QM2A/QM2A for Finance Workshop Answer Sheet

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Date: 10-10-25 **Workshop time & room:** 3-4 381

Tutor's name for this workshop: Shilpi Jha **Worksheet number**

If attending from **another workshop group**, please complete the following:

Your normal tutor ('Taught by' on your timetable):

Your normal workshop day: Your normal workshop time & room:

1. $H_0: \mu \geq 10$ $H_1 \leq 10$

Distribution: t

Degrees of Freedom $N-1$: $40-1=39$

Critical value: $t_{39,0.400}$: 1.303

Decision rule: reject H_0 if sample t-value > 1.303

$$\text{Sample t-value} = \frac{\bar{x}-\mu}{SE(\bar{x})}$$

$$SE(\bar{x}) = \frac{s}{\sqrt{n}}$$

$$\text{Sample t-value} = \frac{13-10}{0.9645}$$

$$SE(\bar{x}) = \frac{6.1}{\sqrt{40}}$$

$$SE(\bar{x}) = \frac{0.1}{6.3245}$$

Sample t-value = 3.1104

$$SE(\bar{x}) = 0.9645$$

Decision.

Sample t-value (3.1104) > critical value 1.303 so reject H_0 at 1% of significance level

ie. The samples does provide evidence to contradict the Newspaper claim

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(2) $N_A = 40$ $\bar{x}_A = 13$ $s_A^2 = 6.1$
$N_B = 100$ $\bar{x}_B = 15$ $s_B^2 = 8.2$

a) $H_0 = \mu_A - \mu_B = 0$ $H_1 = \mu_A - \mu_B \neq 0$

Distribution: t

Degrees of Freedom: $N_A + N_B - 2 = 40 + 110 - 2 = 148$

Significance level: 5%

Critical values: $t_{148, 0.025} \approx \pm 1.96$

Decision rule: Reject H_0 if sample t-value is either < -1.96 or $> +1.96$

Sampl t-value

$$SE = s^2 = \frac{\bar{x}_A - \bar{x}_B - 0}{SE(\bar{x}_A - \bar{x}_B)}$$

$$SE(\bar{x}_A - \bar{x}_B) = \sqrt{\frac{s^2}{N_A} + \frac{s^2}{N_B}}$$

where $s^2 = \frac{(N_A - 1)s_A^2 + (N_B - 1)s_B^2}{N_A + N_B - 2}$

$$s^2 = \frac{(40-1)6.1 + (110-1)8.2}{148}$$

$$s^2 = 8.2$$

$$SE(\bar{x}_A - \bar{x}_B) = \sqrt{\frac{8.2}{40} + \frac{8.2}{110}}$$

$$SE(\bar{x}_A - \bar{x}_B) = 0.5286$$

Decision: As sample - t value is behind our critical value (-1.96) we are able to reject H_0 at 5% of significance level

i.e. there is enough evidence to reject H_0 at 5% of significance level

another words there is a difference between the amount of beer drunk by adults in England and Scotland.

b)

	Decision: Difference	Decision: No Difference
H_0	Type 1 error	No error
H_1	no error	Type 2 error

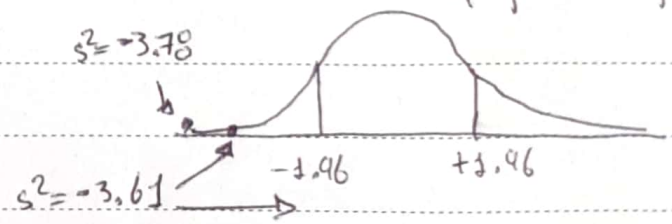
When we decrease the sample size of one side (scottish) we can be in a way of commiting an Type II error

So as marqued here: $SE(\bar{x}_A - \bar{x}_B) = \sqrt{\frac{8.2}{40} + \frac{8.2}{110}}$

Power = 1 − p(Type 2 error)

$SE(\bar{x}_A - \bar{x}_B) = 0.5286$

if we decrease this number (sample size) we got another $SE(\bar{x}_A - \bar{x}_B)$ and this one tends to the right increasing the probability to ~~reject~~ not rejecting H_0



So, in order to reduce the chance of a Type 2 error without increasing the chance of Type 1 error I should increase N.