

Sample final solutions

①

Q1 1 2 2 6 7 8 11

↑
median = 6

$$Q_1 = \frac{2+2}{2} = 2$$

$$Q_3 = \frac{7+8}{2} = 7.5$$

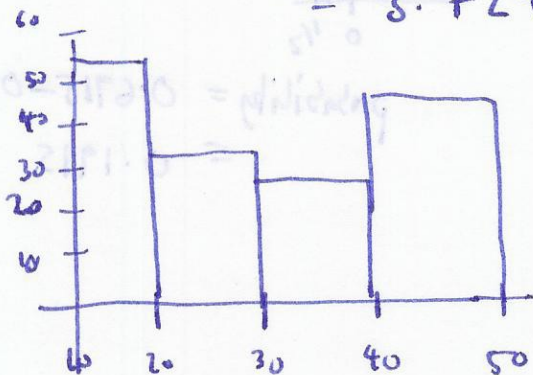
$$\text{mean} = \frac{1+2+2+6+7+8+11}{7} = 5.286 = \bar{x}$$

$$\text{standard deviation} = \sqrt{\frac{[(1-5.286)^2 + (2-5.286)^2 + \dots + (11-5.286)^2]}{7}}$$

or 6

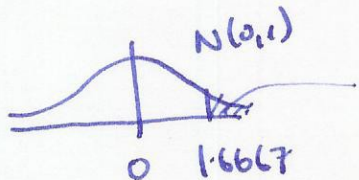
$$= 3.729$$

Q2



Q3 $N(90, 6)$

$$z = \frac{100-90}{6} = \frac{10}{6} = \frac{5}{3} = 1.6667$$



$$0.0478 = 4.78\%$$

Q4 $n=200$ $\hat{p} = \frac{25}{200} = 0.125$

$$z_{\alpha} = 1.96$$

confidence interval: $\hat{p} \pm z_{\alpha} \sqrt{\hat{p}(1-\hat{p})/n}$

$$0.125 \pm 0.0458$$

$$(0.079, 0.171)$$

Q5 margin of error is $z_{\alpha} \sqrt{\hat{p}(1-\hat{p})/n}$

$$\text{solve } 1.96 \sqrt{\frac{0.103}{\sqrt{n}}} = 0.04$$

$$n = \frac{(1.96)^2 \times 0.103}{(0.04)^2} \approx 247$$

Q6 $H_0: \mu = 8.8$

$$n = 12$$

$$H_a: \mu \neq 8.8$$

$$\hat{\mu} = 7.36, s = 4.03$$

test statistic: $\frac{\mu - \hat{\mu}}{s/\sqrt{n}}$

distributed as a t-dist. with $df = 11$.

t_{α} at 5% significance level is 2.201

$$\frac{8.8 - 7.36}{4.03/\sqrt{12}} = 1.23$$

< 2.201 so no significant evidence number of fish caught has changed.

Q7 $H_0: \mu_1 = \mu_2$

$$n_1 = 20 \quad \mu_1 = 349.2 \quad s_1 = 26.1$$

$$H_a: \mu_1 \neq \mu_2$$

$$n_2 = 24 \quad \mu_2 = 358.4 \quad s_2 = 19.5$$

test statistic $\frac{\mu_1 - \mu_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} = -1.302$

distributed as t-dist with $df = 19$ critical value at 10% level

is $t_{\alpha} = 1.729$.

$|t| < |t_{\alpha}|$ so no significant evidence peer tutored group are better.

in R:

Q8 $>x <- c(8.6, 9.3, 10.1, 8, 8.3)$

$>y <- c(8.4, 7.6, 5.4, 10.6, 8.3)$

$> \text{cor}(x, y) = -0.938 = r$

$> \text{summary}(lm(y \sim x))$: $\hat{y} = b_1 x + b_0$

where $b_1 = -2.0715$

$b_0 = 26.4137$: $\hat{y} = -2.0715x + 26.4137$

b_1 confidence interval: $b_1 \pm t_{\alpha} SE_{b_1}$

where t_{α} is critical value for t-dist, $df = 3$ at 95%

so $t_x = 3.182$

$SE_{b_1} = 0.4422$ (from R)

$-2.0715 \pm 3.182 \times 0.4422 = (-3.476, -0.664)$

Q9 $\hat{y} = -2.0715x + 26.4137$

$x = 9 : \hat{y} = -2.0715 \times 9 + 26.4137 = 7.8$ deaths/1000

Q10 in R: $x \leftarrow c(64, 15, 17)$

$y \leftarrow c(12, 42, 30)$

$z \leftarrow c(68, 35, 12)$

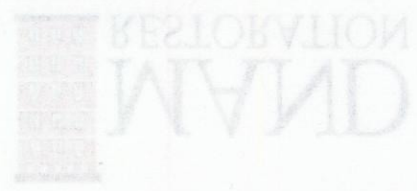
`table <- rbind(x, y, z)`

`chisq.test(table)`

$\chi^2 = 10.353, df = 4, p\text{-value} = 0.03488$

reject H_0 (no association between rows and cols) at 5% significance level.

i.e. there is significant evidence that there is some association between deaths in year group and district.



RESTORATION MAND
1 811 334 3043
P 999 505 8999
80801 YA 10808