Stat 1040 Recitation 11 Solutions

1. (10 points) National data show that on average, college freshmen spend 7.5 hours a week going to parties. It has been suggested that USU is a "party school". An administrator takes a simple random sample of 200 USU freshmen and finds that the average time spent partying is 8.4 hours a week, with an SD of 9 hours. Is this evidence that USU freshmen party more than 7.5 hours a week, on average, or could it just be chance error?

   (a) State the null and the alternative hypothesis.

   null hypothesis: USU is not a "party school". ave = 7.5

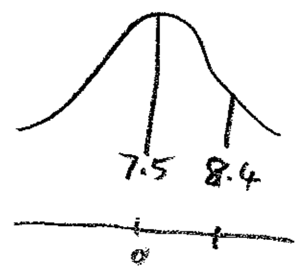
   alt hypothesis: USU is a "party school" ave > 7.5

   (b) Find a test statistic.

   $\underbrace{\qquad\qquad\qquad}_{\text{hours spent}}$, $SD_{box} = ? \approx 9$

   $SE_{sum} = \sqrt{200} \cdot 9 = 127$

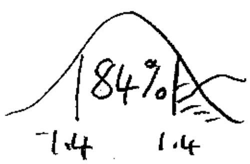
   $SE_{ave} = \frac{127}{200} = .636$

   test statistic = 1.4

   $z = \frac{8.4 - 7.5}{.636} = 1.4$

   (c) Find the P-value.

   P-value = 8%

   (d) Do you reject the null hypothesis? Explain.

   We fail to reject the null because the P-value is larger than 5%.

   (e) State your conclusions about whether or not USU freshmen party more than 7.5 hours a week, on average.

   We conclude that there is no evidence the average is larger than 7.5 hours a week.

2. (10 points) Reading test scores are known to follow the normal curve. The average reading test score is supposed to be 100. I suspect that the children at one of the local schools have a higher average reading score, so I take a simple random sample of 10 of these children and find that their average reading score is 112, with an SD of 18. Is my suspicion correct? Perform the appropriate statistical test. You must clearly state a null and alternative hypothesis, compute a test statistic and a P-value and state your conclusions.

null: the children from this school have an average score of 100.

alt: the children from this school have an average score of more than 100.

$\text{ave}_{box} = 100$, $SD_{box} = ?$ $SD^+ = \sqrt{\frac{10}{9}}(18) = 18.97 \approx 19.$

$SE^+_{sum} = \sqrt{10}(19) = 60$ $\qquad df = 10 - 1 = 9$

$SE^+_{ave} = \frac{60}{10} = 6$

$t = \frac{112 - 100}{6} = 2$

P-value between 2.5% and 5%

We reject the null & conclude they have an average that's bigger than 100.

3. Would your test in question 2 still be valid if reading test scores did not follow the normal curve? Explain.

No - the t-test assumes the tickets in the box follow the normal curve.

4. (10 points) Soil is said to be "neutral" if the pH is 7.0 and "acidic" if the pH is less than 7.0. A soil scientist is concerned that the soil in a certain field might be somewhat acidic. She takes 5 randomly selected samples of soil from the field and finds that the pH levels are 5.8, 6.3, 6.9, 6.2, and 6.5. Suppose it is known that in this sort of situation, pH values follow the normal curve quite closely. Test to see whether the scientist's suspicion is correct. You must state the null and alternative hypotheses, perform the appropriate statistical test, and clearly state your conclusions.

ave = 6.34

$SD^+ = .40$

(calculator)

null: the soil has a pH of 7.0

alt: the soil has a pH of less than 7.0.

$\text{ave}_{box} = 7$, $SD_{box} = ?$ $SD^+ = .40$

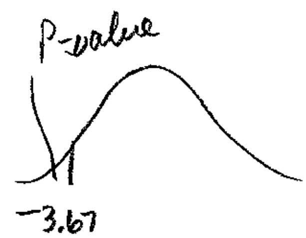
$EV_{ave} = 7$ (from the null)

$SE^+_{sum} = \sqrt{5}(.4) = .89$

$SE^+_{ave} = \frac{.89}{5} = .18$

$t = \frac{6.34 - 7.0}{.18} = -3.67$

if they round this to 6.3 they get $t = -3.9$



$df = 5 - 1 = 4$

P-value is between 1% and 2.5% (close to 1%).

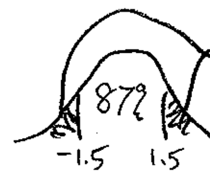
We reject the null & conclude the soil is acidic.

5. (10 points) According to a genetic theory, there is a 10% chance that a randomly selected person from a large population has a given gene. I take a simple random sample of 500 people from this population and find that only 40 have this gene. Perform a statistical test to see whether this is evidence that the genetic theory is incorrect. You should clearly state the null and the alternative, find a test statistic and a P-value and state your conclusions.

null: theory is correct, chance is 10%

alt: " " incorrect, chance is not 10%

$\underbrace{9\boxed{0}\quad\boxed{1}}$, $\text{ave}_{box} = .1$, $SD_{box} = .3$

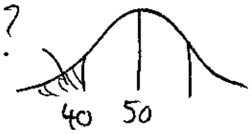


2-tailed P-value = 13%

$EV_{sum} = 500(.1) = 50$

$SE_{sum} = \sqrt{500}(.3) = 6.7$

?



$z = \frac{40-50}{6.7} = -1.5$

P-value is 13% so we fail to reject the null & conclude there is no evidence the theory is not correct.

6. (10 points) A magazine claims that "50% of young mothers say that finding child care is a problem". A community leader thinks the percentage is actually lower than 50% in their community. They take a simple random sample of 450 young mothers and find that 185 say that finding child care is a problem. Test to see whether the community leader is correct. You must clearly state a null and alternative hypothesis, compute a test statistic and a P-value and clearly state your conclusions.

NB: the box is NOT $\underbrace{230\boxed{1}\ 320\boxed{0}}$

null: the magazine is correct, the percent is 50%

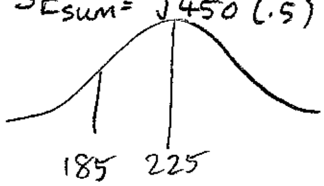
alt: the percent is less than 50.

$\underbrace{\boxed{0}\quad\boxed{1}}$, $\text{ave}_{box} = .5$, $SD_{box} = .5$

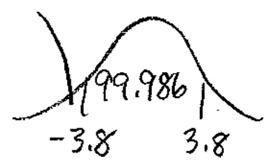
$EV_{sum} = 450(.5) = 225$

$SE_{sum} = \sqrt{450}(.5) = 10.6$

P-value = .007%



$z = \frac{185-225}{10.6} = -3.8$



The P-value is .007% so we reject the null and conclude the percent is less than 50.

7. (5 points) A 1-tailed test of significance is performed and the P-value is 3%. For each of the following, answer True or False:

(a) There is a 3% chance that the null hypothesis is true. False

(b) There is a 3% chance that the null hypothesis is false. False

(c) There is a 3% chance that we will reject the null hypothesis. False

(d) The 1-tailed test is statistically significant. True

(e) The 2-tailed P-value is 6%. True