Ch 11/12 – AP Statistics

**Ch11H1**

**p. 690 #1 693 3a, 4, 5, 6**

#1

1. **µ**= the mean score for all older students in college
2. if **µ** = 115, the sampling distribution of sampling mean is N(115,6)
3. Observing a mean of 118.6 or higher would not be surprising, but a mean of 125.7 or higher is less likely and, therefore, provides more evidence.
4. Yes the sample size is not large enough (n=25) to use the central limit theorem for Normality.
5. No. The older students at this college may not be representative of older students at other colleges in the United States.

#3

1. **µ**=115;**µ** > 115

#4

1. **µ=** the mean gas mileage for Larry’s car on the highway. **µ=** 26 mpg; **µ >** 26mpg
2. **p**= the proportion of teens in your school who rarely or never fight with their friends. Hᵒ: p=0.72;Hᵃ: p ≠ 0.72

#5

1. **p**= the proportion of calls involving life-threatening injuries for which the paramedics arrived within 8 minutes. Hᵒ:p=0.78; Hᵃ: p > 0.78
2. **µ**= the mean percent of local household food expenditures used for restaurant meals

#6

1. Hᵒ and Hᵃ have been switched; The null hypothesis should be a statement of “no change”
2. The null hypothesis should be a statement about **µ**, not sampling mean

**CH11H2**

**P.698 #9, 11, 12 p.703 #19, 20**

#9

1. The test statistic is $z=$ 118.6-115 / 30÷ square root 25. = 0.6 and the P value is P-value 1- .09652= 0.0375
2. The test statistic is z= 127.5-115/30÷ square root 25
3. If **µ** =115, the probability of getting a sample mean of 118.6 or something more extreme by chance is 0.2743, and the probability of getting a sample mean of 125.7 or something more extreme by chance is 0.0375- a much more unlikely occurance. A small P-value tells us that values of sample mean is similar to 125.7 would rarely occur when Hᵒ is true.

#11

1. Sampling mean is 398
2. If **µ** =354 the sampling distribution of the sampling mean is normal with mean 354 and standard deviation 33/ square root 3 = 19.0526. The sampling distribution is normal because weekly sales have a normal distribution.
3. The test statistic is z= 398-354/ 33 square root 3= 2.31 and the P-value =1- 0.9896=0.0104.
4. The P-value of 0.0104 tells us that there is only about a 1.04% chance of getting values of sample means at or above 398 units when Hᵒ is true

#12

1. P(Z ≤ 1.6) = 1-0.9542= 0.0548
2. (Z ≤ -1.6 or Z ≥1.6) = 2 x 0.0548=0.1096

#19

1. 1. Take a random sample of several apartments, and the measure area of each. 2. Hᵒ: **µ**=125; Hᵃ:**µ** <1250
2. 1. Take a random sample of service calls over the year, and find out how long the response time was on each call. 2. Hᵒ:**µ=1.8**; Hᵃ: **µ ≠1.8**
3. 1. Take a random sample of students from his school, and find the proportion of lefties. 2. Hᵒ: p=0.12; Hᵃ: p≠0.12

#20

1. if **µ**= 31%, the sampling distribution of sampling mean is normal with mean 31% and standard deviation 9.6%/ square root 40=1.52%
2. A result like sampling mean =27.6% lies down in the low tail of the density curve, while 30.2% is fairly close to the middle. If **µ** =31%, observing a mean of 30.2% or smaller would not be too surprising, but a mean of 27.6% or smaller is unlikely
3. For sampling mean = 30.2%, the test statistic is z=30.2-31/9.6 ÷ square root 40 = -0.53, and the P-value = 0.2981. For sampling mean = 27.6%, the test statistic is z= 27.9-31/9.6 ÷ square root 40= -2.24, and the P-value = 0.0125
4. The P-value of 0.0125 tells us that sampling mean =27.6%is significant at the 5% level. At the 5% level we can conclude that households spend less than 31% on average for housing; but at the 1% level, we would conclude that households spend 31% on average

**Ch11H3**

**P.701 #13-16, p.703 #21, 23, p.712 #31, 32, 34, p.713 #37, 38**

**#13** Significance at the 1% level means that the P-value is less than 0.01. If the P-value is less than 0.01, then it must also be less than 0.05. If a test is significant at the 5% level, then we know that the P-value is less than 0.05.

**#14**

1. The P-value is P (Z ≥ 2.42) = 1- 0.9922=0.0078. Since the P-value is less than 0.05, the result is statistically significant at the 5% level
2. Since the P-value is less than 0.01, the result is statistically significant at the 1% level
3. For both significant levels we would reject Hᵒ and conclude that we have good evidence that the mean is greater than 1.4mg.

 **#15**

1. Reject Hᵒ if z > 1.645
2. Reject Hᵒ when z ≤ -1.96 or z ≥ 1.96
3. For a two sided alternative the extreme values could be small or large, so the significance level is divided evenly in the two tails 0

 **#16**

1. The test statistic is $z=\frac{0.4365-0.5}{0.2877/√100}$ =-2.20 and the P value is P(Z ≤ -2.20 or Z≥ 2.20)= 2 \* 0.0139= 0.0278
2. Since the P-value is less than 0.05, we say that the result is statistically significant at the 5% level
3. Since the P-value is greater than 0.01, we say that the result is statistically significant is at the 1% level
4. At the 5% level we would reject Hᵒ and conclude the random number generator does not produce numbers with an average of 0.5. At the 1% level we would not reject Hᵒ and conclude that the observed deviation from the mean of 0.5 is something that could happen by chance.

