Monte Carlo Integration

Apply the Monte Carlo integration to the Poisson distribution:

$$P(x) = \frac{e^{-\lambda}\lambda^{x}}{x!} \tag{1}$$

where x = 0, 1, 2, 3...
λ = Mean number of occurrence in the interval
e = Euler's constant

For every from 1 to 9, integral of Poisson Distribution of x in [0,20] is calculated. Since x can only be integer, the total area can be calculate by the sum up each area of [x,x+1] below the Poisson distribution line. Each area can be calculated by Monte Carlo approach.

Below are the graphs for having equal y value for every [x-0.5, x+0.5]:

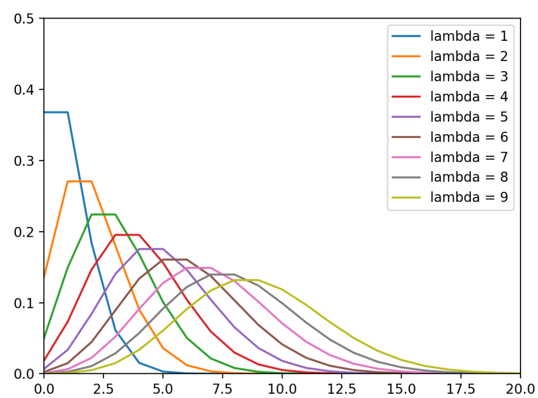
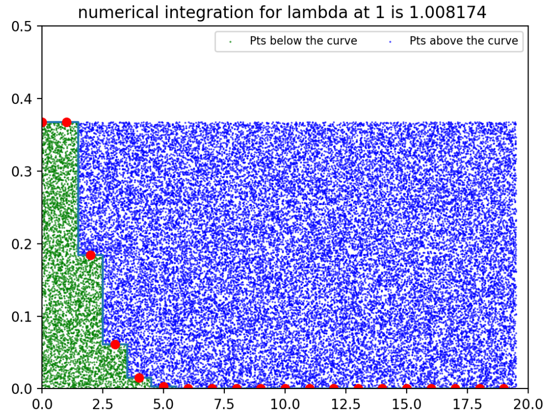
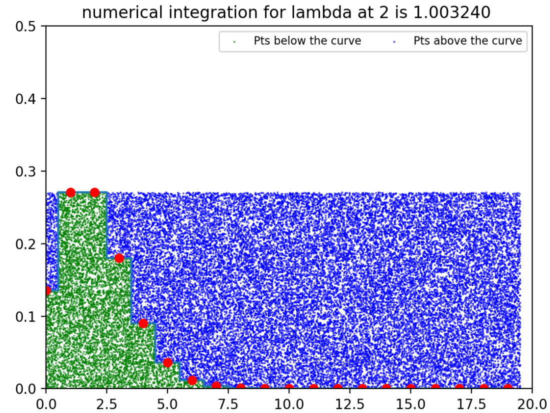
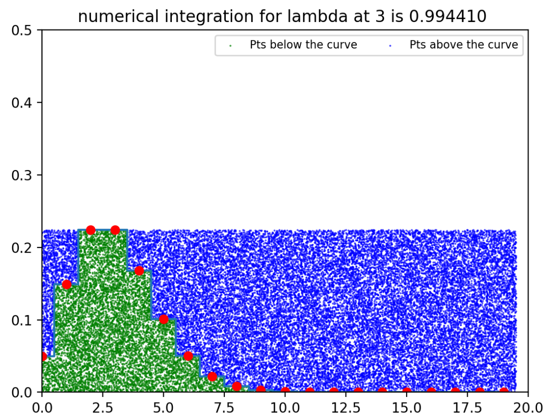
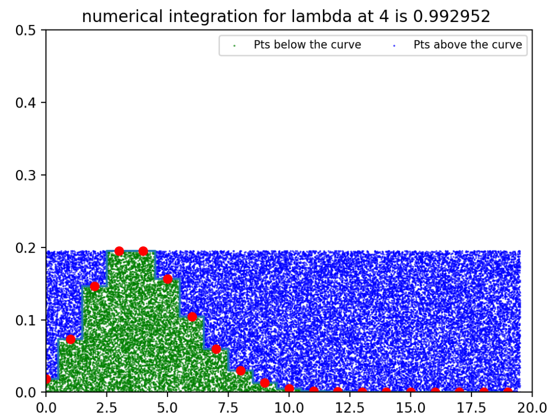


