12. **Too much TV?** A father is concerned that his teenage son is watching too much television each day, since his son watches an average of 2 hours per day. His son says that his TV habits are no different than those of his friends. Since this father has taken a stats class, he knows that he can actually test to see whether or not his son is watching more TV than his peers. The father collects a random sample of television watching times from boys at his son's high school and gets the following data:

    1.9 2.3 2.2 1.9 1.6 2.6 1.4 2.0 2.0 2.2

    Is the father right? That is, is there evidence that other boys average less than 2 hours of television per day? Conduct a hypothesis test, making sure to state your conclusions in the context of the problem.

13. **Graduation tests** Many states mandate tests that have to be passed in order for the students to graduate with a high school diploma. A local school superintendent believes that after-school tutoring will improve the scores of students in his district on the state's graduation test. A tutor agrees to work with 15 students for a month before the superintendent will approach the school board about implementing an after-school tutoring program. The after-school tutoring program will be implemented if student scores increase by more than 20 points. The superintendent will test a hypothesis using $\alpha = 0.02$.

    a. Write appropriate hypotheses (in words *and* in symbols).

    b. In this context, which do you consider to be more serious – a Type I or a Type II error? Explain.

    c. After this trial produced inconclusive results, the superintendent decided to test the after-school tutoring program again with another group of students. Describe two changes he could make in the trial to increase the power of the test, and explain the disadvantages of each.

Name: ______________________________ Period: ________ Date: __________

AP STATISTICS
Review_**Chapter 22 and 23**

12. Too much TV?
$H_0: \mu = 2.0$ hours $\quad H_A: \mu < 2.0$ hours
Conditions:
* Randomization condition: Boys from the high school were randomly sampled.
* 10% condition: The sample is less than 10% of all boys at the high school.
* Nearly Normal condition: The histogram of credit hours is unimodal and reasonably symmetric. This is close enough to Normal for our purposes. (A histogram must be shown.)
Under these conditions, the sampling distribution of the mean can be modeled by Student's t with degrees of freedom: $df = n - 1 = 10 - 1 = 9$.
We will use a one-sample t-test for the mean.
We know: $n = 9$, $\bar{y} = 2.01$, and $s = 0.3446$. So, $SE(\bar{y}) = \frac{0.3446}{\sqrt{10}} = 0.109$.

$t = \frac{\bar{y} - \mu_0}{SE(\bar{y})} = \frac{2.01 - 2}{0.109} = 0.092$ The P-value is $P(t_9 < 0.092) = 0.536$.
The P-value of 0.536 is high, so I fail to reject the null hypothesis. There is no evidence that the son is watching more TV, on average, than his peers.

13. Graduation Tests

a. $H_0: \mu = 20$; The difference between the mean number of points before and after the tutoring program is not more than 20.

   $H_A: \mu > 20$; The difference between the mean number of points before and after the tutoring program is more than 20.

b. A Type I error would be very expensive for the school district. A Type I error would mean that the superintendent thought the tutoring program was working better than it was, so he would implement the program. In reality, the after-school tutoring program did not improve student test scores, so the school district would be spending money on a program that did not help. (Note: Students could argue that a Type II error would be worse.)

c. To increase the power of the test, we could increase the level of significance (α) or increase the sample size. By increasing the level of significance, it could lead to adopting a tutoring program that actually doesn't help. By increasing the sample size, the trial cost would increase.