**Learning Goal:** Describe the sampling distribution for sample proportions and use it to identify unusual (and more common) sample results.

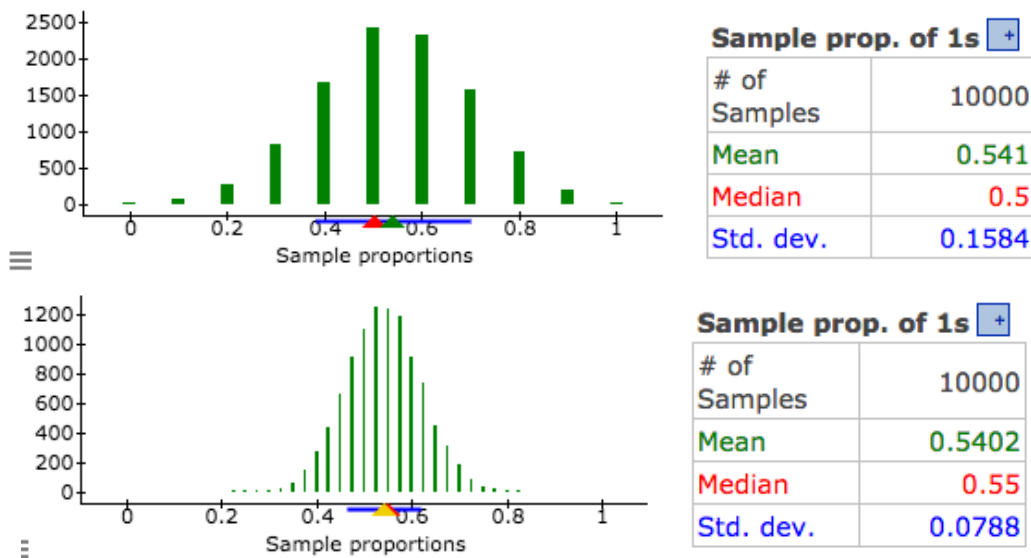**Learning Objective:** Describe the effect of sample size on the distribution of sample proportions.

Introduction:

Your class will discuss these diagrams to review what we have learned from recent activities. Take notes ... contribute to the discussion!
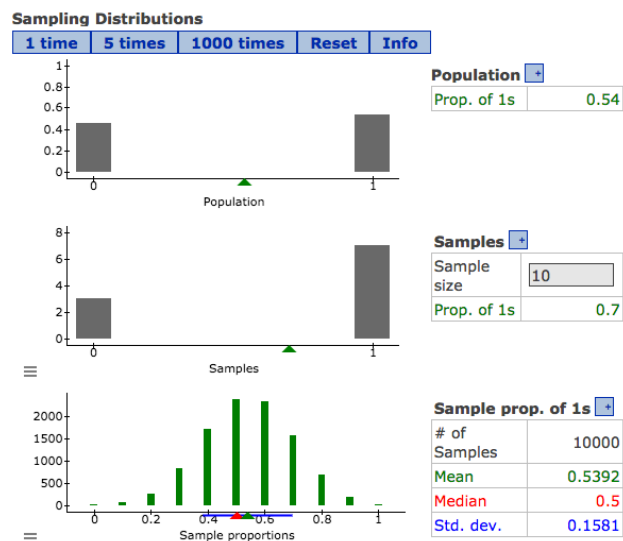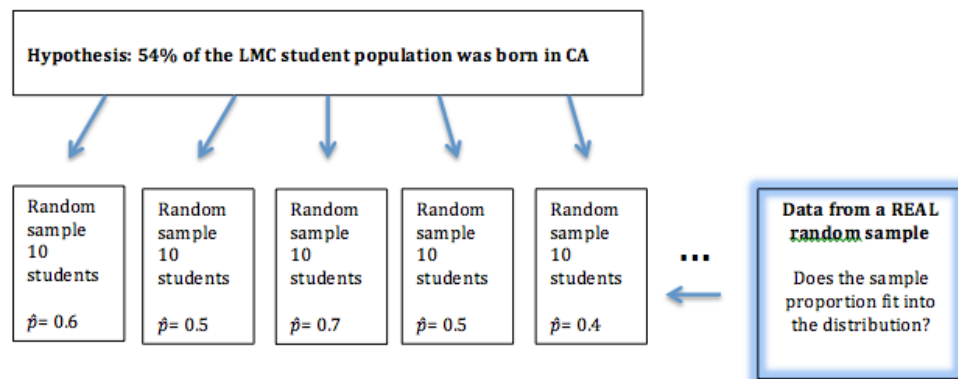
1) In the simulations we have conducted so far, we have always used a sample size of 10 students. Do you think larger samples will be better? Why or why not?

2) Let's repeat the simulation with a larger sample size. Your instructor will run a simulation selecting random samples of 40 students from a hypothetical student population in which 54% are born in California. The resulting distribution of sample proportions will be similar to the second picture below. In your group, use the images below to compare and contrast the distribution of sample proportions for n=10 (on the top) to the distribution of sample proportions for n=40 (on the bottom.)

