Name: __________________________

Directions: MAKE SURE TO COPY YOUR ANSWERS TO A SEPARATE SHEET FOR SENDING ME AN ELECTRONIC COPY LATER.

1. (15) State why the following code doesn’t work. (Do NOT state how to fix it.)
   \[
   \text{integrate(function(x) x^2,1,4) + integrate(function(x) x,4,5)}
   \]

2. Consider the example in Sec. 12.2.1. Find the following:
   (a) (15) \( F_{X}(70.1) \)
   (b) (15) \( EX_2 \)
   (c) (15) In this part only, suppose we sample without replacement. Find \( Cov(X_1, X_2) \).

3. Again consider Sec. 12.2.1 (sampling with replacement), in our “notebook” context, with \( n = 100 \) We have columns for \( X_1, X_2, \ldots, X_{100}, \overline{X}, s^2, \overline{X} - 1.5s/\sqrt{100}, \overline{X} + 1.5s/\sqrt{100} \). (Here \( s \) is as in (12.23). Find the following:
   (a) (10) The long-run average value in the \( \overline{X} \) column.
   (b) (10) The long-run average value in the \( s^2 \) column.
   (c) (10) The long-run proportion of notebook lines for which the population mean is between the values in the last two columns.

4. (10) Consider the code on pp.227-228, but with \texttt{rexp(1,0,1)} in line 4 replaced by \texttt{runif(1,0,1)}. Give the approximate value of the output in line 12.
Solutions:

1. We are trying to add two objects of class `integrate()`, rather than add two numbers.

2.a

\[
\frac{1}{9} + \frac{2}{9} + \frac{1}{9} = \frac{4}{9}
\]

2.b \(EX_i = \mu = (69 + 70 + 72)/3\)

2.c

\[
\text{Cov}(X_1, X_2) = E(X_1 X_2) - EX_1 EX_2 = E(X_1X_2) - \mu^2
\]

\[
E(X_1X_2) = (69 \cdot 70 + 69 \cdot 72 + 70 \cdot 72)/3
\]

3.a \(\mu\)

3.b

\[
E(s^2) = \frac{99}{100}\sigma^2
\]

\[
\sigma^2 = E(X^2) - (EX)^2 = (69^2 + 70^2 + 72^2)/3 - \mu^2
\]

3.c This is a confidence interval, for which we are being asked to find the confidence level. This is

\[1 - 2 \times \text{pnorm(-1.5)}\]

(The original version had \(\sqrt{2}\) rather than \(\sqrt{100}\). The problem was not graded.

4. Use (9.42). Here \(EX = 0.5\) and \(f_X(t) = 1\). So, \(f_Y(t) = 2t\). Then

\[
EY = \int_0^1 t \cdot 2t \, dt = \frac{2}{3}
\]

So the mean length of the interval we arrive within is 2/3, and the mean time to the next/last bus is 1/3.