## Probability Hw #3

1) Consider the following table of ages of U.S. senators:

| Age (yr): | <40 | 40–49 | 50–59 | 60–69 | 70–79 | >79 |
|---|---|---|---|---|---|---|
| Number of senators: | 5 | 30 | 36 | 22 | 5 | 2 |

What is the probability that a senator is under 70 years old given that he or she is at least 50 years old?

(A) .580
(B) .624
(C) .643
(D) .892
(E) .969

2) Which of the following statements about any two events A and B is true?

(A)  $P(A \cup B)$ implies events A and B are independent.
(B)  $P(A \cup B) = 1$ implies events A and B are mutually exclusive.
(C)  $P(A \cap B) = 0$ implies events A and B are independent.
(D)  $P(A \cap B) = 0$ implies events A and B are mutually exclusive.
(E)  $P(A \cap B) = P(A) - P(B)$ implies A and B are equally likely events.

3) Given that $P(A) = 0.6$, $P(B) = 0.3$, and $P(B|A) = 0.5$.

(a)  $P(A \text{ and } B) = ?$
(b)  $P(A \text{ or } B) = ?$
(c)  Are events A and B independent?

4) In the November 27, 1994, issue of *Parade* magazine, the "Ask Marilyn" section contained this question: "Suppose a person was having two surgeries performed at the same time. If the chances of success for surgery A are 85%, and the chances of success for surgery B are 90%, what are the chances that both would fail?" What do you think of Marilyn's solution: $(.15)(.10) = .015$ or 1.5%?

(A) Her solution is mathematically correct but not explained very well.
(B) Her solution is both mathematically correct and intuitively obvious.
(C) Her use of complementary events is incorrect.
(D) Her use of the general addition formula is incorrect.
(E) She assumed independence of events, which is most likely wrong.

5) In a 1974 "Dear Abby" letter a woman lamented that she had just given birth to her eighth child, and all were girls! Her doctor had assured her that the chance of the eighth child being a girl was only 1 in 100.

   *a.* What was the real probability that the eighth child would be a girl?
   *b.* Before the birth of the first child, what was the probability that the woman would give birth to eight girls in a row?

(A) .5, .0039
(B) .0039, .0039
(C) .5, .5
(D) .0039, .4
(E) .5, .01

6) Suppose that among the 6000 students at a high school, 1500 are taking honors courses and 1800 prefer watching basketball to watching football. If taking honors courses and preferring basketball are independent, how many students are both taking honors courses and prefer basketball to football?

(A) 300
(B) 330
(C) 450
(D) 825
(E) There is insufficient information to answer this question.

7) If $P(A) = .2$ and $P(B) = .1$, what is $P(A \cup B)$ if $A$ and $B$ are independent?

(A) .02
(B) .28
(C) .30
(D) .32
(E) There is insufficient information to answer this question.

8) A computer technician notes that 40% of computers fail because of the hard drive, 25% because of the monitor, 20% because of a disk drive, and 15% because of the microprocessor. If the problem is not in the monitor, what is the probability that it is in the hard drive?

(A) .150
(B) .400
(C) .417
(D) .533
(E) .650

9) Given the probabilities $P(A) = .4$ and $P(A \cup B) = .6$, what is the probability $P(B)$ if $A$ and $B$ are mutually exclusive? If $A$ and $B$ are independent?

(A) .2, .4
(B) .2, .33
(C) .33, .2
(D) .6, .33
(E) .6, .4

10) The following are the probability distributions for two random variables, $X$ and $Y$:

| $X$ | $P(X = x)$ |
|---|---|
| 3 | $\frac{1}{3}$ |
| 5 | $\frac{1}{2}$ |
| 7 | $\frac{1}{6}$ |

| $Y$ | $P(Y = y)$ |
|---|---|
| 1 | $\frac{1}{8}$ |
| 3 | $\frac{3}{8}$ |
| 4 | ? |
| 5 | $\frac{3}{16}$ |

If $X$ and $Y$ are independent, what is $P(X = 5 \text{ and } Y = 4)$?

(a) $\frac{5}{16}$

(b) $\frac{13}{16}$

(c) $\frac{5}{32}$

(d) $\frac{3}{32}$

(e) $\frac{3}{16}$

A sample of applicants for a management position yields the following numbers with regard to age and experience:

|  | Years of experience | | |
| --- | --- | --- | --- |
|  | 0–5 | 6–10 | >10 |
| Less than 50 years old | 80 | 125 | 20 |
| More than 50 years old | 10 | 75 | 50 |

a. What is the probability that an applicant is less than 50 years old? Has more than 10 years' experience? Is more than 50 years old and has five or fewer years' experience?

b. What is the probability that an applicant is less than 50 years old given that she has between 6 and 10 years' experience?

c. Are the two events "less than 50 years old" and "more than 10 years' experience" independent events? How about the two events "more than 50 years old" and "between 6 and 10 years' experience"? Explain.

Explain what is wrong with each of the following statements:

a. The probability that a student will score high on the AP Statistics exam is .43, while the probability that she will not score high is .47.

b. The probability that a student plays tennis is .18, while the probability that he plays basketball is six times as great.

c. The probability that a student enjoys her English class is .64, while the probability that she enjoys both her English and her social studies classes is .71.

d. The probability that a student will be accepted by his first choice for college is .38, while the probability that he will be accepted by his first or second choice is .32.

e. The probability that a student fails AP Statistics and will still be accepted by an Ivy League school is –.17.