Characterizing Measurement Data

Assignment 1

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Question 1.

a)

$$\lambda = 5\frac{session}{minute} \rightarrow mean = \frac{1}{\lambda} = \frac{1minute}{5session} \times \frac{60seconds}{1minute} = 12seconds$$

b)

Exponential distribution has *memoryless property*. It means that no matter how much time has elapsed since the previous arrival, the mean waiting time at time T for the next entry will still be 12 seconds.

c)

$$arrivals = period * lambda = 2minutes * 5\frac{arrival}{minute} = 10arrivals$$

d)

Because interarrival times are IID, the first arrival doesn't change the mean.

$$time = 3 * 60 = 180seconds \rightarrow arrivals = \left\lfloor \frac{180 - 18}{12\frac{arrival}{seconds}} \right\rfloor = 13 + 1(firstarrival) = 14$$

Question 2.

a)

W:

$$mean = \frac{1}{\lambda} = 12 \rightarrow \lambda = \frac{1}{12} = 0.08\overline{3}$$

X:

$$mean = n\gamma \rightarrow \gamma = \frac{12}{3} = 4$$

Y:

$$mean = e^{(\mu + \frac{\sigma^2}{2})} \rightarrow e^{(1 + \frac{\sigma^2}{2})} = 12 \rightarrow ln(e^{(1+\frac{\sigma^2}{2})}) = ln(12) \rightarrow 1 + \frac{\sigma^2}{2} = ln(12) \rightarrow \frac{\sigma^2}{2} = ln(12) - 1 \rightarrow \sigma^2 = 2ln(12) - 2 \rightarrow \sigma = \pm($$

```r
sigma=2*log2(12) - 2
cat("sigma is: +-",sigma)
```

```
## sigma is: +- 5.169925
```

Z:

$$mean = \begin{cases} \infty \quad for \quad \alpha \leq 1 \\ \frac{\alpha * k}{\alpha - 1} \quad for \quad \alpha > 1 \end{cases}$$

$$\alpha = 1.25 \rightarrow mean = \frac{\alpha * k}{\alpha - 1} \rightarrow 12 = \frac{1.25k}{1.25 - 1} \rightarrow 12 = \frac{1.25k}{0.25} \rightarrow 12 = 5k \rightarrow k = \frac{12}{5} = 2.4$$

b)

W:

$$F(x) = P(x < 12) = 1 - e^{-\lambda x} = 1 - e^{-\frac{1}{12} * 12} = 1 - \frac{1}{e}$$

```r
p=pexp(12, rate=1/12)
cat("Probability for exponential distribution is: ",p)
```

```
## Probability for exponential distribution is:  0.6321206
```

X:

$$F(x) = P(x < 12) = 1 - \sum_{n=0}^{2} \frac{e^{-\frac{x}{\gamma}} x^n}{\gamma^n n!} = 1 - \sum_{i=0}^{2} \frac{e^{-\frac{x}{4}} x^n}{4^n n!}$$

```r
p=pgamma(3, 4)
cat("Probability for erlang distribution is: ",p)
```

```
## Probability for erlang distribution is:  0.3527681
```

Y:

Z:

c)

W:

X:

Y:

Z:

Question 3.

Question 4.

Question 5.

a)

b)

c)