 **#21**

1. We would reject Hᵒ when z ≤ -2.81 or z ≥ 2.81
2. For a one-sided alternative, z is statistically significant at the 0.005 if z > 2.576

 **#23**

1. If the pop. Mean is 15 there’s about an 8% chance of getting a sample mean as far from or even farther from 15 as we did in the sample
2. We would not reject Hᵒ at 0.05 because the P-value of 0.082 is greater than 0.05
3. The probability that you are wrong is either 0 or 1, depending on the true value of mean

 **#31**

1. Yes. The P-value =0.06 indicates that the results observed are not significant at the 5% level, so the 95% level confidence interval will include 10.
2. No, because the P-value <0.1, we can reject Hᵒ:µ =10 at the 10% level. The 90% confidence would include only those values a for which we could not reject Hᵒ:µ=a at the 10% level

 **#32** the 95% confidence interval for µ is (28.0, 35.0)

1. NO. Since the 95% confidence interval includes 34, we cannot reject Hᵒ: µ=34 at the 5% level.
2. Yes. Since the 95% confidence interval does not include 36, we can reject Hᵒ: µ=36 at the 5% level

 **#34** the two sided P-value is 2 \* 0.04 =0.08

1. Yes. The P-value indicates that the results observed are not significant at the 5% level, so the 95% confidence interval will include 30.
2. No. Because the P-value < 0.1, we can reject Hᵒ:µ=a at the 10% level.

**#37**

1. Yes. 30 is in the 95% confidence interval because P-value = 0.09 means that we would not reject Hᵒ at 0.05
2. No. 30 is not in the 90% confidence interval because we would reject Hᵒ at 0.10

**#38**

1. No. 13 is in the 90% interval, so Hᵒ can be rejected at the 10% level
2. NO. The sample mean is (x-bar) =$x=\frac{12+15}{2}=13.5$, and the standard error is approximately $\frac{1.5}{1.645}=0.91$, so 13.5 is less than one standard error from 13
3. Yes. 10 is not in the 90% confident interval so H$°$ can be rejected at the 10% level
4. If the alternative is Hᵃ:µ < 10, the answer is “No” because 13.5 is well above 10. However if the alternative is Hᵃ: µ > 10 the answer is “Yes” because the sample mean of 13.5 is approximately $\frac{3.5}{0.91}$=3.85 standard errors above 10

**Ch11H4**

**p.745 1, 3, 4 p.754 5, 8**

**#1**

1. 2.015
2. 2.518

**#2**

1. 2.145
2. 0.688

**#3**

1. 14
2. 1.82 is between 1.761
3. (P=0.05) and 2.145 (P=0.0451)
4. T=1.82 is significant at 0.05 but not at 0.01

**#4**

1. 24
2. 1.12 is between 1.059 (P=0.15) and 1.318 (P=0.10)
3. The P-value is between 0.30 and 0.20(The actual P-value is 0.2738.)
4. NO t=1.12 is not significant at either 0.10 or at 0.05

**#5**

1. Hᵒ:µ=1200mg versus Hᵃ:µ < 1200mg where µ= the mean daily calcium intake for women between the age of 18 and 24 years. $t=\frac{1.1181-1}{0.0438/√11}$=-3.95, with df=37 and P-value = 0.00017. Since the P=value is less than 0.05, we reject Hᵒ and conclude that the true mean calcium intake for the women is less than 1200mg
2. Without the two high outliers, t=-6.73 and the P-value $≈$ 0. Our conclusion does not change

**#8**

1. We want to test Hᵒ: µ = 0 versus Hᵃ: µ $\ne $ 0. The test statistic is t= $\frac{328-0}{256/√16}$= 5.125, which df=15 and P-value 0.00012 is less than 0.01, we reject Hᵒ and conclude that there is a change in NEAT that is statically significant
2. With t\* =2.131, the 95% confidence interval is 191.6 to 464.4 cal/day. This tells us how much additional calories might have been burned by the increase in NEAT: it consumed 19% to 46%of the extra 1000 cal/day.

**CH11H5**

**P.759#9 762#15-18, 21**

1. Randomly assign 12 or 13 individuals into a group that will use the right hand knob first; the rest should use the left hand knob
2. Let µ R-L denote the mean of difference (right thread minus left thread) in times. We want to test Hᵒ:µ R-L=0(no difference) versus Hᵃ:µ R-L < 0. The test statistic is t=$\frac{-13.32-0}{22.936√25}$=2.9037, with df= 24 and P-value = 0.0039, Since 0.0039 is less than the significance level 0.05, we reject Hᵒ and conclude there is a statiscally significant evidence to support the hypothesis that right-handed people find right-hand threads easier to use
3. A type 1 error is committed when the designers conclude that right-handed people find right-hand threads easier to use when in fact there is no difference in the times. The consequence of this error is that the designers would create two different instruments when it is unnecessary. A type 2 error is committed when the designers conclude that right handed people find right handed threads easier to use when in fact there is no difference in the times when in fact there is. The consequence of the error is that designers will create one instrument when two are needed.
4. Power of 0.27039very low).

**#15**

1. Df=9
2. The P-value is between 0.025 and 0.05

**#16**

We want t >t\*, where t\* is the upper $\infty $/2 critical value for the t distribution with 20-1=19df. From table C, $\infty $/2=0.0025 so values of the test statistic above t\*19,0.0025=3.174 and below -t\* 19,0.0025=-3.174 are considered significant at the 5% level

**#17**

1. For a t distribution with df=4, the P value is 0.0704 which is not significant at the 5% level
2. For a t distribution with df=9, the P-value is 0.0368 which is significant at the 5% level.

**#18**

1. The parameter µd is the mean difference in the yields for the two varieties of plants.
2. We want to test Hᵒ:µd=0 versus Hᵃ