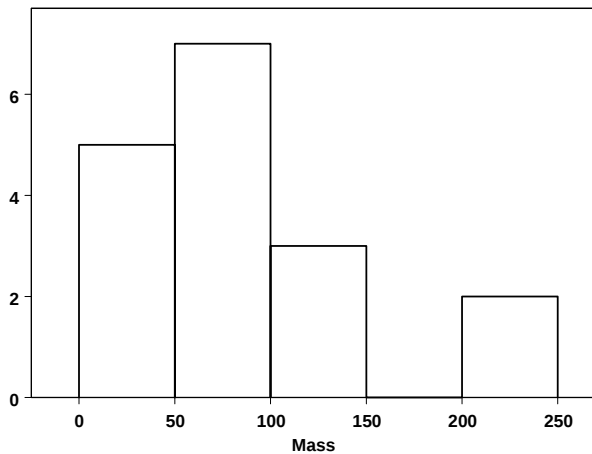


This is a closed book exam. You are allowed, however, to use the formula card that came with the textbook and to have one sheet (double-sided) of 8.5 x 11 paper with notes, either handwritten or typed. You may also use a calculator, although be sure to show your work. The exam consists of five problems worth a total of 100 points. Point values for each part of a question are designated in parentheses at the beginning of the problem.

Be sure to show your work as indicated in order to receive credit.

Problem 1 (10+5+5): Shown below is a histogram for eight year crown masses for 17 Douglas Fir trees. Some summary statistics are also given.



Min	Q1	Median	Q3	Max
17.00	49.00	88.00	112.00	230.00

a) Describe the distribution of the 17 Douglas Fir trees.

The distribution of the Douglas fir tree crown mass is unimodal and right-skewed. There are a couple of larger observations (200-250) range, which indicates there could be one or more outliers.

b) Fill in the blank: Using the five number summary, a tree with a crown mass greater than 206.5 would be considered a potential outlier. **Show your work in the space below.**

$$\begin{aligned} \text{IQR} &= 112 - 49 = 63; & 1.5\text{IQR} &= 1.5(63) = 94.5 \\ \text{Upper limit} &= \text{Q3} + 94.5 = 112 + 94.5 = 206.5 \end{aligned}$$

c) Based on the information in the histogram and the five number summary, one would expect that the mean is *greater than, equal to, or less than* the median. **Choose one and explain.**

Since the distribution of crown masses is right-skewed, one would expect the mean to be greater than the median. The couple of larger crown mass values will have a tendency to pull the mean out to a larger value.

Problem 2 (5+5+10): Summarized in the table below are data from 200 college undergraduates with respect to how they get to class.

	Method of Getting to Class			
Gender	Drive	Bike	Walk	Total
Female	95	10	10	115
Male	65	5	15	85
TOTAL	160	15	25	200

- a) If you choose a college undergraduate at random, what is the probability that the person you choose is a male?
 $P(M) = 85/200 = 0.425$
- b) What is the conditional probability that you choose a male, given that the person chosen walked to class?
 $P(M|W) = 15/25 = 0.6$
- c) Are the events “choose a male” and “choose someone who bikes to class” independent? **Show appropriate calculations to support your answer.**

$$P(M \cap B) \stackrel{?}{=} P(M)P(B)$$

$$P(M \cap B) = 5/200 = 0.025$$

$$P(M) = 0.425$$

$$P(B) = 15/200 = 0.075$$

$$\text{Since } 0.425(0.075) = 0.032 \neq 0.025 \text{ events are dependent}$$

Or, $P(M|B) = 5/15 = 0.333$, which does not equal $P(M) = 0.425$; therefore events are dependent

Problem 3 (10+10+5 points): Ten multiple choice questions are given on an exam, each having responses a, b, c, or d. Suppose a student guesses the answer to each question, and the guesses from question to question are independent. Let X be the number of answers the student gets correct.

- a) What is the distribution of X ? Be sure to specify parameters if necessary.
 $X \sim \text{Binomial}(10, 0.25)$
- b) Calculate the exact probability that the student correctly guesses the answers to nine or more questions.

$$\begin{aligned}
 P(X \geq 9) &= P(X = 9) + P(X = 10) = \\
 &= \binom{10}{9} 0.25^9 (0.75)^1 + \binom{10}{10} 0.25^{10} (0.75)^0 = \\
 &= 10(3.815 \times 10^{-6})(.75) + (1)(9.537 \times 10^{-7})(1) = \\
 &= 2.861 \times 10^{-5} + 9.537 \times 10^{-7} = 2.956 \times 10^{-5} = 0.00002956
 \end{aligned}$$

- c) Calculate the mean and standard deviation of X .

$$\mu = np = 10(0.25) = 2.5; \quad \sigma = \sqrt{npq} = \sqrt{2.5(.75)} = 1.37$$

Problem 4 (5+5+5+10 points): A computer manufacturer claims that the time it takes for a computer to boot up, X , follows a normal distribution with mean = 45 seconds and standard deviation = 15 seconds.

- a) For a randomly selected computer from this manufacturer, find the probability that it takes more than 60 seconds for the computer to boot.

$$P(X > 60) = P\left(Z > \frac{60 - 45}{15}\right) = P(Z > 1) = 1 - P(Z < 1) = 1 - 0.8413 = 0.1587$$

- b) What is the probability that a randomly selected computer takes between 30 and 80 seconds to boot?

$$P(30 < X < 80) = P\left(\frac{30 - 45}{15} < Z < \frac{80 - 45}{15}\right) =$$

$$P(-1 < Z < 2.33) = P(Z < 2.33) - P(Z < -1) = 0.9901 - 0.1587 = 0.8314$$

- c) What is the probability that a randomly selected computer takes exactly 45 seconds to boot?

$$P(X = 45) = 0$$

- d) By what time should 35% of the computers have booted up? (What is the 35th percentile for X ?)

$$P\left(Z < \frac{x_0 - 45}{15}\right) = 0.35; \quad z = -0.385 \quad (-0.38 \text{ or } -0.39 \text{ okay})$$

$$-0.385 = \frac{x_0 - 45}{15} \Rightarrow x_0 = (-0.385)(15) + 45 \Rightarrow x_0 = 39.225 \text{ seconds}$$

Problem 5 (5+5 points): The IRS is randomly selecting 500 taxpayers for audits. For each part below, select the sampling method that best matches the scenario. Your choices are simple random sample, stratified random sample, cluster sample, and systematic sample.

- a) The IRS divides the taxpayers into five income levels and then takes a random sample of 100 taxpayers from each of the five income levels.

Stratified random sample

- b) The IRS randomly selects 500 taxpayers from among all taxpayers.

Simple random sample