STATISTICS 3N03/2J04 - TEST 3 SOLUTIONS

1. (a) SEE DEFINITIONS WEB PAGE.

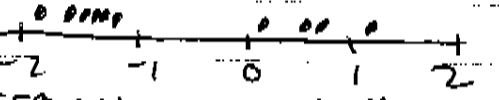
(b) YOU WANT TO TEST THAT THE VARIABILITY OF YOUR PRODUCT (OR YOUR MEASURING DEVICE) IS NO GREATER THAN THE SPECIFIED VARIANCE σ_0^2

2. THE SAMPLE VARIANCE s^2 IS AN UNBIASED ESTIMATE OF THE TRUE VARIANCE σ^2, FOR ANY DISTRIBUTION, IF THE DATA ARE INDEPENDENT.

3. [PLEASE SEE LAST YEAR'S TO3 SOLUTIONS FOR THE MARKING SCHEME.]

(a) PAIRED DATA. DIFFS: .38, .05, -1.27, -1.91, 0.5, -1.34, -1.59, 1.17, -1.13, -1.5

$\bar{d} = -0.664$ $s_d^2 = 1.16316$



TO TEST THE HYPOTHESIS OF NO DIFFERENCE IN MEAN.

$$t_0 = \frac{-0.664}{\sqrt{\frac{1.16316}{10}}} = -1.9469 \quad \text{REF: } t(9)$$

SINCE $t_{.025;9} = 2.262$, $t_{.05;9} = 1.833$, 2-SIDED $.05 < P < .1$

∴ THERE IS SOME EVIDENCE ($0.05 < P < .1$) FROM THESE DATA THAT THE MEAN SATELLITE WIND SPEED IS NOT THE SAME AS THE MEAN GROUND WIND SPEED.

ASSUME: NORMALITY (SAMPLE SIZE TOO SMALL BUT DOT DIAGRAM LOOKS SKEWED), INDEPENDENCE (CAN'T TEST).

NOTE: A SCATTER PLOT OF SATELLITE VS. GROUND WOULD ALSO BE A GOOD GRAPH.

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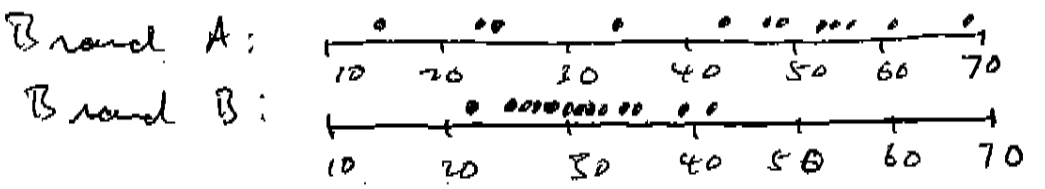
(b) INDEPENDENT SAMPLES

$n_1 = 12$ $\bar{x}_1 = 43.6916$ $s_1^2 = 286.3862878$

$n_2 = 13$ $\bar{x}_2 = 31$ $s_2^2 = 31.516$



TO TEST THE HYPOTHESIS OF NO DIFFERENCE IN VARIANCE:

$$F_0 = \frac{286.3862878}{31.516} = 9.087 \qquad \text{Ref}: F(11,12)$$

Since $f_{.01,11,12} = 4.2$, $P \ll 0.02$ (2-SIDED)

∴ THERE IS STRONG EVIDENCE ($P \ll 0.02$) THAT THE BRANDS ARE NOT EQUALLY VARIABLE. BRAND A IS MORE CONSISTENT THAN BRAND B.

ASSUMPTIONS: NORMALITY (LOOKS OK ON DOT PLOTS), INDEPENDENCE (CAN'T TEST).

WE COULD DO THE UNEQUAL-VARIANCES t-TEST TO GET $t_0 = 2.475$, $df = 13.2$, $P \approx 0.02$

OR THE EQUAL-VARIANCES t-TEST TO GET

$$t_0 = \frac{43.6916 - 31}{12.3659\sqrt{\frac{1}{12}+\frac{1}{13}}} = 2.5597 \qquad \text{Ref}: t(23)$$

SINCE $t_{.01,23} = 2.500$, $P \approx 0.02$

EITHER WAY, THERE IS SOME EVIDENCE ($P \approx 0.02$) THAT THE MEAN TIME TO RAISE TEMPERATURE BY 10^0 IS NOT THE SAME FOR EACH BRAND.

ASSUMPTIONS: SEE F-TEST ASSUMPTION ABOVE.