10.b $I = 4, \quad J = 10.$

	$x_{i\cdot}$	$\bar{x}_{i\cdot}$
1	260.8	26.08
2	246.9	24.69
3	299.5	29.95
4	338.4	28.64

$x_{\cdot\cdot}$	$\bar{x}_{\cdot\cdot}$
1145.6	28.64

$$SST_r = \frac{1}{J}\sum_{i=1}^{I} x_{i\cdot}^2 - \frac{1}{IJ}x_{\cdot\cdot}^2$$

$$= \frac{1}{10}\cdot(260.8^2 + 246.9^2 + 299.5^2 + 338.4^2) - \frac{1}{4\cdot 10}\cdot(1145.6^2)$$

$$= 509.122$$

$$SSE = \sum_{i=1}^{I}\sum_{j=1}^{J}(x_{ij} - \bar{x}_{i\cdot})^2$$

$$= 563.134$$

$$SST = \sum_{i=1}^{I}\sum_{j=1}^{J} x_{ij}^2 - \frac{1}{IJ}x_{\cdot\cdot}^2$$

$$= 1072.256 \quad = SST_r + SSE$$

$$MST_r = \frac{SST_r}{I-1} = 169.7073$$

$$MSE = \frac{SSE}{I(J-1)} = 15.6426$$

$$F = \frac{MST_r}{MSE} = 10.8490$$

$$df_{Tr} = I - 1 = 3$$

$$df_E = I(J-1) = 36$$

$$f_{0.01,3,36} \approx 4.51$$

$10.85 > 4.51$, reject H_0.

Source of variation	df	Sum of Squares	Mean Square	f
Treatment	3	509.122	169.7073	10.8490
Error	36	563.134	15.6426	
Total	39	1072.256		

10.26

	J_i	$x_{i.}$
1	4	56.4
2	5	64.0
3	4	55.3
4	4	52.4
5	5	85.7
6	4	72.4

n	$x_{..}$
26	386.2

a)

$$SST = \sum_{i=1}^{I}\sum_{j=1}^{J_i} x_{ij}^2 - \frac{1}{n}x_{..}^2 = 113.6446$$

$$SSTr = \sum_{i=1}^{I}\frac{1}{J_i}x_{i.}^2 - \frac{1}{n}x_{..}^2 = 108.1851$$

$$SSE = SST - SSTr = 5.4595$$

$$MSTr = \frac{SSTr}{I-1} = 21.6370 \qquad df_{Tr} = 5$$

$$MSE = \frac{SSE}{n-I} = 0.2730 \qquad df_E = 20$$

$$f = \frac{MSTr}{MSE} = 79.2638$$

Assume test at 0.01 level

$f_{0.01,5,20} = 4.10$ $\quad 79.2638 > 4.10$ $\quad$ reject H_0.

Source of variance	df	Sum of squares	Mean square	f
Treatment	5	108.1851	21.6370	79.2638
Error	20	5.4595	0.2730	
Total	25	113.6446		

b) $w_{ij} = Q_{\alpha, I, n-I} \cdot \sqrt{\frac{MSE}{2}\left(\frac{1}{J_i} + \frac{1}{J_j}\right)}$

at $\alpha = 0.01$, $I = 6$, $n-I = 20$,

$Q = Q_{0.01, 6, 20} = 5.51$ $\qquad$ CI : $(\mu_i - \mu_j) \pm w_{ij}$

i	j	$\mu_i - \mu_j$	w_{ij}	CI	
1.0000	2.0000	1.3000	1.3655	-0.0655	2.6655
1.0000	3.0000	0.2750	1.4394	-1.1644	1.7144
1.0000	4.0000	1.0000	1.4394	-0.4394	2.4394
1.0000	5.0000	-3.0400	1.3655	-4.4055	-1.6745
1.0000	6.0000	-4.0000	1.4394	-5.4394	-2.5606
2.0000	3.0000	-1.0250	1.3655	-2.3905	0.3405
2.0000	4.0000	-0.3000	1.3655	-1.6655	1.0655
2.0000	5.0000	-4.3400	1.2874	-5.6274	-3.0526
2.0000	6.0000	-5.3000	1.3655	-6.6655	-3.9345
3.0000	4.0000	0.7250	1.4394	-0.7144	2.1644
3.0000	5.0000	-3.3150	1.3655	-4.6805	-1.9495
3.0000	6.0000	-4.2750	1.4394	-5.7144	-2.8356
4.0000	5.0000	-4.0400	1.3655	-5.4055	-2.6745
4.0000	6.0000	-5.0000	1.4394	-6.4394	-3.5606
5.0000	6.0000	-0.9600	1.3655	-2.3255	0.4055

c). $\frac{(\bar{X}_1 + \bar{X}_2 + \bar{X}_3 + \bar{X}_4)}{4} - \frac{(\bar{X}_5 + \bar{X}_6)}{2} = \hat{\theta} = -4.1638$

