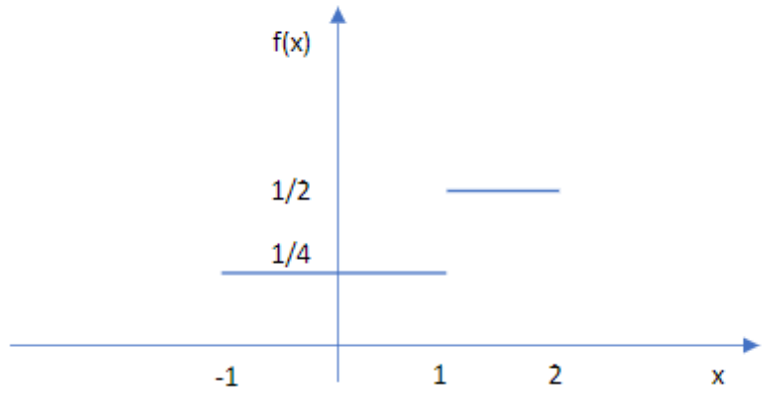

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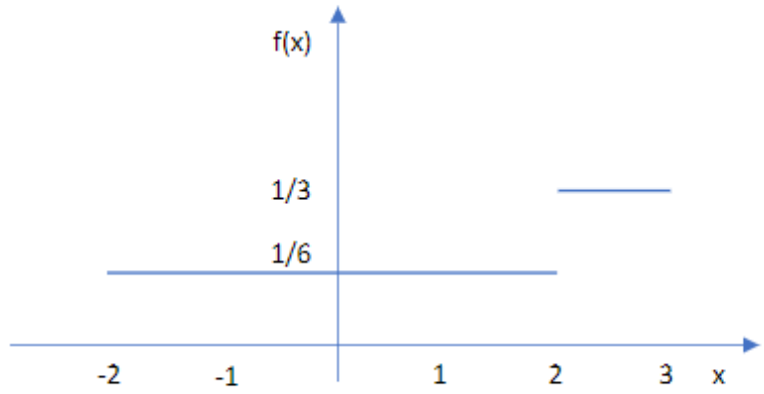
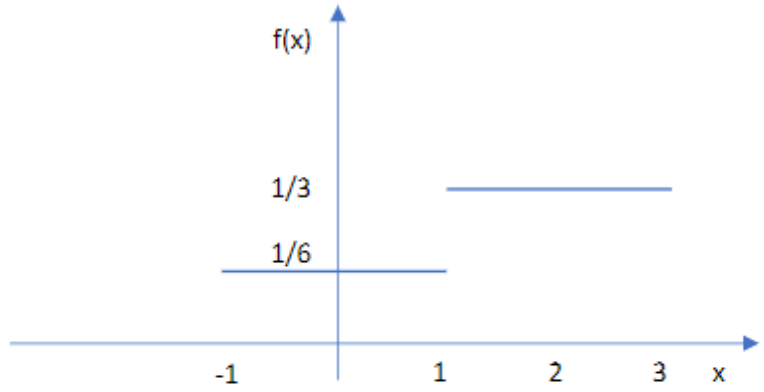


iv.



Item 3

Extend the pseudorandom number generator class with the method discret(double[] xx, double[] p):doublegenerating random values according to a discrete distribution given in stabelled form. Demonstrate the operation of the programme for the values in the table (you can propose the probability values p yourself - note: they must add up to 1).

$\tilde{x}_k$	-2	-1	0	1	2	3	4
p	p_1	p_2	p_3	p_4	p_5	p_6	p_7