Economics 250 Mid-Term Test 2
25 March 2010

Instructions: You may use a hand calculator. Do not hand in the question sheet. Answer all four questions in the answer booklet provided. Show your work. Formulas and tables are provided at the end of the question pages.

1. Suppose GDP growth in percent per year, labelled $\dot{Y}$, is a discrete random variable that can take on the value 0 or 3 in the years 2010 and 2011, with these joint probabilities:

$\dot{Y}_{2010}$	0	0	3	3
$\dot{Y}_{2011}$	0	3	0	3
Probability	0.4	0.1	0.1	0.4

(a) Use the marginal distribution for $\dot{Y}_{2011}$ to find $\mathrm{E}(\dot{Y}_{2011})$.

(b) Use the conditional distribution of $\dot{Y}_{2011}$ given $\dot{Y}_{2010} = 3$ to find $\mathrm{E}(\dot{Y}_{2011}|\dot{Y}_{2010})$.

2. Risk managers at a financial firm are assessing a portfolio that is a 50:50 mixture of two assets. The return on the first asset is $r_1 \sim N(2, 1)$ and the return on the second asset is $r_2 \sim N(6, 4)$. The correlation between the two returns is 0.8. The portfolio return is:

$$r_p = 0.5r_1 + 0.5r_2.$$

(a) What is the probability that the portfolio has a negative return?

(b) Would holding just one of the assets (*i.e.* changing the weights from 0.5 and 0.5 to either 1 and 0 or 0 and 1) reduce the chances of a negative return?

3. Suppose that we label the incomes (in thousands of dollars) of people by X. A researcher studies a sample of 30 incomes and finds an average of $\overline{X} = 30$ and a sample standard deviation of $s = 4$.

(a) Find a 95% confidence interval for the average income of the population.

(b) How could the researcher make the estimator more efficient (*i.e.* reduce the margin of error)?

4. Engineers test a sample of 100 automobile headrests in a crash test.

(a) If the population failure rate were actually $P = 0.15$ what would be the probability of finding a sample proportion that fails that is 20 percent or greater?

(b) Suppose that engineers find that 20 headrests fail. Given that they observe a sample failure rate of 0.20, and do not know the true parameter P, find a 90% confidence interval for the population proportion that fails.