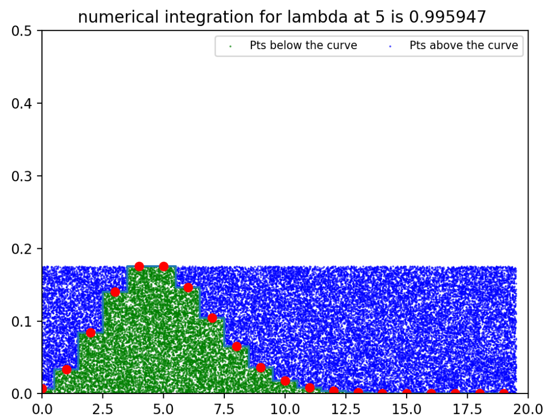
Figure 1: Monte Carlo Integration

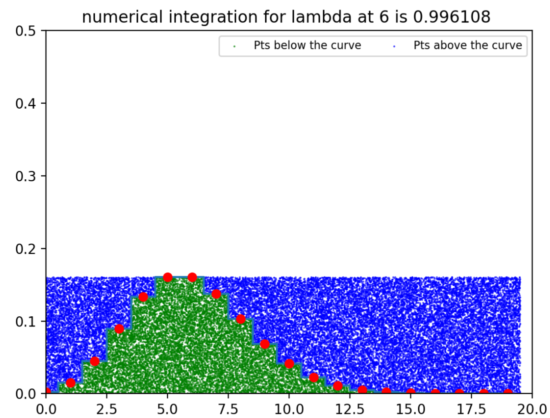

numerical integration for lambda at 1 is 1.008174
Pts below the curve
Pts above the curve

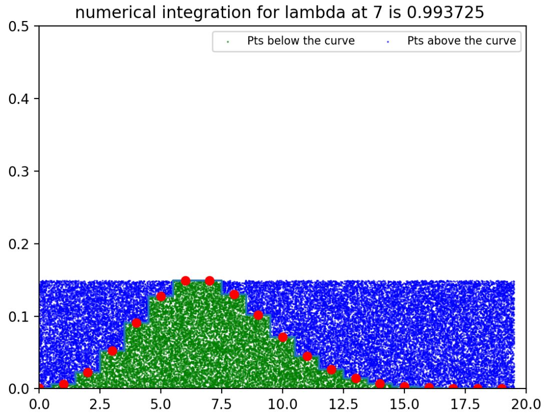

numerical integration for lambda at 2 is 1.003240
Pts below the curve
Pts above the curve

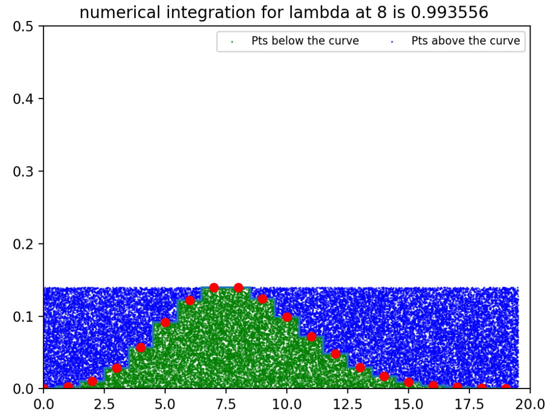

numerical integration for lambda at 3 is 0.994410
Pts below the curve
Pts above the curve

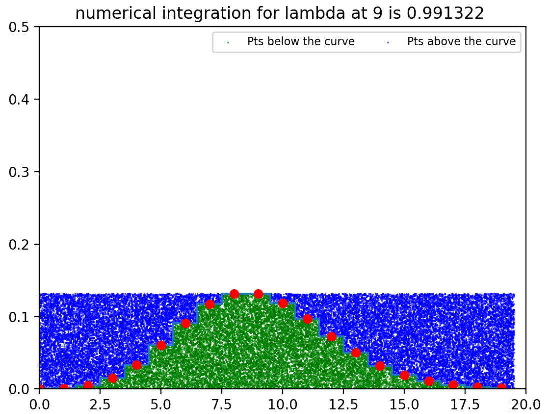

numerical integration for lambda at 4 is 0.992952
Pts below the curve
Pts above the curve


numerical integration for lambda at 5 is 0.995947
Pts below the curve
Pts above the curve

