King Fahd University of Petroleum and Minerals
Department of Mathematics

Stat 201

Major Exam II

251

November 10 , 2025

Net Time Allowed: 90 Minutes

USE THIS AS A TEMPLATE

Write your questions, once you are satisfied upload this file.

1. (Exercise 4-178) The life of a semiconductor laser at a constant power is a lognormal random variable with a mean of 7104.26 hours and a standard deviation of 790.33 hours. What is the life in hours that 99.9% of the lasers exceed?

   Note: Round your final answer to the nearest whole hour.

   (a) 5012 hours
   (b) 5062 hours
   (c) 4662 hours
   (d) 6797 hours
   (e) 9947 hours

2. (Exercise 4-131) The life (in hours) of a magnetic resonance imaging machine (MRI) is modeled by a Weibull distribution with parameters $\beta = 0.5$ and $\delta = 1200$ hours. Determine the probability that the MRI fails before 4800 hours.

   (a) 0.8647
   (b) 0.1353
   (c) 0.9817
   (d) 0.3935
   (e) 1.0000

3. (Suggested Problem 4-102) The distance between major cracks in a highway follows an exponential distribution with a mean of 12 km. What is the probability that the first major crack occurs between 24 and 36 km of the start of inspection?

   (a) 0.0855
   (b) 0.6321
   (c) 0.9502
   (d) 0.1353
   (e) 0.9145

4. (Suggested Problem 4-62) The fill volume of an automated filling machine used for filling cans of carbonated beverage is normally distributed with a mean of 355 cc and a standard deviation of 5 cc. What is the probability that a fill volume is exactly 345 cc?

   (a) 0
   (b) 0.97725
   (c) 0.02275
   (d) 0.15866
   (e) 0.84134

5. (Exercise 4-7) Suppose that $f(x) = 1.5\,x^2$ for $-1 < x < 1$. Determine $\mathbb{P}(-0.5 < X < 0.5)$.

   (a) 0.1250
   (b) 0.0833
   (c) 0.1667
   (d) 0.0625
   (e) 0.5000

6. (Exercise 4-23) The gap width is an important property of a magnetic recording head. In coded units, if the width is a continuous random variable over the range $0 < x < 4$ with $f(x) = 0.125\,x$, determine the cumulative distribution function of the gap width.

   (a) $F(x) = \begin{cases} 0, & x \le 0, \\ 0.0625\,x^2, & 0 < x < 4, \\ 1, & x \ge 4\;. \end{cases}$

   (b) $F(x) = \begin{cases} 0, & x \le 0, \\ 0.1250\,x^2, & 0 < x < 4, \\ 1, & x \ge 4\;. \end{cases}$

   (c) $F(x) = \begin{cases} 0, & x \le 0, \\ 0.0313\,x^2, & 0 < x < 4, \\ 1, & x \ge 4\;. \end{cases}$

   (d) $F(x) = \begin{cases} 0, & x \le 0, \\ 0.2500\,x, & 0 < x < 4, \\ 1, & x \ge 4\;. \end{cases}$

   (e) $F(x) = \begin{cases} 0, & x \le 0, \\ 0.0625\,x^2, & 0 < x < 2, \\ 1, & x \ge 2\;. \end{cases}$

7. (Exercise 7-4) Suppose that samples of size $n = 5$ are selected at random from a normal population with mean 120 and standard deviation 12. What can you say about the probability that the sample mean falls in the interval from $\mu_{\bar{X}} - 1.73\,\sigma_{\bar{X}}$ to $\mu_{\bar{X}} + 0.95\,\sigma_{\bar{X}}$?

   (a) 0.78712
   (b) 0.91637
   (c) 0.21287
   (d) This probability cannot be found because the sample size is small.
   (e) 0.82894

8. (Exercise 7-12) The amount of time that a customer spends waiting at an airport check-in counter is a random variable with mean 8.5 minutes and standard deviation 6 minutes. Suppose that a random sample of $n = 58$ customers is observed. Find the probability that the average time waiting in line for these customers is more than 10.1 minutes.

   (a) 0.02118
   (b) 0.00159
   (c) 0.05480
   (d) 0.39358
   (e) 0.97882

9. (Exercise 8-9) Suppose that $n = 100$ random samples of water from a freshwater lake are taken and calcium concentration (mg/L) measured. A 95% confidence interval on the mean calcium concentration is: $[\,0.52\,,\ 0.74\,]$.

   Which interpretation of this interval is correct?

   (a) If we were to repeat this entire sampling process many times (taking $n = 100$ samples and computing a 95% CI), about 95% of those intervals would contain the true mean μ.
   (b) There is a 95% probability that the true mean calcium concentration μ lies between 0.52 and 0.74 mg/L.
   (c) About 95% of individual water samples from this lake have calcium concentration between 0.52 and 0.74 mg/L.
   (d) Because the confidence level is 95%, at least 95 of the 100 measured samples in this study must lie between 0.52 and 0.74 mg/L.
   (e) With 95% confidence, the calcium concentration of the next single water sample drawn from this lake will lie between 0.52 and 0.74 mg/L.

10. (Exercise 8-7) A confidence interval estimate is desired for the gain in a circuit of semiconductor device. Assume that the gain is normally distributed with the standard deviation $\sigma = 30$. How large n must be if the length of the 95% confidence interval is to be 30?

    (a) 16
    (b) 15
    (c) 4
    (d) 3
    (e) 30

11. (Exercise 8-14) The lifetime in hours of 75-watt light bulbs is known to be normally distributed with standard deviation of 25 hours. A random sample of size 20 bulbs has a mean life of 1014 hours. The margin of error for a 78.87% confidence interval on the mean lifetime is

    (a) 6.99
    (b) 10.95
    (c) 13.98
    (d) 7.16
    (e) 1.56

12. (Exercise 8-60) A study is to be conducted of the percentage of homeowners who own at least two television sets. How large a sample is required if we wish to be 97% confident that the error in estimating this percentage is less than 0.017?

    (a) 4074
    (b) 32
    (c) 3324
    (d) 273
    (e) 8148

13. (Exercise 8-1(c)) For a normal population with known variance, the confidence level for the interval $\bar{x} \pm 1.85\frac{\sigma}{\sqrt{n}}$ is

   (a) 93.57%
   (b) 96.78%
   (c) 98.39%
   (d) 95%
   (e) 90%

14. (Exercise 8-27 modified) A research engineer for a tire manufacturer is investigating tire life for a new rubber compound and has build 16 tires and tested them to end-of-life in a road test. The sample mean is $\bar{x}$ km and the sample standard deviation is s km. A 90% confidence interval on the mean tire life is reported as : $[\,5514.28\,,\ 60284.91\,]$.

   What is the value of the sample standard deviation s?

   (a) 62,487.88 km
   (b) 66,590.43 km
   (c) 124,972.18 km
   (d) 15,621.52 km
   (e) 62,738.41 km