CEE110
Homework #4

You must show all work for full credit and submit it through Gradescope by the deadline.

1. According to the WHO, 1 in 88 people worldwide had been confirmed with Coronavirus (COVID-19).

a. If a random sample of 200 people is selected, what are the expected value and standard deviation for the number who have been confirmed with COVID-19?

b. Calculate the approximate probability that at least 2 people in the sample have been confirmed with COVID-19?

c. If the sample size is 352, what is the approximate probability that fewer than *5* of the selected people have been confirmed with COVID-19?

2. UCLA data center contains 1000 computer servers. Each server has probability 0.003 of failing on a given day.

a. What is the probability that exactly two servers fail?

b. What is the probability that fewer than 998 servers fail?

c. What is the mean and standard deviation of the number of servers that fail?

3. In the Port of Los Angeles, a ship discharges bacteria with a concentration of 10 numbers/m^3, which follows the Poisson process.

a. What is the probability that one cubic meter of discharge contains at least 8 bacteria?

b. What is the mean and standard deviation of the bacteria in 1.5 m^3 of discharge from a ship?

c. What is the probability that the number of organisms in 1.5 m^3 of discharge exceeds its mean value by more than one standard deviation?

4. Time headway in traffic flow is the elapsed time between the time that one car finishes passing a fixed point and the instant that the next car begins to pass that point. Suppose X is a continuous random variable for the time headway for two randomly chosen consecutive cars on a freeway with the following pdf:

$$f(x) = \begin{cases} ce^{-4x} & x \geq 0 \\ 0 & else \end{cases}$$

where c is a positive constant.

a. Find c.

b. Find the cdf of X, F(x).

c. Find P(2 < X < 5)

d. Find E(X).

5. Let X be the distribution of the amount of gravel (in tons) sold by a construction supply company in LA in a given week is a continuous rv X with the following cdf.

$$F(x) = \begin{cases} 0 & x < -2 \\ \frac{1}{2} + \frac{3}{32}\left(4x - \frac{x^3}{3}\right) & -2 \leq x < 2 \\ 1 & 2 \leq x \end{cases}$$

a. Find the probability of X is less than 0

b. Find the median (50^{th} percentile).

c. Find the pdf.

6. The amount of time, in minutes, that a student must wait for a Bruin bus is suggested to be uniformly distributed on the interval (7.5, 20).

a. What is the mean and variance of the waiting time?

b. What is the cdf of waiting time?

c. Find P(10≤X≤15).

d. What is the probability that the observed waiting time is within 1 standard deviation of the mean value?