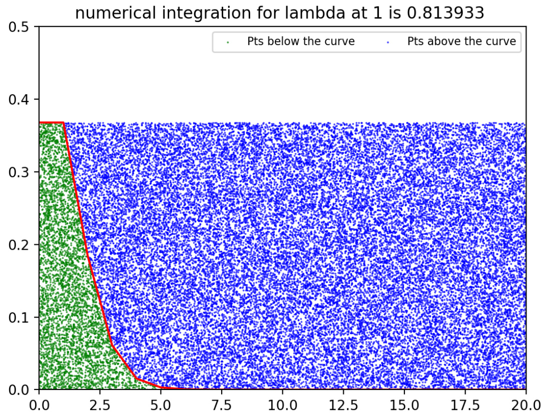

numerical integration for lambda at 6 is 0.996108
Pts below the curve
Pts above the curve

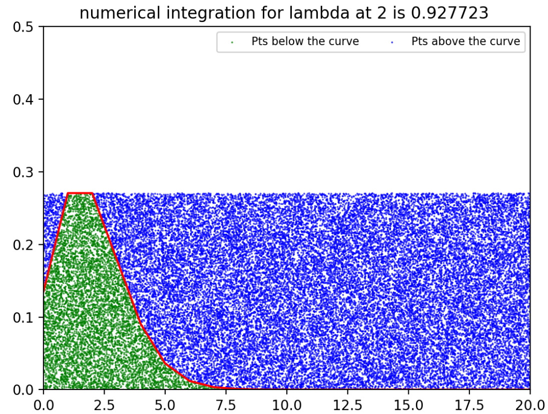


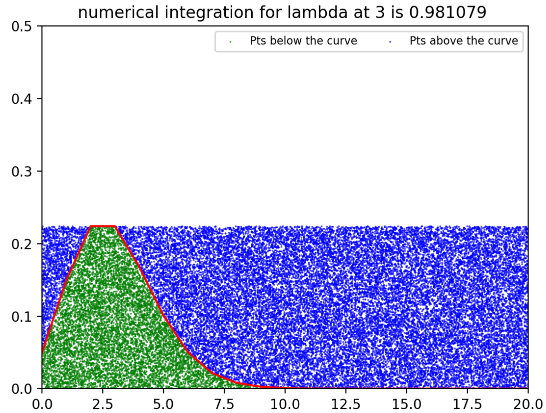


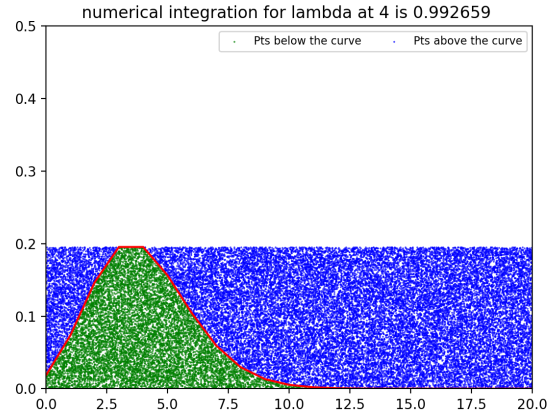


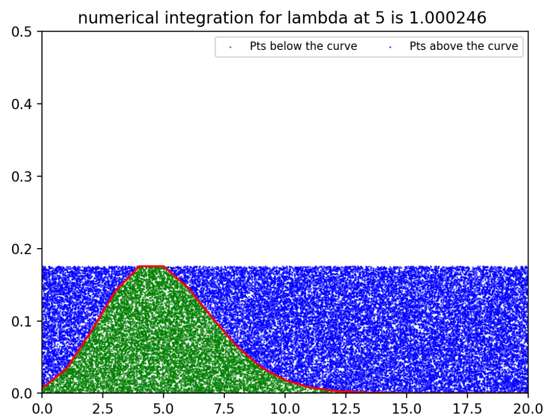
The other approach is to approximate by connecting each data point and use first degree polynomial. Below are the graphs:

