ECO251 QBA1
SECOND HOUR EXAM
March 21, 2003

Name: ____KEY_______________
Social Security Number: ____________________

Part I: (48 points) Do all the following: All questions are 2 points each except as marked. Exam is normed on 50 points including take-home. (There are 57 possible points.)

1. If two events are mutually exclusive, what is the probability that both occur at the same time?
   a) *0.
   b) 0.50.
   c) 1.00.
   d) Cannot be determined from the information given.

2. If two events are collectively exhaustive, what is the probability that one or the other occurs?
   a) 0.
   b) 0.50.
   c) *1.00.
   d) Cannot be determined from the information given.

3. If two events are independent, what is the probability that they both occur?
   a) 0.
   b) 0.50.
   c) 1.00. **Explanation:** $P(A \cap B) = P(A) \cdot P(B)$, but we don't know either.
   d) *Cannot be determined from the information given.

4. A business venture can result in the following outcomes (with their corresponding chance of occurring in parentheses): Highly Successful (10%), Successful (25%), Break Even (25%), Disappointing (20%), and Highly Disappointing (?). If these are the only outcomes possible for the business venture, what is the chance that the business venture will be considered Highly Disappointing?
   a) 10%
   b) 15%
   c) *20%
   d) 25%

Show your work in problems 7-9.

TABLE 5-4

The following table contains the probability distribution for X = the number of traffic accidents reported in a day in Corvallis, Oregon.

X	0	1	2	3	4	5
$P(X)$	0.10	0.20	0.45	0.15	0.05	0.05

5. Referring to Table 5-4, the probability of at least 1 accident is ___.90_____. **Explanation:** $P(x \geq 1) = 1 - P(1)$

6. Referring to Table 5-4, the mean or expected value of the number of accidents is __2.00__.

7. Referring to Table 5-4, the standard deviation of the number of accidents is _1.1832_. (4)

$\mu = E(x) = \sum xP(x) = 2.00$, $E(x^2) = \sum x^2 P(x) = 5.40$, $\sigma^2 = E(x^2) - \mu^2 = 5.40 - 2^2 = 1.40$, $\sigma = \sqrt{1.40} = 1.1832$

x	$P(x)$	$xP(x)$	$x^2P(x)$
0	.10	0.00	0.00
1	.20	0.20	0.20
2	.45	0.90	1.80
3	.15	0.45	1.35
4	.05	0.20	0.80
5	.05	0.25	1.25
Sum	1.00	2.00	5.40

8. We sell a product with a markup of \$7 per unit and have fixed costs of \$500 monthly. Thus, if we sell 100 units, our profits will be \$7(100) – 500 =\$200. If our expected sales are 250 units and the standard deviation is 20, what is the mean and standard deviation of our profits? (4)

Solution: Use the solution of problem J2. The formula says that if $y = ax + b$, $\mu_y = a\mu_x + b$ and $\sigma_y^2 = a^2\sigma_x^2$, so, if $y = 7x - 500$, $a = 7$ and $b = -500$. Then $\mu_y = 7\mu_x - 500 = 7(250) - 500 = 1250$, and $\sigma_y^2 = a^2\sigma_x^2 = (7)^2 20^2 = 19600$. Thus $\sigma_y = \sqrt{19600} = \sqrt{7^2(20)^2} = 7(20) = 140$.

TABLE 4-2
An alcohol awareness task force at a Big-Ten university sampled 200 students after the midterm to ask them whether they went bar hopping the weekend before the midterm or spent the weekend studying, and whether they did well or poorly on the midterm. The following result was obtained.

	Did Well on Midterm	Did Poorly on Midterm
Studying for Exam	80	20
Went Bar Hopping	30	70

If we finish the table we get:

	Did Well on Midterm	Did Poorly on Midterm	Total
Studying for Exam	80	20	100
Went Bar Hopping	30	70	100
Total	110	90	200

9. Referring to Table 4-2, what is the probability that a randomly selected student who went bar hopping will do well on the midterm?
   a. *30/100 **Explanation:** This is a conditional probability. Out of the 100 who went bar hopping, only 30 did well on the exam.
   b. 30/110
   c. 30/200
   d. (100/200)*(110/200)

10. Referring to Table 4-2, the events "Did Well on Midterm" and "Studying for Exam" are
    a) *statistically dependent. **Explanation:** To be independent the probability that someone did well on the midterm, which is 110 out of 200, has to be the same as the conditional probability that someone did well on the midterm, given that he/she studied for the exam, which is 80 out of 100. These fractions are not equal.
    b) mutually exclusive.
    c) collective exhaustive.
    d) None of the above.

11. Suppose A and B are events where $P(A) = 0.4$, $P(B) = 0.5$, and $P(A \cap B) = 0.1$. Then $P(B|A) =$ <u>.25</u>. **Explanation:** Note that $P(A \cap B) = P(B \cap A) = .1$ and, by the multiplication rule, $P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{.1}{.4} = .25$. Note that you can't use Bayes' Rule here because you don't know $P(A|B)$.

12. Suppose A and B are events where $P(A) = 0.4$, $P(B) = 0.5$, and $P(A \cap B) = 0.1$. Then $P(A \cup B)$ = <u>.8</u>. **Explanation:** Note that by the addition rule, $P(A \cup B) = P(A) + P(B) - P(A \cup B) = .4 + .5 - .1 = .8$.

13. Evaluate C_4^{52} <u>270725</u>.

    Explanation: $C_r^n = \frac{n!}{(n-r)!\,r!}$. So $C_4^{52} = \frac{52!}{(48)!\,4!} = \frac{52 \cdot 51 \cdot 50 \cdot 49}{4 \cdot 3 \cdot 2 \cdot 1} = 270725$