Math 10 - GW 22 Answers

1. A random sample of 25 waiting times (in minutes) before patients saw a medical professional in a hospital's minor emergency department had a standard deviation of 0.7 minute. After a new admissions procedure was implemented, a random sample of 21 waiting times had a standard deviation of 0.5 minute. At a = 0.10, can you support the hospital's claim that the standard deviation of the waiting times has decreased?

(a) (DESIGN) State your Hypothesis

Pop 1 =new procedure

Pop 2 = current procedure

Ho: The standard deviation of the waiting times has not decreased

Ha: The standard deviation of the waiting times has decreased

Ho: $\sigma_1 \geq \sigma_2$ Ha: $\sigma_1 < \sigma_2$

(b) (DESIGN) State Significance Level of the test and explain what it means.

α=.10, the maximum probability of making Type I error, which would be incorrectly claiming standard deviation was reduced.

(c) (DESIGN) Determine the statistical model (test statistic)

$$F = \frac{s_2^2}{s_1^2}$$

df = 24num, 20 den

(d) (DESIGN) Determine decision rule (critical value method)

Reject Ho if F >1.77

(DATA) Conduct the test and **circle** your decision

(a)

$$F = \frac{0.7^2}{0.5^2} = 1.96$$

Reject Ho

(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.

The new procedure reduces the standard deviation of the waiting time, which means the wait per patient is more consistent, less variable.

2. An engineer wants to compare the tensile strengths of steel bars that are produced using a conventional method and an experimental method. (The tensile strength of a metal is a measure of its ability to resist tearing when pulled lengthwise.) To do so, the engineer randomly selects steel bars that are manufactured using each method and records the following tensile strengths (in Newtons per square millimeter). At a = 0.10 , can the engineer claim that the experimental method produces steel with greater mean tensile strength? Should the engineer recommend using the experimental method? First use the F test to determine whether or not to use equal variances in choosing the model.

Experimental	395	389	421	394	407	411	389	402	422	416	402	408	400	386	411	405	389
Conventional	362	352	380	382	413	384	400	378	419	379	384	388	372	383			

Hypothesis Test: Independent Groups (t-test, pooled variance)

Experimental	Conventional	
402.76	384.00	mean
11.34	17.70	std. dev.
17	14	n

29	df
18.765	difference (Experimental - Conventional)
211.416	pooled variance
14.540	pooled std. dev.
5.248	standard error of difference
0	hypothesized difference
3.58	t
.0012	p-value (two-tailed)
.0006	p-value (one-tailed, upper)
.9994	p-value (one-tailed, lower)

F-test for equality of variance	
313.23	variance: Conventional
128.69	variance: Experimental
2.43	F
.0944	p-value

Hypothesis Test: Independent Groups (t-test, unequal variance)

Experimental	onventional	
402.76	384.00	mean
11.34	17.70	std. dev.
17	14	n

21	df
18.765	difference (Experimental - Conventional)
5.472	standard error of difference
0	hypothesized difference
3.43	t
.0025	p-value (two-tailed)
.0013	p-value (one-tailed, upper)
.9987	p-value (one-tailed, lower)

(a) (DESIGN) State your Hypothesis

Pop 1 = experimental method
Pop 2 = conventional method

Ho: The experimental method does not produce steel with greater mean tensile strength
Ha: The experimental method produces steel with greater mean tensile strength

Ho: $\mu_1 \leq \mu_2$ Ha: $\mu_1 > \mu_2$

(b) (DESIGN) State Significance Level of the test and explain what it means,

α=.10, the maximum probability of making Type I error, which would be incorrectly claiming the experimental steel is stronger.

(c) (DESIGN) Determine the statistical model (test statistic)

Since the F-test for equality of variance has a p-value of 0.0944 <.10, we should use the unequal variance test for comparing two independent samples.

(d) (DESIGN) Determine decision rule (pvalue method)

Reject Ho if p-value<.10

(e) (DATA) Conduct the test and **circle** your decision

Pvalue = 0.0013 (2nd pvalue on right side above)

Reject Ho

(f) (CONCLUSION) State your overall conclusion in language that is clear, relates to the original problem and is consistent with your decision.

The experimental steel is stronger and the engineer should recommend the change.