

Name: \_\_\_\_\_ Key \_\_\_\_\_

**STAT 345 - Summer, 2006: Quiz 3**

BASED ON SECTIONS: 2.2 – 2.6

All parts are worth 1 point, except where noted. There is a back!!

1. Let  $A$  and  $B$  be two events such that  $P(A) = 0.9$ ,  $P(B) = 0.4$ , and  $P(A \cap B) = 0.36$ .

- (a) What is  $P(A \cup B)$ ?

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0.9 + 0.4 - 0.36 = 0.94$$

- (b) What is  $P(A|B)$ ?

$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.36}{0.4} = 0.9$$

- (c) Are  $A$  and  $B$  independent events? Explain why or why not?

Yes,  $A$  and  $B$  are independent as  $P(A|B) = P(A)$  (see part (b))

- (d) What is  $P(A \cap B')$ ? (2 points)

By independence of  $A$  and  $B$ ,  $A$  and  $B'$  are also independent.

$$P(A \cap B') = P(A)P(B') = (0.9)(1 - 0.4) = (0.9)(0.6) = 0.54$$

$$\text{Or, } P(A \cap B') = P(A) - P(A \cap B) = 0.9 - 0.36 = 0.54$$

$$\begin{aligned} \text{Or, } P(A \cap B') &= P(B'|A)P(A) = (1 - P(B|A))P(A) = \\ &= \left(1 - \frac{P(A \cap B)}{P(A)}\right)P(A) = \left(1 - \frac{0.36}{0.9}\right)(0.9) = (1 - 0.4)(0.9) = 0.54 \end{aligned}$$

2. A batch of 50 semiconductor chips contains 8 that are defective. Two chips are selected at random, without replacement, from the batch. Find the following probabilities:

(a) The first chip selected is defective.

$$\frac{8}{50}$$

(b) The second chip selected is defective given the first chip was defective.

$$\frac{7}{49}$$

(c) The second ship selected is defective given the first chip was not defective.

$$\frac{8}{49}$$

(d) The second chip selected is defective (you don't know if the first chip was defective or not.) (2 points)

Use the total probability formula:

$$\begin{aligned} &P(\text{second defective}) \\ &= P(\text{second defective}|\text{first defective})P(\text{first defective}) + \\ &P(\text{second defective}|\text{first not defective})P(\text{first not defective}) \\ &= \frac{7}{49} \frac{8}{50} + \frac{8}{49} \frac{42}{50} = \frac{8}{50} \end{aligned}$$

(e) (Extra Credit) Suppose three chips are selected at random without replacement. What is the probability that the first two chips are defective and the third chip is not defective? (2 points)

$$\frac{8}{50} \frac{7}{49} \frac{42}{48}$$