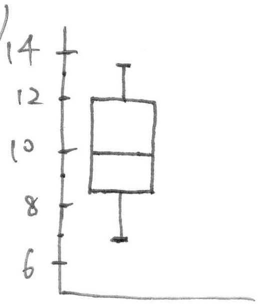
Stats Sample 3.

Q1. a) i) 6.9 7.9 8.8 9.3 10.6 11.3 12.7 13.2

$\{6.9,\ 8.35,\ 9.95,\ 12,\ 13.2\}$

ii)



fairly symmetric

No outlier $\quad 1.5\ iqr = 3.65 \times 1.5 = 5.475$

$8.35 - 5.475 = 2.875$

$12 + 5.475 = 17.475$

median 10, range $6.9 \sim 13.2$

iii) D. small standard deviation without any outlier.

iv) Normally distributed.

v) $\mu = \bar{x} \pm t_{7;\,0.975} \frac{s}{\sqrt{n}}$

$= 10.0875 \pm 2.365 \times \frac{2.2510}{\sqrt{8}}$

$= 10.0875 \pm 1.8822$

$= [8.2053,\ 11.9697]$

vi) $H_0: \mu = 9$ against $H_a: \mu > 9$

$t_0 = \frac{\sqrt{n}(\bar{x} - \mu_0)}{s} \sim t_{n-1}$

$= \frac{\sqrt{8}(10.0875 - 9)}{2.2510} \sim t_7$

$= 1.366.$

$t_{7;\,0.95} = 1.895.$

$1.366 \ngtr 1.895$

$\therefore$ Do not reject H_0.

Therefore we cannot contradict that the mean ozone concentration in his city does not exceed 9 ppm.

vii) P-value $= P(T > 1.366)$

from table $0.10 < \text{P-value} < 0.15$., means we can reject H_0 at any significance level greater than or equal to 0.15.

This is bigger than α, 0.05, So we do not reject H_0.

If we reject H_0, we would have $10\% \sim 15\%$ chance of being wrong.

b). See sample 1 Q2 b).

Q2. a) i) independence assumption
normality assumption.
equal variance assumption

ii) quantile plot — dots lies around a straight line shows normality.
plotting ~~res~~ residual against ~~time load~~ observation order. No pattern should be observed (independence)
plotting residuals against fitted value. No pattern shows equal variance.

b). 14.8182. ~~14.35~~

c) 99.6%

d) 0.998

e) 3.646

f) $H_0: \beta_1 = 0$ against $H_a: \beta_1 \neq 0$.

~~Reject H_0 if $\hat{b}_1 \notin [- t_{10; 0.975} \frac{S}{\sqrt{S_{xx}}}, \pm$~~

$t_0 = 48.6 \sim t_{10}$.

Reject H_0 if p-value $< \alpha$ (0.05).

p-value $= 2 \times P(T > 48.6) < 2 \times 0.0005 = 0.001 < 0.05$

$\therefore$ Reject H_0.

Therefore, X has significant impacts to Y.

g) $\beta_1 = \hat{b}_1 \pm t_{10; 0.975} \times \text{SE coef}$

$= 14.8182 \pm 2.228 \times 0.3049$

$= 14.8182 \pm 0.6793$

$= [14.1289, 15.4975]$

h) We have 0.081 chance of being wrong if we reject the hypothesis that there is an Y intercept ~~at X=0~~.

i). $\hat{y} = 4.348 + 14.8182 \times 7.5 = 115.3845$.

$\left[\hat{y} \pm 3.646 \times t_{10; 0.975} \sqrt{1 + \frac{1}{12} + \frac{(7.5 - 6.5)}{143}}\right] = [115.3845 \pm 0.9805]$

$= [114.404, 116.365]$

3. a). Independence

Normality

Equal variance.

b).

Source	df	SS	MS	F
Factor	2	165.778	82.889	13.04.
Error	15	95.333	6.356	
Total	17	261.111		

c). μ_1, μ_2, μ_3 be true mean tensile strength for different concentration

$H_0: \mu_1 = \mu_2 = \mu_3$ against H_a: Not all means equal.

observed $f_0 = 13.04$, following $F_{2;15}$

$f_{2;15;0.95} = 3.68 < 13.04$.

Reject ~~if $f_0 > f_{2;15;}$~~ H_0, since $f_0 > f_{2;15;0.95}$.

p-value $= P(X > 13.04)$ $X \sim F_{2;15}$.

p-value $< 0.005 < 0.05$.

∴ There is significant difference in ~~con~~ tensile strength at different concentration.

d) $CI = [\bar{X}_2 - \bar{X}_3 \pm t_{15;0.975}\sqrt{MS_{ER}(\frac{1}{n_2}+\frac{1}{n_3})}]$

$= [-1.33 \pm 2.131 \times \sqrt{6.356 \times (\frac{1}{6}+\frac{1}{6})}]$

$= [-1.33 \pm 3.102]$

$= [-4.432, 1.772]$

No. since $0 \in [-4.432, 1.772]$

e). $\frac{0.05}{3} = 0.0167$

$0.0004 < 0.0167$. ∴ Reject $H_0: \mu_1 = \mu_3$.

∴ Not same conclusion.