MAT 200 - Test 4 - Fall 2015

PART 2/2

Instructor: Dr. Francesco Strazzullo   **Name** KEY

Instructions. Technology is allowed on this exam, without internet connectivity. Each problem is worth 10 points: together with the online portion, you have 100 points available. You might use the formulas sheet from our book or from our Eagleweb page: **if you do use one cite it. You cannot use cheat-sheets that include solved exercises.**

SHOW YOUR WORK NEATLY, PLEASE (no work, no credit).

1. The director of research and development is testing a new drug. She wants to know if there is evidence at the 0.02 level that the drug stays in the system for more than 384 minutes. For a sample of 79 patients, the mean time the drug stayed in the system was 386 minutes. Assume a population *variance* of 289.

Step 1. State the hypotheses:

H_0: $\boxed{\mu \leq 384}$ H_a: $\boxed{\mu > 384}$

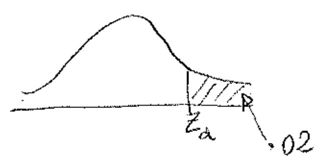
Step 2. Say why you would use a $Z-Test$, a $T-Test$, a 2-*SampZ-Test*, or 2-*SampTTest* (pooled or unpooled).

ONE SAMPLE AND $\sigma = \sqrt{289} = 17$ KNOWN $\Rightarrow$ Z-TEST.

$n = 79$, $\bar{X} = 386$

Step 3. Specify if the test type: left-tailed, right-tailed, or two-tailed.

RIGHT-TAILED: H_a WITH "$>$"



Step 4. Find the P-value of the test statistic. (Round your answer to 4 decimal places.)

$P = .1479$

Step 5. Determine the critical value of the level of significance.

$\alpha = .02 \Rightarrow Z_\alpha = Z_{.02} = $ INVNORM$(.98) = 2.0537$

Step 6. Determine the decision rule for rejecting the null hypothesis H_0 (in terms of P-value or test statistics).

$P > \alpha \Rightarrow$ FAIL TO REJECT H_0

ALSO $Z = 1.0457 < Z_\alpha$

Step 7. Determine the conclusion: Reject Null Hypothesis or Fail to Reject Null Hypothesis.

3. An advertising executive claims that there is a difference in the mean household income for credit cardholders of Visa Gold and of MasterCard Gold. A random survey of 17 Visa Gold cardholders resulted in a mean household income of $78,960 with a standard deviation of $9400. A random survey of 12 MasterCard Gold cardholders resulted in a mean household income of $73,730 with a standard deviation of $11,000. Is there enough evidence to support the executive's claim? Let μ_1 be the true mean household income for Visa Gold cardholders and μ_2 be the true mean household income for MasterCard Gold cardholders. Use a significance level of $\alpha = 0.01$ for the test. Assume that the population variances are not equal and that the two populations are normally distributed.

Step 1. State the hypotheses:

H_0: $\boxed{\mu_1=\mu_2 \text{ OR } \mu_1-\mu_2=0}$ $\qquad$ H_a: $\boxed{\mu_1\neq\mu_2 \text{ OR } \mu_1-\mu_2\neq 0}$

Step 2. Say why you would use a $Z-Test$, a $T-Test$, a *2-SampZ-Test*, or *2-SampTTest* (pooled or unpooled). 2 SAMPLES WITH σ UNKNOWN ⇒ 2-SAMP T-TEST, MOREOVER "NOT EQUAL VARIANCES" ⇒ "NOT POOLED (SE)".

SAMPLE 1 (VISA): $n_1=17$, $\bar{x}_1=78960$, $S_1=9400$; SAMPLE 2 (MC): $n_2=12$, $\bar{x}_2=73730$, $S_2=11000$.

Step 3. Specify if the test type: left-tailed, right-tailed, or two-tailed.

H_a HAS "$\neq$": TWO-TAILED TEST

Step 4. Find the P-value of the test statistic. (Round your answer to 4 decimal places.)

$p=.195$, $t=1.3379$ } USING 2-SAMP TTEST, OR $df=11$ AND $t=\dfrac{(\bar{x}_1-\bar{x}_2)-\overbrace{(\mu_1-\mu_2)}^{=0}}{\sqrt{\frac{S_1^2}{n_1}+\frac{S_2^2}{n_2}}}=1.3379$, AND $p=2\cdot TCDF(t,\infty,11)=.208$

Step 5. Determine the critical value of the level of significance.

$\alpha=.01 \Rightarrow \alpha/2=.005$
$df=MIN(n_1-1, n_2-1)=12-1=11$ } $\rightarrow t_{\alpha/2}=-INVT(.005, 11)=3.1058$

Step 6. Determine the decision rule for rejecting the null hypothesis H_0 (in terms of P-value or test statistics).

$p>\alpha$ (FAIL TO REJECT H_0)

ALSO $|t|<t_{\alpha/2}$

Step 7. Determine the conclusion: Reject Null Hypothesis or Fail to Reject Null Hypothesis.

2. A manufacturer of potato chips would like to know whether its bag filling machine works correctly at the 431 gram setting. Based on a 18 bag sample where the mean is 421 grams and the standard deviation is 14, is there sufficient evidence at the 0.01 level that the bags are underfilled? Assume the population distribution is approximately normal.

Step 1. State the hypotheses:

H_0: $\boxed{\mu \geq 431}$ H_a: $\boxed{\mu < 431}$

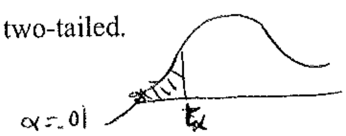
Step 2. Say why you would use a $Z - Test$, a $T - Test$, a 2-*SampZ-Test*, or 2-*SampTTest* (pooled or unpooled).

ONE SAMPLE AND σ IS UNKNOWN $\Rightarrow$ T-TEST

$n = 18$ (POPUL. NORM. DISTRIBUTED), $\bar{X} = 421$, $S = 14$

Step 3. Specify if the test type: left-tailed, right-tailed, or two-tailed.

H_a HAS "<" : LEFT-TAILED



Step 4. Find the P-value of the test statistic. (Round your answer to 4 decimal places.)

$p = .0038$

Step 5. Determine the critical value of the level of significance.

$\alpha = .01 \rightarrow t_\alpha = t_{.01} = \text{INVT}(.01, 17) = -2.5669$

$df = n - 1 = 17$

Step 6. Determine the decision rule for rejecting the null hypothesis H_0 (in terms of P-value or test statistics).

$p < \alpha \Rightarrow$ REJECT H_0

ALSO $t = -3.0305 < t_\alpha$

Step 7. Determine the conclusion: Reject Null Hypothesis or Fail to Reject Null Hypothesis.