

# Stat 140: More Probability Examples

## Diabetes and hypertension

Diabetes and hypertension are two of the most common diseases in Western, industrialized nations. In the United States, approximately 9% of the population have diabetes, while about 30% of adults have high blood pressure. The two diseases frequently occur together: an estimated 6% of the population have both diabetes and hypertension.

1. Are having diabetes and having hypertension disjoint?
2. Draw a Venn diagram summarizing the variables and their associated probabilities.
3. Let  $A$  represent the event of having diabetes, and  $B$  the event of having hypertension. Calculate  $P(A \text{ or } B)$ .
4. What percent of Americans have neither hypertension nor diabetes?

## Drug Testing

Mandatory drug testing in the workplace is common practice for certain professions, such as air traffic controllers and transportation workers. A false positive in a drug screening test occurs when the test incorrectly indicates that a screened person is an illegal drug user. Suppose a mandatory drug test has a false positive rate of 1.2% (i.e., has probability 0.012 of indicating that an employee is using illegal drugs when that is not the case).

**1. A company gives all 150 of its employees drug tests, and in reality all 150 employees are not drug users. Assume that the drug tests are independent: the outcome of one drug test has no effect on the others. Define the events:**

$$\begin{aligned}A_1 &= \text{the 1st employee tests positive} \\A_2 &= \text{the 2nd employee tests positive} \\&\vdots \\A_{150} &= \text{the 150th employee tests positive}\end{aligned}$$

**a. Find the probability that a particular employee tests negative**

**b. Find the probability that all 150 employees test negative**

**c. Find the probability that at least one employee (falsely) tests positive**

**2.**

Because of the high likelihood of at least one false positive in company wide drug screening programs, an individual with a positive test is almost always re-tested with a different screening test: one that is more expensive than the first, but has a lower false positive probability. Suppose the second test has a false positive rate of 0.8%.

What is the probability that an employee who is not using illegal drugs will test positive on both tests? Assume the two tests are independent of each other.