CEE110
Homework #5

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

1. Pollutant concentration of influent to a wastewater reactor is assumed to follow a normal distribution with $\mu = 0.40$, and $\sigma = 0.04$.
   a. Find the probability that the concentration exceeds 0.51.
   b. Find the probability that the concentration is at most 0.33.
   c. What is the largest 10% of all concentration values?

2. Suppose the pore size for a microfilter is normally distributed with mean 110 μm and standard deviation 12.9 μm.
   a. Find the probability that the size of a single droplet is at least 140 μm.
   b. Find the probability that the size of a single droplet is between 90 and 140 μm.
   c. What is the smallest 3% of all droplets?
   d. If the sizes of five independently selected droplets are measured, what is the probability that exactly two of them exceed 140 μm?

3. For a wet season in Los Angeles, the stormwater pollution load of total dissolved solids could be modeled with a lognormal distribution with a mean value of 12,933 kg/day/km and a coefficient of variation CV= 0.37 ($CV=\sigma_x/\mu_x$).
   a. Find the mean value and standard deviation of ln(X).
   b. Find the probability that X is at most 12,500 kg/day/km.
   c. Find the probability that X exceeds its mean value. Why is this probability not .5?
   d. Is 17,000 the 95th percentile of the distribution?

4. Suppose that the distances between faults along the wire have an exponential distribution with parameter $\lambda=0.02368$.
   a. Find the probability that the distance is at most 100 m? At most 200 m? Between 100 and 200 m?
   b. What is the probability that distance exceeds the mean distance by more than 1 standard deviations?
   c. What is the value of the median distance?

5. Suppose that the lifetime of a certain battery has a gamma distribution with mean 24 months and standard deviation 12 months.

a. Find the probability that a battery will last between 9 and 18 months.
b. Find the probability that a battery will last at most 24 months? Is the median of the lifetime distribution less than 24 months? Why or why not?
c. Find the 99th percentile of the lifetime distribution.
d. Suppose the test will actually be terminated after t months. What value of t is such that only 0.1% of all batteries would still be operating at termination?

6. Suppose 3 tsunami stroke Los Angeles per year between 1961 and 1990, which follows a Poisson distribution.

a. What is the probability that at least one tsunami strikes Los Angeles in the next one year?
b. What is the probability that it will be at least one year until the next tsunami strikes Los Angeles?
c. If one year has passed without a tsunami, what is the probability that it will be within another six months until the next tsunami hits Los Angeles?
d. Let T be the time until the occurrence of the fifth tsunami. Find the probability of T is between 1 and 2 years?