Homework #10

Due on 11/09/2026, Monday, before class.

1. Exercise 3.2.5 on page 172 (Graduates only)

   3.2.5. Let X have a Poisson distribution with $\mu = 100$. Use Chebyshev's inequality to determine a lower bound for $P(75 < X < 125)$. Next, calculate the probability using R. Is the approximation by Chebyshev's inequality accurate?

2. Exercise 3.2.11 on page 172

   3.2.11. Let the number of chocolate chips in a certain type of cookie have a Poisson distribution. We want the probability that a cookie of this type contains at least two chocolate chips to be greater than 0.99. Find the smallest value of the mean that the distribution can take.

3. Exercise 3.3.2 on page 182 (Hint: Use the Chi-Square Distibution Table on page 708)

   3.3.2. If X is $\chi^2(5)$, determine the constants c and d so that $P(c < X < d) = 0.95$ and $P(X < c) = 0.025$.

4. Exercise 3.3.24 on page 185 (Graduates only)

   3.3.24. Let X_1, X_2 be two independent random variables having gamma distributions with parameters $\alpha_1 = 3$, $\beta_1 = 3$ and $\alpha_2 = 5$, $\beta_2 = 1$, respectively.

   (a) Find the mgf of $Y = 2X_1 + 6X_2$.

   (b) What is the distribution of Y?

5. Exercise 3.4.2 on page 194

   3.4.2. If X is $N(75, 100)$, find $P(X < 60)$ and $P(70 < X < 100)$ by using either Table II or the R command `pnorm`.

6. Exercise 3.4.31 on page 197

3.4.31. A certain job is completed in three steps in series. The means and standard deviations for the steps are (in minutes)

Step	Mean	Standard Deviation
1	17	2
2	13	1
3	13	2

Assuming independent steps and normal distributions, compute the probability that the job takes less than 40 minutes to complete.