Computing and Data Science
Simulations
Assignment no. 5 (Continuous Distributions)
3rd Year
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1. **Let x be the random variable described by the uniform probability distribution with its lower bound at a = 120, upper bound at b = 140. Find the following:**
   a. **PDF**
   b. **Average**
   c. **SD**
   d. **Variance**
   e. **p (x = 130)**
   f. **p (125≤ x ≤ 135)**

Answer:

a. pdf = $\{\frac{1}{b-a}$ a ≤ x ≤ b

   pdf = $\frac{1}{140-120} = 0.05$ 120 ≤ x ≤ 140

b. E(x) = $\frac{140+120}{2} = 130$

c. SD = $\frac{(b-a)}{\sqrt{12}} = \frac{140-120}{\sqrt{12}} = 5.77305$

d. Variance = $\frac{(b-a)^2}{12} = 33.333333$

e. p (x = 130) = $\frac{1}{b-a} = 0.05$

f. p (125≤ x ≤ 135) = F (135) − F (125)

   $= \frac{135-125}{140-120} = 0.5$

2. According to British weather forecasters, the average monthly rainfall in London during the month of June is μ = 2.09 inches. Assume the monthly precipitation is a normally-distributed random variable with a standard deviation of σ = 0.48 inches.

a. What is the probability that London will have between 1.5 and 2.5 inches of precipitation next June?

b. What is the probability that London will have 1 inch or less of precipitation?

c. If London authorities prepare for flood conditions when the monthly precipitation falls in the upper 5% of the normal June amounts, how much rain would have to fall to cause local authorities to begin flood preparations?

Answer:

a. p $(1.5 \leq x \leq 2.5)$ =

$$= p \left(\frac{1.5-2.09}{0.48} \leq z \leq \frac{2.5-2.09}{0.48}\right)$$

$$= p (-1.229 \leq z \leq 0.854)$$

$$= \phi (0.854) - \phi (-1.229)$$

$$= \phi (0.854) - (1 - \phi (1.229))$$

$$= 0.693$$

b. p $(x \leq 1)$ = p $\left(z \leq \frac{1-2.09}{0.48}\right)$ = p $(z \leq -2.2708)$ = 0.0116

c. P(Z>z) = 0.05 = P $(Z \leq z)$ = 0.95

$$\frac{x-2.09}{0.48} = z_{0.95} = \emptyset (z) = 0.95 = 1.64$$

$$x = 1.64*0.48 + 2.09 = 2.8772$$

3. **The number of visits to the Book4Less.com discount travel website is a Poisson- distributed random variable with a mean arrival rate of 10 visits per minute.**
   a. What is the CDF?
   b. What is the standard deviation of the distribution?

   ## Answer:

   a. **CDF** $= \sum_{i=0}^{k=10} \frac{e^{-\Lambda} * \Lambda^i}{i!} = \sum_{i=0}^{k=10} \frac{e^{-10} * 10^i}{i!}$

   b. **standard deviation** $= \sqrt{10}$

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4. **Solve same Erlang question with three lambs in the device.**

   ## Answer:

   k = 3   **E = 1/ kθ**   **θ = 0.0003**

   F (2160) = 1- $\sum_{i=0}^{k-1} \frac{e^{-k\theta x} k\theta \, x^i}{i!} =$ **1 -** $\sum_{i=0}^{2} \frac{e^{-1.944} \, 1.944^i}{i!} =$ **0.308**

   the required probability is 1- 0.308 = 0.6918