

Math 17C

Kouba

Examples Using Conditional Probability

EXAMPLE 1.) Bag 1 has 2 oranges and 1 apple. Bag 2 has 1 orange and 3 apples. You also have a “loaded” (unbalanced) coin which gives  $P(Tail) = 2/5$  and  $P(Head) = 3/5$ . Play the following game :

- i.) Flip the coin 1 time.
- ii.) If you get a Tail, select 1 fruit from Bag 1. If you get a Head, select 1 fruit from Bag 2.

- 1.) What is the probability of selecting an orange ?
- 2.) What is the probability of selecting an apple ?

Let  $C$  : select an orange,

$B_1$  : you get a Tail,

$B_2$  : you get a Head

EXAMPLE 2.) A blood test for the Hantavirus shows a positive (+) result in 97% of all cases when the virus is actually present in an individual and in 6% of all cases when the virus is NOT present in an individual (false positive). Assume that 13 out of every 200 people are carriers of the virus. If a person is selected at random and this test is administered, what is the probability that the test result is positive (+) ?

Let  $A$  : the test is positive (+),

$B_1$  : a person carries the virus,

$B_2$  : a person does not carry the virus

EXAMPLE 3.) (Genetics– Mendel’s First Law) Gregor Mendel (Austria 1856) studied pea plants and the color of their flowers determined by two genes in their chromosomes. Assume that the following genotypes are possible : CC, Cc (same as cC), and cc, where types CC and Cc produce red flowers and type cc produces white flowers. For example, if we cross genotypes Cc and Cc, we cannot be sure of the genotypes of the offspring, but we can deduce the following probabilities :

$P(CC) = 1/4$  (red flowers) ,  $P(Cc) = 2/4 = 1/2$  (red flowers) ,  $P(cc) = 1/4$  (white flowers)

Suppose that you have a batch of red- and white-flowering pea plants, where all three genotypes CC, Cc, and cc are represented. Assume that 40% of the plants are type CC, 35% of the plants are type Cc, and 25% of the plants are type cc. You will pick 1 plant at random from the batch and cross it with a pea plant of genotype Cc. What is the probability that the offspring will have red flowers ?

Let  $A$  : offspring has red flowers,  
 $B_1$  : batch plant is of genotype CC,  
 $B_2$  : batch plant is of genotype Cc,  
 $B_3$  : batch plant is of genotype cc

EXAMPLE 4.) A candy bowl holds 25 Snicker bars and 15 Hershey bars. Select two candy bars without replacement.

Let  $A$  : 1st pick is a Snicker bar,  
 $B$  : 2nd pick is a Hershey bar

Determine if events  $A$  and  $B$  are independent.