Statistics 31, Section 3, Midterm II
Tuesday, November 14, 2000

Name: _____

Pledge: I have neither given nor received aid on this examination.

Signature: _____

Instructions: Do not do any actual numerical calculations. Answers in a form that you would type into an Excel field, such as "=28*SQRT(82)^2", with a *working* answer, are expected).

1. A company makes 50% of its cars at Factory A, 30% at Factory B and the rest at Factory C. Factory A produces 10% lemons, Factory B produces 15% lemons and Factory C produces 5% lemons. A car is chosen at random. What is the probability that:

   a. It is a lemon?

   b. It came from Factory B if it is a lemon?

2. The weights of a random sample of 25 runners averaged 60 kg. Suppose that the standard deviation of the population is known to be 10 kg.

   a. What is $\sigma_{\bar{X}}$, the standard deviation of the sample average $\bar{X}$?

   b. Find the 99% margin of error for estimating the population mean μ using $\bar{X}$.

   c. Give a 90% confidence interval for μ .

   d. Exactly how would the confidence interval in (c) change if the sample average were based on a random sample of 100 runners?

   e. How large a sample would be required to estimate μ within $\pm 0.1\,\text{kg}$ with 95% confidence?

3. A household is called prosperous if its income exceeds $75,000, and called educated if the householder completed college. 20% of all households are prosperous, 30% are educated, and 19% are prosperous and educated. If a household is chosen at random:

a. What is the probability that it either is educated, or else is prosperous?

b. What is the probability that it is educated given that it is prosperous?

c. Is the event that it is educated independent of the event that it is prosperous? Why or why not?

3. A box label claims that on average boxes contain 40oz. A random sample of 12 boxes shows an average of 39oz., with s = 2.2. To see if we should dispute the claim, consider the hypotheses:

$H_+: \quad \mu > 40 \qquad H_0: \quad \mu = 40 \qquad H_-: \quad \mu < 40$

a. Find the p-value to assess the strength of the evidence in favor of H_+.

b. If the p-value to test H_+: were equal to 0.0613, interpret the results from both the "yes-no" and the "gray level" viewpoints.

4. According to government data, 15% of employed men have never been married.

   a. If 12 employed men are selected at random, what is the probability that at least 10 have never been married?

   b. If 12 employed men are selected at random, what is the probability that less than 4 have been married?

   c. 12 employed men are selected at random, what is the mean number that have never been married?

   d. Let X denote number the number who have never been married, in a random sample of 12 employed men. What is the standard deviation of X ?

   e. If 1200 employed men are selected at random, what is the probability that at least 100 have never been married?