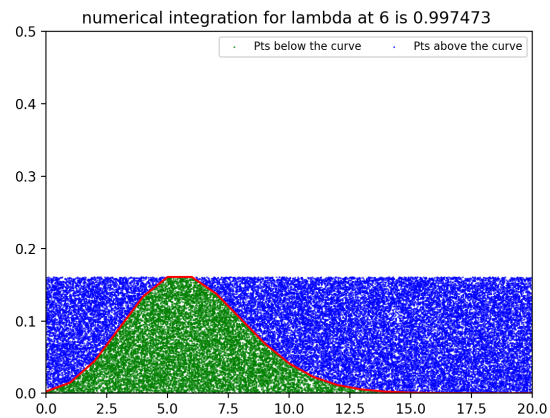


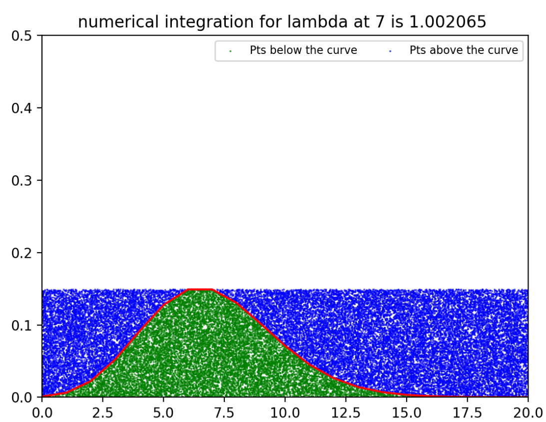


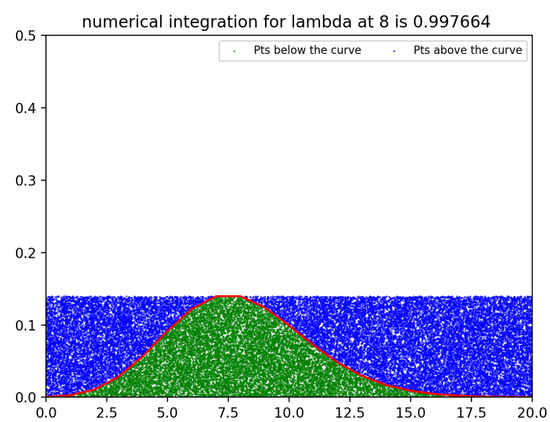

numerical integration for lambda at 3 is 0.981079
Pts below the curve
Pts above the curve

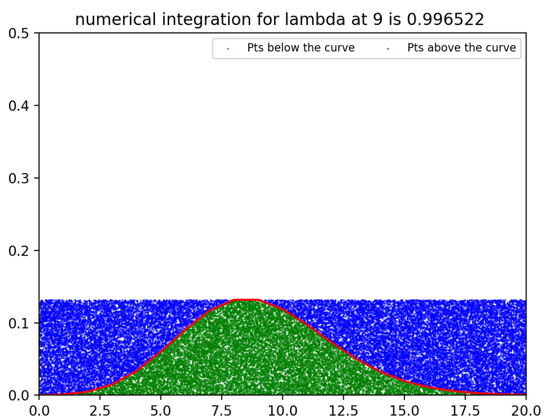

numerical integration for lambda at 4 is 0.992659
Pts below the curve
Pts above the curve


numerical integration for lambda at 5 is 1.000246
Pts below the curve
Pts above the curve


numerical integration for lambda at 6 is 0.997473
Pts below the curve
Pts above the curve


numerical integration for lambda at 7 is 1.002065
Pts below the curve
Pts above the curve


numerical integration for lambda at 8 is 0.997664
Pts below the curve
Pts above the curve



numerical integration for lambda at 9 is 0.996522
Pts below the curve
Pts above the curve
0.5
0.4
0.3
0.2
0.1
0.0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0