$\sum \frac{c_i^2}{J_i} = \left(\frac{1}{4}^2\right) \cdot \left(\frac{1}{4} + \frac{1}{5} + \frac{1}{4} + \frac{1}{4}\right) + \left(-\frac{1}{2}^2\right) \cdot \left(\frac{1}{5} + \frac{1}{4}\right) = 0.1719$

for a 0.01 level, (99% CL)

$t_{\alpha/2, n-I} = t_{0.005, 20} = 2.8453$

CI: $-4.1638 \pm 2.8453 \cdot \sqrt{0.273 \cdot 0.1719}$

$= (-4.7801, -3.5474)$

10.38 $\bar{x}_{i.}$ $\sum\sum x_{ij}^2$ $I=5$, $J=6$, $n=30$

$$\bar{x}_{..} = \frac{1}{5}\sum \bar{x}_{i.} = 2.448$$

$$SST = \sum_i \sum_j x_{ij}^2 - \frac{(\sum_i \sum_j x_{ij})^2}{n}$$

$$= 183.4 - \frac{(2.448 \times 30)^2}{30}$$

$$= 3.6189$$

$$SSE = \sum_i \sum_j x_{ij}^2 - \sum_i \frac{(\sum x_{ij})^2}{J_i}$$

$$= 183.4 - \sum_i \frac{(\bar{x}_{i.} \cdot 6)^2}{6}$$

$$= 2.6896$$

$$SSTr = SST - SSE = 0.9293$$

$$MSTr = \frac{SSTr}{I-1} = 0.2323 \qquad df_{Tr} = I-1 = 4$$

$$MSE = \frac{SSE}{n-I} = 0.1076 \qquad df_E = n-I = 25$$

$$f = \frac{MSTr}{MSE} = 2.1594$$

Source	df	SS	MS	f
Tr	4	0.9293	0.2323	2.1594
Err	25	2.6896	0.1076	
Total	29	3.6189		

at $\alpha = 0.05$,

$f_{0.05,4,25} = 2.7587 > 2.1594$. Not enough evidence to reject H_0

True average DNA content is unaffected by type of carbonhydrates in the diet.

10.39

$$\theta = \mu_1 - (\mu_2 + \mu_3 + \mu_4 + \mu_5)/4$$

$$\hat{\theta} = \bar{X}_1 - (\bar{X}_2 + \bar{X}_3 + \bar{X}_4 + \bar{X}_5)/4 = 0.1650$$

$$\sum \frac{c_i^2}{J_i} = \frac{1}{6} + \frac{1}{4}^2 \left(\frac{1}{6} \cdot 4\right) = 0.2083$$

for $\alpha = 0.05$, $t_{0.025, 25} = 2.0595$

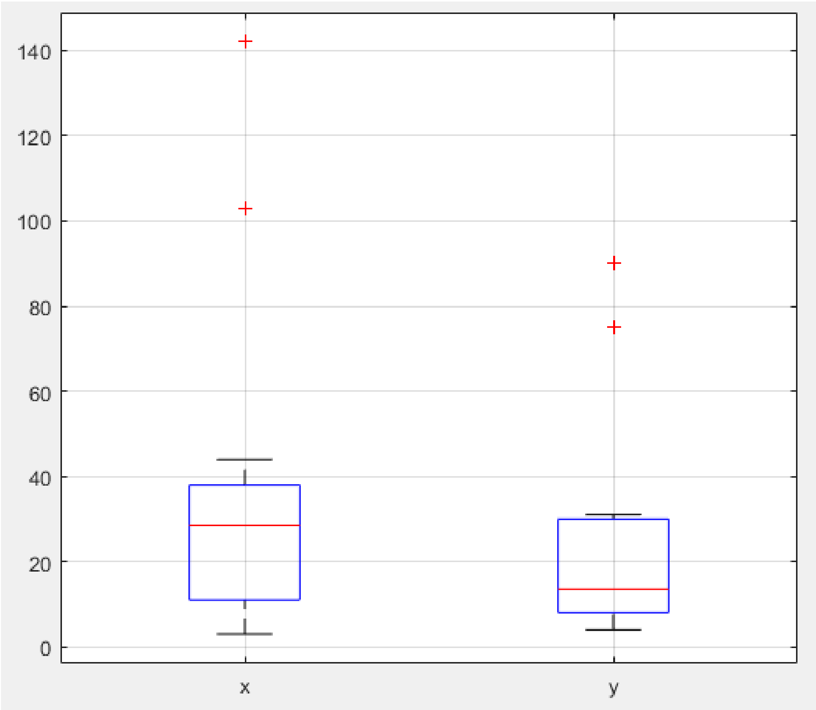
CI: $0.1650 \pm 2.0595 \cdot \sqrt{0.1076 \cdot 0.2083}$

$= (-0.1433, 0.4733)$

The interval include zero.

