Section #8

1. Application of coats of paint to cars manufactured by the Little Red Car Company is performed by a robot. The design specifications of this robot reveal that the mean coating thickness (X) for the low-viscosity paint used is 1.20 mm, with a standard deviation of 0.25 mm. The owners of the Little Red Car Company want to know if their robot meets these performance specs. The following sample has been collected:

0.83	0.88	0.88	1.04	1.09	1.12	1.29	1.31
1.48	1.49	1.59	1.62	1.65	1.71	1.76	1.83

   Note that the population of coating thicknesses X follows a normal distribution. The sample mean is 1.35 mm and the sample variance is 0.1146 mm^2

   (a) Calculate the mean of the sampling distribution of the mean of X.
   (b) Calculate the variance of the sampling distribution of the mean of X.
   (c) Calculate the probability that a random measurement X will be greater than 1.35.
   (d) Calculate the probability that the mean of X, determined from the sample of 16, will be greater than 1.35 mm.
   (e) Calculate the probability that the mean of X, determined from a sample of 32, will be greater than 1.35mm.
   (f) Calculate the probability that the variance of X, determined from a sample of 16, will be greater than 0.1146 mm^2.
   (g) Calculate the probability that the variance of X, determined from a sample of 31, will be greater than 0.1146 mm^2.

2. A study of noise level on takeoff of jets at a particular airport is being undertaken to assess if a new residential area near the airport can be developed. The noise levels (X) in decibels of jets as they pass over the new residential area have been measured. If X has a true mean of 109 decibels and a standard deviation of 23 decibels, what is the probability that a sample mean obtained from a sample of 8 measurements will be greater than 115 decibels? Assume that X follows a normal distribution.

   (a) 0.74
   (b) 0.40
   (c) 0.23
   (d) 0.77
   (e) none of the above

3. Indoor swimming pools are noted for their poor acoustical properties. The goal is to design a pool in such a way that the average time that it takes a low-frequency sound to die is at most 1.3 seconds with a standard deviation of at most 0.6 seconds. A compliance study of a pool in Calgary will employ 5 measurements to confirm these design specifications have been met. Assuming that the original population of times follows a normal distribution, what is the sample variance value S_0^2 that corresponds to the probability $P[S^2 > S_0^2] = 0.05$ if the true standard deviation is 0.6 seconds?

   (a) 0.797
   (b) 0.854
   (c) 1.423
   (d) 9.488
   (e) none of the above

4. The late manifestation of an injury following exposure to a sufficient dose of radiation is common. An extensive study of this phenomenon has revealed that the time (in days) that elapses between exposure to radiation and the appearance of peak erythema (skin redness) has a true mean of 12.5 days and a true standard deviation of 5.5 days. What is the probability that a sample mean computed from a sample of 12 observations will be greater than 2 weeks (14 days)? Assume the original population follows a normal distribution.

    (a)   0.17
    (b)   0.39
    (c)   0.83
    (d)   0.94
    (e)   none of the above

5. A manufacturer of a photographic film claims that the shelf life of this film is 120 days. He wants to draw a conclusion about this claim based on a sample of 8 observations with a mean of 133 days and a standard deviation of 16 days. If the computed t-value is between $-t_{0.025}$ and $t_{0.025}$, the manufacturer is satisfied with the claim. Does the sample information support the manufacturer's claim? Assume approximately normal distribution of the shelf life of the film.

6. Pull-strength tests on 10 soldered leads for a semi conductor device yield the following results in pounds force required to rupture the bond:

   19.8   12.7   13.2   16.9   10.6   18.8   11.1   14.3   17.0   12.5

Another set of 8 leads was tested after encapsulation to determine whether the pull strength has been increased by encapsulation of the device, with the following results:

   24.9   22.8   23.6   22.1   20.4   21.6   21.8   22.5

Find the probability that σ_2^2 / σ_1^2 will equal 1.

7. A study has shown that men earn on the average $292.50 per week with a standard deviation of $15.60, and women earn on the average $266.10 per week with a standard deviation of $18.20. For a group of 16 men and 16 women, is it likely that the men will earn on the average $30 per week more than the women?