Professor Joyce Jacobsen

Economics 300
Summer 2010

Assignment #3

Due Friday 6/11/10 by 6 p.m. in the Econ 300/QAC201 slot in the Economics Alcove

Please show the calculations used to arrive at your answers. Round final answers to the second decimal place if necessary.

A. Two fair dice are cast. What is **(i)** the probability and **(ii)** the odds that:

1) At least one is a 3?

2) The total is 10?

3) The two dice are the same?

B. The table below classifies the U.S. labor force in 2009 by age and employment status (*Employment and Earnings Online*, 1/10, p. 192):

	Y (workers 25-54)	O (workers 55-64)	Totals
E (employed)	95.1	21.0	116.1
U (unemployed)	8.6	1.5	10.1
Totals	103.7	22.5	126.2 million

1) What is Pr(U), i.e., the unemployment rate?

2) What is Pr(U|Y), i.e., the younger workers' unemployment rate? What is Pr(U|O), i.e., the older workers' unemployment rate?

3) Is unemployment independent of age?

C. To reduce illegal drug use among employees, a company proposes to screen applicants using a blood test that has been shown to be correct 96% of the time (for both drug users and nonusers). The company would immediately drop those persons failing the test from the applicant pool, while all other applicants would proceed to an interview. Suppose that 5% of applicants actually use illegal drugs.

1) Of the applicants dropped from the pool, what percent are actually innocent of illegal drug use?

2) Of the remaining applicants, what percent are illegal drug users?

3) Suppose that the company switches to using a different blood test that has a false positive rate (i.e., it incorrectly identifies a nonuser as a drug user) of 10% and a false negative rate (i.e., it incorrectly identifies a drug user as a nonuser) of 2%. Answer the questions in parts **1** and **2** for this test. Why might a company prefer using this test to the original test?

D. Suppose that 3 defective light bulbs have been mixed up with 12 good ones.

1) If 4 bulbs are chosen at random without replacement, what is the probability that all 4 are good?

2) If the first 4 are good, what is the probability that the next 2 chosen (without replacing the first 4) are good?

3) If we started all over again and chose 4 bulbs with replacement, what is the probability that at least 3 would be good?

E. A salesperson makes 2 calls per year on a store, with the probability of a sale each time being 60%. Let X denote the total sales in a year (0, 1, or 2).

1) Tabulate the probability distribution p(x).

2) What is the probability of at least one sale?

3) Now assume that while the chance of a sale on the first call is still 60%, the chance of a sale on the second call depends on what happened on the first call, being 70% if the first call was a sale, or 20% if the first call was no sale. Tabulate the probability distribution p(x). What is the probability of at least one sale?

F. On the basis of past experience, the buyer for a bicycle store estimates that X, the number of bicycles demanded next year at the market price, will be somewhere between 50 and 200, with the following distribution:

x	p(x)
50	.10
140	.35
150	.40
200	.15

1) What is the mean number sold? What is the standard deviation?

2) If 150 are ordered, what is the probability they will all be sold? What is the probability that some will be left over?

G. You throw five fair dice (maybe you are playing Yahtzee). X = the # of dice showing an even number.

1) Graph the probability distribution of X.

2) Calculate the mean and standard deviation of X and show them on the graph.

3) What are the odds that 3 or more dice are showing an even number?

H. A multiple choice exam consists of 10 questions, each having 5 possible answers. To pass, you must answer at least 6 out of the 10 questions correctly. What is your chance of this if:

1) You go into the exam without knowing anything and have to resort to pure guessing?

2) You have studied enough so that on each question, 3 choices can be eliminated. Then you have to make a pure guess between the remaining 2 choices.

3) You have studied enough so that you know the correct answer on 3 questions. For the remaining 7 questions, you have to resort to pure guessing.

I. If X is normally distributed around a mean of 10 with a standard deviation of 4, find:

1) $Pr(X > 16)$ 3) $Pr(6 < X < 14)$

2) $Pr(X < 9)$ 4) $Pr(15 > X > 7)$

J. The time required to complete an Econ 300 final exam is found to be normally distributed, with a mean of 125 minutes and a standard deviation of 10 minutes.

1) What proportion of the students will finish in 120 minutes?

2) How long should the time be to allow just enough time for 97% of the students to finish the test?