

2005-11-25

STATS 3N03/3J04 - TEST 3 SOLUTIONS

1(a) INDEPENDENT SAMPLES

$$n_1 = 5 \quad \bar{x}_1 = 2.10624 \quad \Delta_1 = 0.029064$$

$$n_2 = 5 \quad \bar{x}_2 = 2.09946 \quad \Delta_2 = 0.033055$$

$$\text{POOLED VARIANCE ESTIMATE: } \Delta_p = 0.031124$$

$$t_0 = \frac{2.10624 - 2.09946}{0.031124 \sqrt{\frac{1}{5} + \frac{1}{5}}} = 0.3444, \text{ REF: } t(8), .8 > P > .5$$

CONCLUSION: THERE IS NO EVIDENCE (.8 > P > .5) THAT THE CALIBRATION HAS CHANGED FROM FIRST DAY TO SECOND.

ASSUME: NORMALITY (CAN'T TEST BUT LOOKS OK ON GRAPH), INDEPENDENCE WITHIN AND BETWEEN SAMPLES (CAN'T TEST), HOMOSCEDASTICITY (SEE F TEST BELOW).

$$F_0 = (0.033055)^2 / (0.029064)^2 = 1.293, \text{ REF: } F(4,4), P > 0.5$$

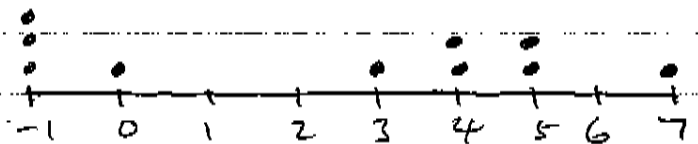
CONCLUSION: NO EVIDENCE (P > 0.5) OF HETEROSEDASTICITY

ASSUME: NORMALITY, INDEPENDENCE, AS FOR t-TEST.

[18 MARKS IF ALL OF THE ABOVE IS GIVEN; MAX 13 MARKS IF WRONG ANALYSIS IS DONE.]

(b) PAIRED DATA

$$n = 10 \quad \bar{d} = 2.5 \quad \Delta_d = 8.94$$



$$t_0 = \frac{2.5 - 0}{\sqrt{8.94/10}} = 2.6434, \text{ REF: } t(9), 0.05 > P > 0.02$$

CONCLUSION: THERE IS SOME EVIDENCE (.05 > P > .02) THAT NEANETCH RATE DIFFERS BETWEEN CENTRE AND EDGE

ASSUME: NORMALITY (OK BY GRAPH BUT SAMPLE TOO SMALL TO TELL), INDEPENDENCE (NO WAY TO TEST, OBSERVATIONS ARE NOT IN ANY ORDER, SAMPLE IS SMALL).

[12 MARKS IF ALL THE ABOVE IS GIVEN; MAX 8 MARKS FOR WRONG ANALYSIS.]

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SIGN TEST: THERE ARE 9 NON-ZERO DIFFERENCES,
6 OF THEM ARE POSITIVE.

$$X_0 = 6, \text{ REF: } \text{BIN}(9, \frac{1}{2}), P = 2P(X \geq 6 | X \sim \text{Bin}(9, \frac{1}{2}))$$

$$= 2 \left\{ \binom{9}{6} \left(\frac{1}{2}\right)^9 + \binom{9}{7} \left(\frac{1}{2}\right)^9 + \binom{9}{8} \left(\frac{1}{2}\right)^9 + \binom{9}{9} \left(\frac{1}{2}\right)^9 \right\} = 0.5078$$

CONCLUSION: THERE IS NO EVIDENCE ($P = 0.51$) FROM
THESE DATA THAT ETCH RATE DIFFERS BETWEEN CENTRE
AND EDGE.

* THE t -TEST HAS GREATER POWER THAN THE SIGN
TEST (NOTE THAT IT GIVES A RESULT SIGNIFICANT
AT THE 5% LEVEL, THE SIGN TEST IS NOT
SIGNIFICANT).

* THE SIGN TEST IS MORE ROBUST BECAUSE IT DOES
NOT ASSUME NORMALITY.

[5 MARKS IF ALL THE ABOVE IS GIVEN.]

2. HERE: $\alpha = 0.05$, $\beta = 0.1$, $\delta = 1$, USE $\sigma^2 = \Delta_d^2 = 8.94$
FROM TABLES: $Z_{0.025} = 1.960$, $Z_{0.1} = 1.282$

REQUIRE $n = \frac{(Z_{0.025} + Z_{0.1})^2 \sigma^2}{\delta^2} = 94$ WAFERS

[5 MARKS]

FULL MARKS = 40