**Problem Statement 1:**

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?

Solution:

For this problem:

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

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

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

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

n1P1=100\*0.52= 52

n1(1-P1) = 100\*(1-0.52) =48

n2P2 =100\*0.47 =47

n2(1-P2) =100\*(1-0.47)= 53

Find the mean of the difference in sample proportions: E(p1 - p2) = P1 - P2 = 0.52 - 0.47 = 0.05.

Find the 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

Find the probability.

We need to find the probability that p1 is less than p2. In other words it 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](http://stattrek.com/Help/Glossary.aspx?Target=z-score).

zp1-p2 = (x - μp1 - p2 ) / σd = = (0 - 0.05)/0.0706 = -0.7082

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

Therefore, the probability that the survey will show a greater percentage of Republican voters in the second state than in the first state is 0.24.