

CGS602A: Basic Statistics, Data Analysis and Inference

Quiz #2:

Max marks: 50

27-11-2020

Time: 1hr

1. Answer all 4 questions.
2. Please do not collaborate.
3. You can use any online tables or statistical calculators to get actual values where needed. For example, <https://www.danielsoper.com/statcalc/default.aspx>.

1. Fill in the following table where: \bar{x} is the sample mean, σ is the population standard deviation, s the sample standard deviation, $s_{\bar{x}}$ is an estimate of the sampling distribution std. dev., $\sigma_{\bar{x}}$ is the standard deviation of the sampling distribution, $z_{\frac{\alpha}{2}}$ and $t_{\frac{\alpha}{2}, \nu}$ have their usual meanings where α is the confidence level and ν is the degrees of freedom for the t-distribution. If there is no formula (exact or approx.) to calculate the CI (confidence interval) write NA.

The first line in the table shows a filled in example. For other rows fill in the missing (blank) entries.

Pop. distr.	σ	Samp. size (N)	CI	Exact/Approx.
Normal	Known	$N \geq 30$	$\bar{x} \pm z_{\frac{\alpha}{2}} \sigma_{\bar{x}}$	Exact
Normal	Known	$N < 30$		
Not normal	Known	$N < 30$		
Normal	Unknown	$N < 30$		
Not normal	Unknown	$N \geq 30$		
Not normal	Unknown	$N < 30$		

[10]

2. (a) Given a sample of size N chosen from an infinite normal distribution what can you say about the confidence interval $a \leq \mu \leq b$ as α changes from 0.1 to 0.05 to 0.01. Justify your answer.
- (b) If for a given confidence level you wish to shrink the confidence interval what can you do? Justify your answer.

[6,4=10]

3. (a) Suppose $H_0 : \mu = 100$. You do a right tailed test at $\alpha = 0.05$ for some sample size N . Assume the population distribution is normal. Draw a graph of *probability of rejecting H_0* on the Y-axis versus *possible values for the true population mean* on the X-axis (choosing values on either side of 100 i.e. values that are less than and greater than 100). Give a brief justification for the shape of your graph.
- (b) How will the graph in part (a) change if the sample size is doubled to $2N$? Justify.

[(6,4),5=15]

4. For a sample of $N = 19$ write the full decision rules to reject $H_0 : \sigma^2 = \sigma_0^2$ where $\alpha = 0.05$ and the alternate hypotheses are:

(a) $H_a : \sigma^2 > \sigma_0^2$.

(b) $H_a : \sigma^2 < \sigma_0^2$.

(c) $H_a : \sigma^2 \neq \sigma_0^2$.

First decide what statistic you will use and then write the decision rules using the statistic.

[5×5=15]