

## ENEE324-03 Spring 2019. Problem set 7

Date due April 16, 2019

**Problem 1.** A phone call to the service center has a normal distribution with mean 10min and standard deviation 2 min. During one day there were 5 phone calls and during the other day there were 6 calls. What is the probability that the sample average taken on each of the two days is at most 11?

**Problem 2.** The profit collected from selling apples in a grocery store has mean 18% and standard deviation 6%. Assume that the profit margins at different stores are independent RVs. What is the approximate probability that the sample mean for a random sample of 40 stores is between 16% and 19%? (you can use normal approximation).

**Problem 3.** Let  $X_1 \sim \text{Exp}(\lambda_1)$ ,  $X_2 \sim \text{Exp}(\lambda_2)$  be life spans of two devices. Assume that  $X_1$  and  $X_2$  are independent. Compute the pdf of the total lifespan  $X_1 + X_2$  and the pdf of the random variable  $Y$  defined as  $Y = \frac{X_1}{X_1 + X_2}$ .

**Problem 4.** Let  $X_1, X_2, \dots, X_{20}$  be independent Poisson RVs with common value of the expectation  $\mu = 1$ .

(a) Use the Markov inequality to bound above  $P(\sum_{i=1}^{20} X_i > 15)$ .

(b) Use the fact that random variable  $\frac{\sum_{i=1}^{20} X_i - 20\mu}{\sqrt{20(\text{Var}(X_1))}}$  is approximately standard Gaussian and compute the approximate value of the probability  $P(\sum_{i=1}^{20} X_i > 15)$ .

(c) Compute the true value of the probability in parts (a), (b).

**Problem 5.** The length of a certain football field is measured 50 times, and the length  $L$  is assumed to be the (sample) average of these results. Each measurement has a random error uniformly distributed on  $[-1, 1]$  (measured in yards). What is the probability that the value of  $L$  is different from the true value by less than 0.25 yards?