

You may work with one partner on this assignment, submitting one report with both names, provided that both students contribute substantially to the work. Word-processed reports are preferred to hand-written ones.

### ***Which Tire?***

We will collect data in class based on a well-known campus legend. (We found that 18 of 32 students in class chose the right front tire.) You will conduct a test of whether the data provide evidence that Cal Poly students tend to choose the right front tire more often than would be expected if the four tire choices were equally likely.

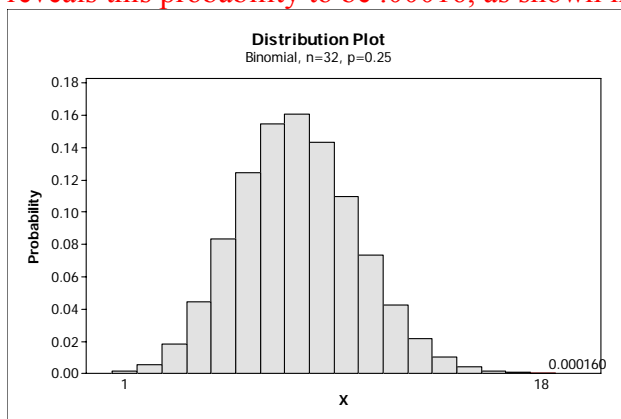
(a) State the appropriate null and alternative hypothesis, in symbols and in words.

The null hypothesis is that students choose the right front tire with probability  $1/4$  ( $H_0: \pi = .25$ ).

The alternative hypothesis is that students choose the right front tire with probability greater than  $1/4$  ( $H_a: \pi > .25$ ).

(b) Use the binomial distribution (and Minitab's Probability Distribution Plot, under the Graph menu) to determine the (exact) p-value for this test. Also submit the relevant graph of this probability distribution, with the appropriate probability shaded.

The p-value is  $\Pr(X \geq 18)$ , where  $X$  has a binomial distribution with  $n = 32$  and  $\pi = .25$ . Minitab reveals this probability to be  $.00016$ , as shown in the following graph:



(c) Write a sentence describing what this p-value is the probability of.

This p-value ( $.00016$ ) is the probability that 18 or more people in a sample of 32 would choose the right front tire, if in fact the right front tire is only picked with probability  $1/4$ .

(d) Is the sample result statistically significant at the  $\alpha = .05$  level? How about at the  $\alpha = .01$  level?

Yes, the sample result is statistically significant at both  $\alpha$  levels, because the p-value (.00016) is less than both .05 and .01.

(e) Write a couple of sentences summarizing the conclusion that you would draw from this analysis and also explaining the reasoning process that underlies your conclusion.

Our class data provide extremely strong evidence that students choose the right front tire more than  $\frac{1}{4}$  of the time. This conclusion follows because our analysis shows that results as extreme as we found in class (18 of 32 choosing right front) would occur only about 16 times in 100,000 repetitions if in fact the right front tire only had a  $\frac{1}{4}$  probability of being picked.

(f) Suppose that the sample size had been five times larger, with the same proportion of students choosing the right front tire. Repeat this analysis, and comment on how your p-value and conclusion change.

With a larger sample size, and the same sample results proportionally, the p-value becomes even smaller, and so the evidence that students choose right front more than  $\frac{1}{4}$  of the time becomes even stronger. (The p-value is so small that Minitab does not compute it.)