Sample prop. of 1s ⊞	
# of Samples	10000
Mean	0.541
Median	0.5
Std. dev.	0.1584

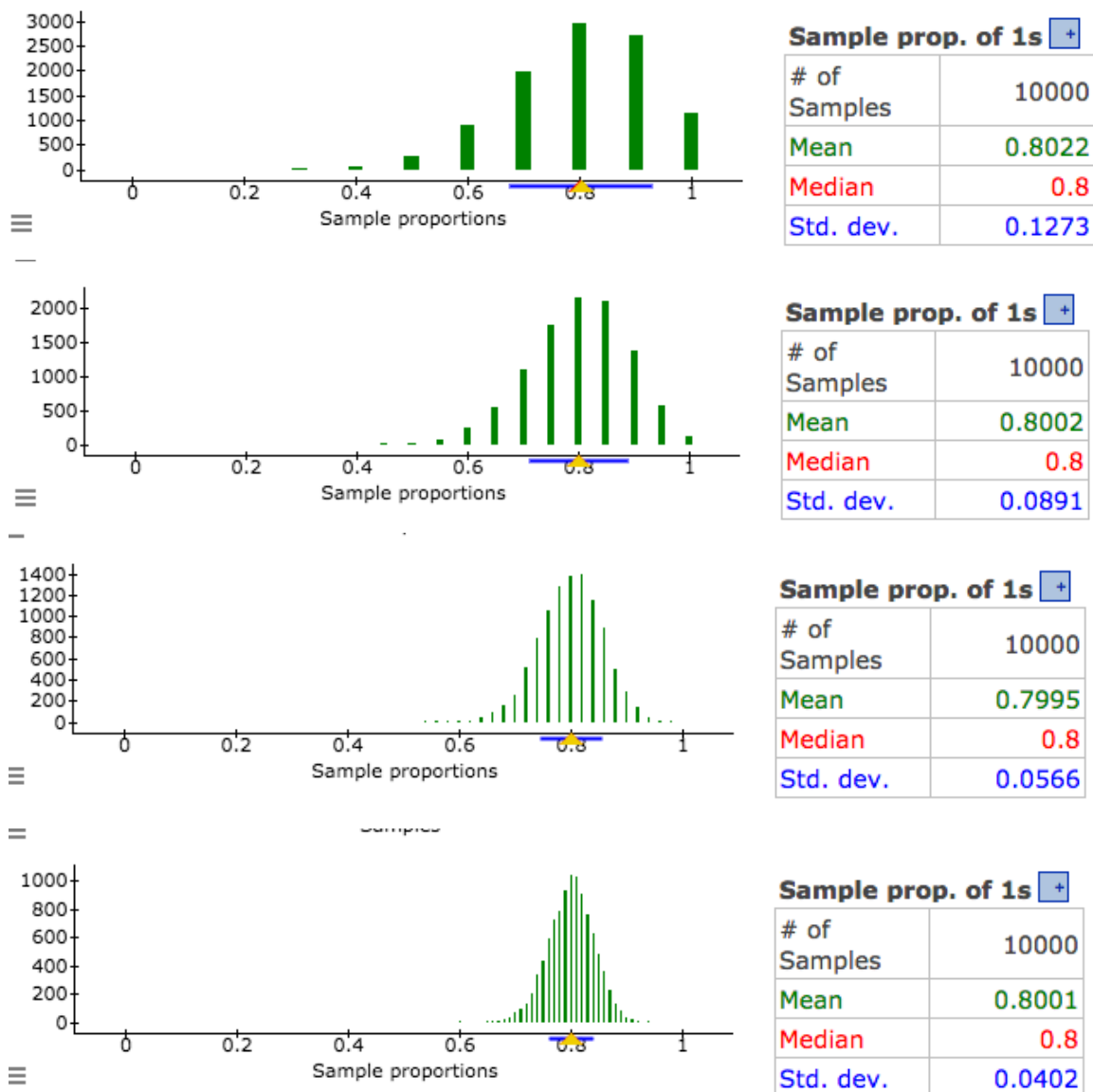| Sample prop. of 1s ⊞	
# of Samples	10000
Mean	0.5402
Median	0.55
Std. dev.	0.0788

a) Compare the means for the two distributions. What do you notice? Why does this make sense?

b) Compare the standard deviations of the two distributions. What do you notice? Why does this make sense?

3) Now we are changing the context of our simulations.

Suppose that we think that 80% of LMC students will vote in the next election. So our hypothesis is p=0.80.

We created four distributions of sample proportions by selecting random samples from a population with p=0.80. One distribution came from samples of 10 students. We used samples of 20 students, samples of 50 students, and samples of 100 students to create the other three distributions. These are pictured below.

Sample prop. of 1s +	
# of Samples	10000
Mean	0.8022
Median	0.8
Std. dev.	0.1273

Sample prop. of 1s +	
# of Samples	10000
Mean	0.8002
Median	0.8
Std. dev.	0.0891

Sample prop. of 1s +	
# of Samples	10000
Mean	0.7995
Median	0.8
Std. dev.	0.0566

Sample prop. of 1s +	
# of Samples	10000
Mean	0.8001
Median	0.8
Std. dev.	0.0402

a) Start by labeling each distribution with the size of the samples represented (n=10, n=20, n=50, n=100). Briefly explain how you made your decision.

b) Compare the means of the distributions. What do you notice? Why does this make sense?

c) Compare the standard deviations of the four distributions. What do you notice? Why does this make sense?

d) Our intuition tells us that larger samples have less error on average. How do the sampling distributions support this statement?

e) Which sample sizes keep the average error within 10% of our hypothesized 0.80? Which sample sizes keep the average error within 5%? Explain how you know.

f) Compare the shapes of the four distributions. What do you notice about the shape as n increases? Which sample sizes have distributions that look normal in shape?

4) Let's think about the effect of sample size on our conclusions.

Suppose that we poll a random sample of 10 real students and 70% (7 out of 10) say that they plan to vote in the next election. Do you think that this sample came from a population with 80% planning to vote? Why or why not?

Suppose that we poll a random sample of 100 real students and 70% (70 out of 100) say that they plan to vote in the next election. Do you think that this sample came from a population with 80% planning to vote? Why or why not?