1.

x	y	$(x_i-\bar{x})^2$	$(y_i-\bar{y})^2$	$(x_i-\bar{x})(y_i-\bar{y})$
40	56	2025	13853.29	5296.5
10	62	5625	12476.89	8377.5
100	195	225	453.69	319.5
110	240	625	4395.69	1657.5
120	170	1225	13.69	-129.5
150	270	4225	9273.69	6259.5
20	48	4225	15800.49	8170.5
90	196	25	497.29	111.5
80	214	25	1624.09	-201.5
130	286	2025	12611.29	5053.5
		20250 $=S_{xx}$	71000.1 $=S_{yy}$	108915 $=S_{xy}$

$\bar{x} = 85$

$\bar{y} = 173.7$

$\hat{\beta} = \frac{S_{xy}}{S_{xx}} = \frac{108915}{20250} = 5.3785$

$\hat{\alpha} = \bar{y} - \hat{\beta}\bar{x} = 173.7 - (5.3785)85$

$= -283.47$

$y = -283.47 + 5.3785x$

2. i $\hat{\beta}^2 = \frac{S_{xy}}{S_{xx}} = \frac{875.16}{301.66} = 2.9$

$\hat{\alpha} = \bar{y} - \hat{\beta}^2 \bar{x} = 32.1 - 2.9(96.875 - 2.9(32.1)$

$= 3.785$

$y = 3.785 + 2.9x$

ii $\hat{\sigma}^2 = \frac{1}{10}(875.16$

$= \frac{1}{n-2}\left(S_{yy} - \frac{S_{xy}^2}{S_{xx}}\right) = \frac{1}{10}\left(6409.7125 - \frac{875.16^2}{301.66}\right)$

$= 387.07$

$se(\hat{\beta}) = \sqrt{\frac{\hat{\sigma}^2}{S_{xx}}} = \sqrt{\frac{387.07}{301.66}} = 1.133276$

$\hat{\beta}^2 \pm t_{10, 0.025}\, s.e(\hat{\beta}^2)$

$2.9 \pm 2.228\,(1.13276)$

$(0.376, 5.424)$

iii $\hat{y}_{x_0} = 3.785 + 2.9(40) = 119.78)$

$\therefore$ 95% CI $= 119.78 \pm 2.228\sqrt{387.07\left(\frac{1}{12} + \frac{(40 - 32.1)^2}{301.66}\right)}$

$= 119.78 \pm 2.228\,(10.5989)$

$(96.17, 143.39)$

3

i Difference b/w mean time taken to commute is in order City A to D
Variation for City C lowest while highest for D

ii Populations normal
Populations must have common variance
Independent observations

iii H_0: Mean differences same
H_1: not same

$SS_{TOT} = 1116.11$ $SS_{REG} = 516.11$ $SS_{RES} = 600$

ANOVA TABLE

	dF	SS	MSS	F
REG	3	516.11	172.04	6.88
RES	24	600	25	
TOT	27	1116.11		

$f_{3,24_{tab}} = 3.009 << f_{Cal}$

∴ Reject at 5% level

4

5

6. i $r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}} = \frac{661.2}{\sqrt{54.9 \times 8923.6}} = 0.94466$

ii $\hat{\beta} = \frac{661.2}{54.9} = 12.044$

$\hat{\alpha} = 56.2 - 12.044(3.9) = -413.516$

$y = -413.516 + 12.044x$

iii $SS_{TOT} = S_{yy} = 8923.6$

$SS_{REG} = \frac{661.2^2}{54.9} = 7963.305$

$SS_{RES} = 8923.6 - 7963.305$
$= 960.295$

iv $R^2 = 0.8924$

7. i $\hat{\beta} = \frac{-954.9672}{4789.4221} = -0.199439$

$\hat{\alpha} = 17.985 - (-0.19939)(15.83)$
$= 21.141$

$y = 21.141 - 0.19939x$

ii $\hat{\sigma}^2 = \frac{1}{9}\left(1189.21 - \frac{(-954.9672)^2}{4789.4221}\right) = 110.977$

$s.e(\hat{\beta}) = \sqrt{\frac{110.977}{4789.4221}} = 0.152$

$\frac{\hat{\beta} - 0}{s.e(\hat{\beta})} \sim t_{n-2}$ $\quad \frac{-0.19939}{0.152} = -1.3117 < t_{9,tab}$

∴ Do not reject

iii $r = \frac{-954.7672}{\sqrt{4789.4221 \times 1189.21}} \approx -0.4001$

8

9.

i Moderate negative relationship

ii $R = \frac{-296}{\sqrt{75 \times 7482.4}} = -0.686$

iii

iv $R^2 = 0.4706$

10.