251y0224 10/30/02

ECO 251 QUANTITATIVE BUSINESS ANALYSIS I
SECOND EXAM
OCTOBER 29, 2002

NAME: _____KEY_____________

SECTION ENROLLED: MWF TR 10 11 12:30

(Circle both days and time separately or just write down days and time)

Part I. Multiple Choice (40 Points) Remember that 'At least one' means 'one or two or three or four or……'. It does not mean 'exactly one.'

1. If A and B are complementary events:

 a. $P(A \cap B) = 0$
 b. $P(A \cup B) = 1$
 c. $P(A) = 1 - P(B)$
 d.* All of the above.
 e. None of the above.

2. The following table shows the probabilities of the Whizbang Corporation's stock movement:

Economic Conditions	Stock Price Rises	Stock Price Falls	Total
Good	.30	.04	__
Fair	.20	__	__
Poor	__	.20	__
Total	__	.44	

Complete the table and then find the probability that the stock price goes up given that economic conditions are poor.

a. .0600
b.* .2308
c. .7600
d. .1456
e. .1075

Solution: Here is the completed table.

Economic Conditions	Stock Price Rises	Stock Price Falls	Total
Good	.30	.04	.34
Fair	.20	.20	.40
Poor	.06	.20	.26
Total	.56	.44	1.00

Using the notation in the next problem, $P(U|Po) = \frac{P(U \cap Po)}{P(Po)} = \frac{.06}{.26} = .2308$

3. Let us name the events in the previous problem as follows: G Economic Conditions Good; F Economic Conditions Fair; Po Economic Conditions Poor; U Stock price goes up and D Stock price goes down. Then the probability that conditions are poor if the stock price is going down is
   a. $P(D \cap Po)$
   b. $P(D|Po)$
   c.* $P(Po|D)$
   d. $P(D \cup Po)$
   e. None of the above.

4. In the two problems above, the joint probability of a rising stock price and poor economic conditions is:
   a.* $P(U \cap Po) = .06$
   b. $P(U \cup Po) = .76$
   c. $P(U \cap Po) = .23$
   d. $P(U \cup Po) = .06$
   e. $P(U \cap Po) = .76$

5. If the probability that a child is a boy or a girl is equally likely and I have 4 children, what is the probability that at least one of the first three is a girl?
   a. .375
   b.* .875
   c. .625
   d. .667
   e. .750

Solution: Forget about the fourth child! The probability of at least one girl in 3 tries could be the sum of the probabilities of 1, 2 and 3 girls. To see how to do it this way look at the examples where we found the probabilities of 1, 2 or three heads. To do it right, find
$P(\overline{BBB}) = 1 - P(BBB) = 1 - .5 \times .5 \times .5 = 1 - .125 = .875$.

6. A factory has three veeblefetzers. Veeblefetzer A produces defective items 4 percent of the time is only used for 10% of the output. Veeblefetzer B produces 20% of the output, and 3% of its output is defective. Because only 2% of the output of veeblefetzer C is defective, 70% of the output is produced on veeblefetzer C. If a defective item is found, the probability that it comes from veeblefetzer C is closest to
   a. 70%
   b.* 60%
   c. 50%
   d. 40%
   e. 30%

Solution: Here is the completed table.

	A	B	C	Total
D	0.4	0.6	1.4	2.4
$\overline{D}$	9.6	19.4	68.6	97.6
Total	10	20	70	100

To get the 'total' row, take 100 and multiply it by the percents given for production by each machine. To get the D row, multiply the total by the percent defective. For example, 4% of 10 is 0.4. Get the total defective by adding the row. Then the fraction of defective items that come from C is 0.7 out of 1.4 or 50%. Formally, you were given the following: $P(A) = .10$, $P(B) = .20$, $P(C) = .70$,

$P(D|A) = .04$, $P(D|B) = .03$ and $P(D|C) = .02$. You were asked for $P(C|D)$. By Bayes' rule,

$P(C|D) = \frac{P(D|C)P(C)}{P(D)} = \frac{(.02)(.70)}{.024} = \frac{.014}{.024} = 0.5833$, where we found $P(D)$ using

$P(D) = P(D \cap A) + P(D \cap B) + P(D \cap C) = P(D|A)P(A) + P(D|B)P(B) + P(D|C)P(C)$

$= (.04)(.10) + (.03)(.20) + (.01)(.70) = .003 + .004 + .007 = .014$

7. In problem 6, the proportion of output that is defective is closest to
   a.* 2%
   b. 3%
   c. 3.5%
   d. 4%
   e. 1.5%

8. The event A has a probability of p ; the event B also has a probability of p . If the two events are independent

   a.* $P(A \cup B) = 2p - p^2$
   b. $P(A \cup B) = 2p$
   c. $P(A \cup B) = 2p + p^2$
   d. $P(A \cup B) = 0$
   e. $P(A \cup B) = p^2$

Solution: From the addition rule $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. $P(A) = p$, $P(B) = p$ and, since A and B are independent, $P(A \cap B) = P(A)P(B) = p^2$. So $P(A \cup B) = p + p - p^2 = 2p - p^2$.