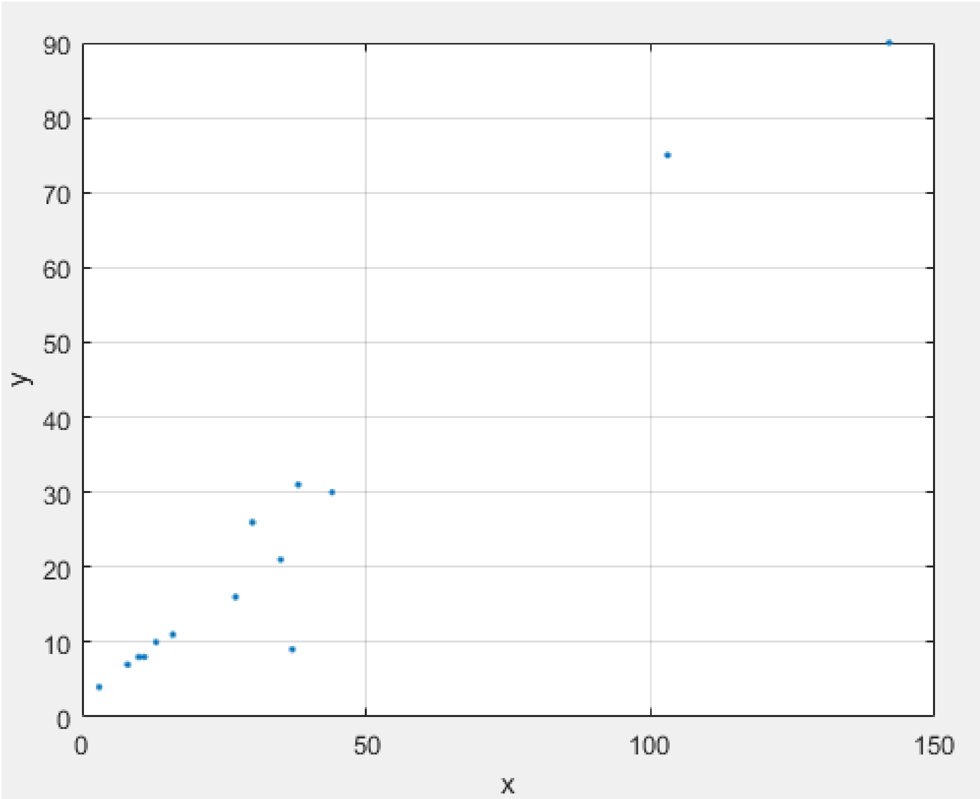
12.4

a)



The IQR of both x & y are quite similar, but the median of x is larger than that of y. Both sets of data have the same number of outliers on the top/ larger side.

b)



x & y show a roughly linear correlation, with some outliers.

12.9 $y = -0.12 + 0.095x$

a) $\Delta x = 1$ in

$\Delta y = 0.095$ m^3/min. It is the slope of the regression line.

b) $\Delta x = 5$ in

$\Delta y = 5 \times 0.095 = -0.475$ m^3/min

c) $x = 10$, $\mu_y = 0.83$ $x = 15$ $\mu_y = 1.305$

d) $\sigma = 0.025$

$$P(y > 0.835) = 1 - \Phi\left(\frac{0.835 - 0.83}{0.025}\right)$$

$$= 1 - 0.5793$$

$$= 0.4207$$

$$P(y > 0.84) = 1 - \Phi\left(\frac{0.01}{0.025}\right)$$

$$= 0.3446$$

e) $P(y_{10} > y_{11}) = P(y_{10} - y_{11} > 0)$

$$= 1 - \Phi\left(\frac{0.095}{0.0354}\right)$$

$$= 0.0036$$

$\mu_{y|11} = 0.925$

$E(Y_1 - Y_2) = \mu_{y|10} - \mu_{y|11} = -0.095$

$V(Y_1 - Y_2) = 0.025^2 \cdot 2 = 0.00125$

$\sigma' = \sqrt{0.00125} = 0.0354$