**Assignment 18.2**

In one state, 52% of the voters are Republicans, and 48% are Democrats. In a second

state, 47% of the voters are Republicans, and 53% are Democrats. Suppose a simple

random sample of 100 voters are surveyed from each state. What is the probability that the survey will show a greater percentage of Republican voters in the second state than in the first state?

P1 = the proportion of Republican voters in the first state

P2 = the proportion of Republican voters in the second state

p1 = the proportion of Republican voters in the sample from the first state and

p2 = the proportion of Republican voters in the sample from the second state.

The number of voters sampled from the first state (n1) = 100

The number of voters sampled from the second state (n2) = 100.

The solution involves four steps.

* Make sure the sample size is big enough to model differences with a normal population.

n1P1 = 100 \* 0.52 = 52

n1(1 - P1) = 100 \* 0.48 = 48

n2P2 = 100 \* 0.47 = 47 and

n2(1 - P2) = 100 \* 0.53 = 53 are each greater than 10

The sample size is large enough.

Mean of the difference in sample proportions:

E(p1 - p2) = P1 - P2 = 0.52 - 0.47 = 0.05.

Standard deviation of the difference.

σd = sqrt{ [ P1(1 - P1) / n1 ] + [ P2(1 - P2) / n2 ] }   
 σd = sqrt{ [ (0.52)(0.48) / 100 ] + [ (0.47)(0.53) / 100 ] }   
 σd = sqrt (0.002496 + 0.002491) = sqrt(0.004987) = 0.0706

* Probability. This problem requires us to find the probability that p1 is less than p2. This is equivalent to finding the probability that p1 - p2 is less than zero. To find this probability, we need to transform the random variable (p1 - p2) into a z-score. That transformation appears below.

z p1 - p2 = (x - μ p1 - p2 ) / σd = = (0 - 0.05)/0.0706 = -0.7082

Probability of a z-score being -0.7082 or less is 0.24.