A N S W E R K E Y

STAT 1051: QUIZ 7

Name

1. Write the formula for the test statistic to use when testing the hypothesis:

$$H_0 : \mu = \mu_0 \text{ vs } H_1 : \mu \neq \mu_0$$

at the level of significance of α with n observations and not knowing the population variance, σ^2.

Answer 1 *(5 pts)* $T = \frac{\bar{x}-\mu_0}{\frac{s}{\sqrt{n}}}$

Write your answer using notation like this:

(a) `sqrt(n)` for $\sqrt{n}$

(b) `(a+b+c)/2` for $\frac{(a+b+c)}{2}$

(c) `z_(alpha/2)` for subscripts like $z_{\frac{\alpha}{2}}$ and `y^2` for superscripts like y^2

2. Boys were given a spelling test. The mean grade of 32 boys was 72 with a sample standard deviation of 8. Test the hypothesis that their average grade is less than 75 at a level of significance of .05.

(a) **Answer 2** *(5 pts)* $\alpha = .05$ *One-sided test and variance is unknown hence T test statistic is used.*

(b) **Answer 3** *(5 pts)* $t_{31,.05} = 1.695$

(c) **Answer 4** *(5 pts)* $T = \frac{72-75}{\frac{8}{\sqrt{32}}} = -2.12$

(d) **Answer 5** *(5 pts) Is* $T = -2.12 < -1.695$ *? Yes*

(e) **Answer 6** *(5 pts) Reject null hypothesis.*

(f) **Answer 7** *(5 pts) Why? Because* $T = -2.12 < -1.695$. *Another answer could be that* $\alpha = .05 > p - value = .02105667$ *Note: p-value=.02105667*

3. **Answer 8** *(5 pts) Let* t_0 *be a specific value of t. Find* t_0 *such that* $P(t \geqslant t_0)$*=.01 where df=8.*

$t_{8,.01} = 2.896$

4. STAT51 students counted the number of e's for an experiment in counting on the first day of class. The average number of e's from the 47 students is 218.957 with a sample standard deviation of 71.143.

   (a) Test the hypothesis that the class average equals the true value of 315 versus the alternative hypothesis that the class average is less than the true value. Use a .05 level of significance.

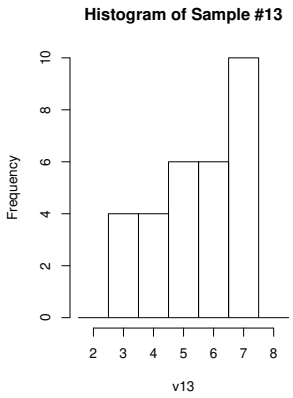
      i. $\alpha = .05$ one sided test
      ii. $t_{46,.05} \approx 1.67866$
      iii. **Answer 9** *(5 pts)* $T = \frac{218.957-315}{\frac{71.143}{\sqrt{47}}} = -9.255129$
      iv. **Answer 10** *(5 pts) Is* $T = -9.255129 < -1.67866$*? Yes; therefore, reject null hypothesis*
      v. **Answer 11** *(5 pts) Is this a one-side or two-side test? This is a one sided, because we are testing the null hypothesis against the alternative that class average is LESS THAN the true value.*

   (b) Construct a 90% confidence interval about the mean for the number of e's which the STAT51 students counted.

      i. $\alpha = .10$ $\frac{\alpha}{2} = .05$ $n - 1 = 46$
      ii. $t_{n-1,\frac{\alpha}{2}} = t_{46,.05} \approx 1.6759$
      iii. **Answer 12** *(5 pts)* $a = \bar{x} - \frac{s}{\sqrt{n}} t_{n-1,\frac{\alpha}{2}} = 218.957 - \frac{71.143}{\sqrt{47}} 1.6759 = 201.5657$
      iv. **Answer 13** *(5 pts)* $b = \bar{x} + \frac{s}{\sqrt{n}} t_{n-1,\frac{\alpha}{2}} = 218.957 + \frac{71.143}{\sqrt{47}} 1.6759 = 236.3483$
      v. **Answer 14** *(5 pts) 90% CI is:* $(201.5, 236.3)$ *(Parentheses are required for notation of confidence interval.)*
      vi. **Answer 15** *(5 pts) Why is the confidence interval for the STAT51 students so far away from the true number of e's?*

      The set of data which the class produce was biased for several reasons which we discussed in class. For one reason, the class as a whole undercounted the number of e's, due to a five minute time limit. Therefore, the estimate and its confidence interval are erroneous, even though the computations are correct and the right formulas were used. A confidence interval is valid only for unbiased estimates and for unbiased data.

5. A simulation of the theory of confidence intervals taken from what would have been Computer Assignment #3 if it were assigned was performed by producing 20 sets of 30 randomly generated numbers based on a $U(3,7)$ probability distribution. The average of 600 random numbers is 4.943. A picture of those 30 random numbers taken from set number 13 is shown here. The sample mean associated with sample # 13 is 5.466667 with sample deviation of 1.431983.



   (a) Why is the histogram not perfectly flat?

   Answer 16 *(5 pts) A histogram is not perfectly flat, because it is not a probability distribution.*

   (b) Let V be a random variable which is distributed as stated above. Compute the expected value and variance of V. Note: $E[V] = \frac{a+b}{2}$ and $var(V) = \frac{(b-a)(b-a+2)}{12}$

      i. **Answer 17** *(5 pts)* $E[V] = E[V_i] = \mu = \frac{3+7}{2} = 5$

      ii. **Answer 18** *(5 pts)* $var(V) = var(V_i) = \sigma^2 = \frac{(7-3)(7-3+2)}{12} = 2$

   (c) Define $\bar{V} = \frac{\sum_{i=1}^{20} V_i}{20}$. Compute $E[\bar{V}]$ and $var(\bar{V})$.

      i. **Answer 19** *(5 pts)* $E[\bar{V}] = \mu = 5$

      ii. **Answer 20** *(5 pts)* $var(\bar{V}) = \frac{\sigma^2}{n} = \frac{2}{20} = .1$

6. **BONUS**

   Answer 21 *(5 pts) Write the missing Greek name above each Greek letter.*

eta	***Alpha***	*kappa*	***rho***	*omicron*	*pi*	*omicron*	***lambda***	***iota***	*sigma*
η	A	$\varkappa$	ϱ	o	π	o	λ	ι	ς

7. **BONUS** This hill the name of which is written in Greek and upon which many famous buildings were constructed is located in Athens. What is its name in English?

   Answer 22 *Acropolis*