Econ 102_A01-A04 (Analysis of Economic Data): Cameron Spring 2021
Solutions to Second Midterm Exam

Version A

1.(a) $H_0 : \mu \geq 5$ against $H_a : \mu < 5$. (Make the claim the alternative).
$p = 0.03$ was for 2-sided test with area in both tails. For a 1-sided test we therefore halve and $p = 0.03/2 = 0.015$ (and note that $\bar{x} = 4.4 < \mu = 5$ so we are in the left tail as desired).
Since $p = 0.015 < 0.05$ we reject H_0 at 5%.
(b) The regression fit is more flexible and is not restricted to be linear (it is nonparametric).
(c) Correlation $= 50/(\sqrt{25} \times \sqrt{100}) = 50/(5 \times 10) = 50/50 = 1.0$.
(d) $b_2 = 50/25 = 2$.
(e) $R^2 = 30/200 = 0.15$.

2.(a) $b_2 = 14.79$ so a \$1 increase in capital is associated with output \$14.79 higher.
(b) A 95% confidence interval for β_2 is (13.01, 16.57) from the regression output.
(c) A 90% confidence interval for β_2 is $b_2 \pm t_{40,.05} \times s_{b_2} = 14.791 \pm invttail(40, .05) \times 0.8793$
$= 14.791 \pm 1.684 \times 0.8793 = 14.791 \pm 1.481 = (13.31, 16.27)$.
(d) $H_0 : \beta_2 = 13$ against $H_a : \beta_2 \neq 13$.
$t = (b_2 - 13)/s_{b2} = (14.791 - 13)/0.8793 = 1.791/0.8793 = 2.036$.
Since $t = 2.036 < t_{40,.005} = invttail(40, .005) = 2.704$ we do not reject H_0 at 1% level.
Conclude that a \$1 million increase in capital spending may be associated with a \$13 million increase in output when testing at level 0.01.
(e) `2*ttail(40,2.0361)` or `test k=13`
(f) $\widehat{q} = -372 + 14.791 \times 3000 = -372 + 44373 = 44,001$.
(g) `regress q k, vce(robust)`.
(h) 16344 from output.

3.(a) 1. Model $y_i = \beta_1 + \beta_2 x_i + u_i$
2. Zero conditional mean error. $\mathrm{E}[u_i|x_i] = 0$ for all i.
3. Constant conditional variance error. $\mathrm{Var}[u_i|x_i] = \sigma_u^2$ for all i.
4. Independent errors. u_i independent of u_j for all $i \neq j$.
(b) Assumptions 1 and 2 are necessary for unbiasedness.
(c) We expect 8 as here OLS is unbiased so the average of the slopes approximately equals $\beta_2 = 8$.
(d) Heteroskedastic standard errors should be used. The error is heteroskedastic with variance $9\mathbf{x}^2$ (and independent).

4.(a) $u = y - (9 + 3 \times 3) = 20 - 18 = 2$
(b) $\widehat{y} = 10 + 2 \times 3 = 16$.
(c) $e = y - \widehat{y} = 20 - 16 = 4$.

Multiple Choice for Version A

Question	**1.**	**2.**	**3.**	**4.**	**5.**
Answer Version A	*d*	*b*	*d*	*d*	*a*

Version B

1.(a) $H_0 : \mu \leq 4$ against $H_a : \mu > 4$. (Make the claim the alternative).
$p = 0.08$ was for 2-sided test with area in both tails. For a 1-sided test we terefore halve and $p = 0.08/2 = 0.04$ (and note that $\bar{x} = 5.4 > 4$ so we are in the right tail as desired).
Since $p = 0.04 < 0.05$ we reject H_0 at 5%.
(b) The regression fit is more flexible and is not restricted to be linear (it is nonparametric).
(c) Correlation $= 200/(\sqrt{6400} \times \sqrt{25}) = 200/(80 \times 5) = 200/400 = 0.5$.
(d) $b_2 = 200/6400 = 1/32 = 0.03125$.
(e) $R^2 = 100/(100 + 40) = 100/140 = 0.714$.

2.(a) $b_2 = 12.77$ so a \$1 increase in capital is associated with output \$12.77 higher.
(b) A 95% confidence interval for β_2 is (11.49, 14.05) from the regression output.
(c) A 99% confidence interval for β_2 is $b_2 \pm t_{49,.005} \times s_{b_2}$
$= 12.774 \pm invttail(49, .005) \times 0.6377 = 12.774 \pm 2.680 \times 0.6377 = 12.774 \pm 1.709 = (11.06, 14.48)$.
(d) $H_0 : \beta_2 = 10$ against $H_a : \beta_2 \neq 10$.
$t = (b_2 - 10)/s_{b2} = (12.774 - 10)/0.6377 = 2.774/0.6377 = 4.350$.
Since $t = 4.350 > t_{49,.05} = invttail(49, .05) = 1.677$ we reject H_0 at 10% level.
Conclude that a \$1 million increase in capital spending is not associated with a \$10 million increase in output when testing at level 0.10.
(e) `2*ttail(49,4.350)` or `test k=10`
(f) 16991 from output
(g) $\widehat{q} = 3649 + 12.774 \times 4000 = 3649 + 51096 = 54,745$.
(h) `regress q k, vce(robust)`.

3.(a) $\widehat{y} = 9 + 3 \times 4 = 21$.
(b) $e = y - \widehat{y} = 20 - 21 = -1$.
(c) $u = y - (10 + 2 \times 4) = 20 - 18 = 2$

4.(a) 1. Model $y_i = \beta_1 + \beta_2 x_i + u_i$
2. Zero conditional mean error. $\mathrm{E}[u_i|x_i] = 0$ for all i.
3. Constant conditional variance error. $\mathrm{Var}[u_i|x_i] = \sigma_u^2$ for all i.
4. Independent errors. u_i independent of u_j for all $i \neq j$.
(b) Assumptions 1 and 2 are necessary for unbiasedness.
(c) We expect 3 as here OLS is unbiased so the average of the slopes approximately equals $\beta_2 = 3$.
(d) Default standard errors are fine. The error is homoskedastic (with constant variance 12) and independent.

Multiple Choice for Version B

Question	**1.**	**2.**	**3.**	**4.**	**5.**
Answer Version B	*c*	*a*	*b*	*b*	*c*

The course grade will be based on a curve from the combined scores of midterm 1 (20%), midterm 2 (20%), final (50%) and assignments (20%). **The curve for this exam is only a guide**. Curve below has average GPA 2.72 for this exam.

Scores out of	34
$75th$ percentile	27.5 (81%)
Median	24.5 (72%)
$25th$ percentile	21 (62%)

A+	33 and above	C+	21 and above
A	29 and above	C	20 and above
A-	27 and above	C-	19 and above
B+	25.5 and above	D+	18 and above
B	24 and above	D	17 and above
B-	22.5 and above	D-	16 and above