Midterm I

Econ 253 Spring 2001

You have 60 minutes to answer the following 6 questions. Each question is worth 20 points, so you should plan to spend an equal amount of time on each one. You may use a calculator and a single-sided sheet of paper with notes and formulas. Any collaboration is considered a violation of the honor code, as is discussing the exam with students in other sections who have not yet taken the exam. Good luck!

1. The following table describes the joint probability distribution of stock price/earnings ratios (PE) and their annual returns (R).

		R		
		0%	1%	5%
	1	0	0.1	0.1
PE	10	0.1	0	0.2
	100	0.1	0.4	0

   Answer the following questions:

   (a) What is the expected value of stock returns?

   (b) What is the expected value of stock returns given that the PE ratio is equal to 100?

2. You need 18 computer memory chips to install in the motherboard of a PC. You order 20 memory chips because you know that 10% of all chips are defective.

   (a) What is the probability that all chips you ordered will work?

   (b) What is the probability that exactly 18 chips will work?

   (c) What is the probability that you will be able to make your computer work?

3. A random sample of 500 owners of single-family homes is drawn from the population of a city. Let the random variable X denote annual household income in thousands of dollars, and the random variable Y denote the value of a house, also in thousands of dollars. The following information is available:

$$n = 500 \qquad \sum_{i=1}^{n} x_i = 24,838 \qquad \sum_{i=1}^{n} = 107,226$$
$$\sum (x_i - \overline{x})^2 = 66,398 \qquad \sum (y_i - \overline{y})^2 = 1,398,308$$
$$\sum (x_i - \overline{x})(y_i - \overline{y}) = 194,293$$

Answer the following questions:

(a) Compute the sample mean and standard deviation of the value of the houses in this sample. Do the same for household income.

(b) Compute the correlation between income and house value.

(c) Construct a 95% confidence interval for the mean value of the houses. What assumptions do you have to make to do this?

4. Daily sales in a convenience store are normally independently distributed with an unknown mean μ and a variance σ^2. In January the store was open 28 days and average daily sales were $\overline{x}_J = \frac{1}{28}\sum_{i=1}^{28} x_i$. In February the store was open only 20 days and average daily sales were $\overline{x}_F = \frac{1}{20}\sum_{i=29}^{48} x_i$. Consider two estimators of the population mean μ:

$$\begin{aligned} \overline{x} &= \frac{1}{48}\sum_{i=1}^{48} x_i \\ \widetilde{x} &= \frac{1}{2}(\overline{x}_J + \overline{x}_F) \end{aligned}$$

Thus, $\overline{x}$ is the sample mean over all observations, while $\widetilde{x}$ is the average of the two averages. Answer the following questions:

(a) Are both estimators unbiased?

(b) Which estimator is more efficient?

5. A credit card company surveyed 225 of its customers and found that their average income is \$35,000 with a sample standard deviation of \$5,102.

   (a) Construct a 95% confidence interval for population mean of income.

   (b) How many customers should the company survey so that the 95% interval is within $\pm$\$100 of the population mean?

6. Suppose that X denotes annual incomes, in thousands of dollars, and that X is normally distributed with mean 26 and variance 36. A random sample of 25 persons is drawn from the group. What is the probability that the average income is between $\$25,000$ and $\$29,000$?