Econ 102 (Analysis of Economic Data): Cameron Spring 2015
Solutions to First Midterm Exam

Version A

1.(a) No. `growth` does not appear to be normally distributed.
This is a judgement call but the data appear to be right-skewed.
Skewness $0.64 > 0$ by a fair bit OR mean 4.15 greater than the median 3.29 OR e.g. the 5th percentile is 2.8 below the median but the 95th percentile is 6.7 above the median.

(b) Use a histogram OR smoothed histogram OR kernel density estimate.

(c) For variable `growth` interquartile range $= 5.993 - 2.057 = 3.936$.

(d) Since average growth rate is 4.15%, real tuition and fees double in $72/4.15 = 17.35$ years. So doubled in year $2014 + 17 = 2031$.

(e) This question meant to ask for the change in the overall price level. Nominal and real were the same in 2014. In 1986 their ratio was $2739/1259 = 2.176$. Prices are 2.176 times higher, an increase of 117.7 percent.
Alternative correct answer if you interpreted it as change in tuition and fees is 8471-1259=7212.

(f) From 1986 to 2014 Δ lnNominal$= (9.0444 - 7.1381) = 1.9063$ in 28 years.
So increase at $1.9063/28 = 0.068$ per year or 6.8% per year.

2.(a) A 95 percent confidence interval is $4.155236 \pm t_{.025;27} \times 2.974328/\sqrt{28}$
$= 4.155236 \pm 2.0518305 \times 0.562095 = 4.155236 \pm .1.1533237 =$ (3.0019, 5.3086).

(b) $H_0 : \mu = 5$ against $H_0 : \mu \neq 5$.
$t = (4.155236 - 5)/(2.974328/\sqrt{28}) = -1.5029$.
Since $|t| = 1.5029 < t_{.05;27} = 1.7033$ do not reject H_0.
We do not reject $H_0 : \mu = 5$ at significance level .10.

(c) `tsset year` and `generate growth = 100*(real-l.real)/l.real`
OR `generate growth = 100*(real[_n]-real[_n-1])/real[_n-1]`

(d) `import delimited using tuition.csv` OR `insheet using tuition.csv`

3.(a) $\bar{x} = (6 + 4 + 2 + 8)/4 = 20/4 = 5$.
$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2 = \frac{1}{3}[(1)^2 + (-1)^2 + (-3)^2 + (3)^2] = \frac{1}{3}[1 + 1 + 9 + 9] = 20/3 = 6.667$.
(b) $\mu = \mathrm{E}[X] = 0.1 \times 10 + 0.3 \times 20 + 0.6 \times 30 = 1 + 6 + 18 = 25$.
$\sigma^2 = \mathrm{E}[(X - \mu)^2] = 0.1 \times (10 - 25)^2 + 0.3 \times (20 - 25)^2 + 0.6 \times (30 - 25)^2$
$= 0.1 \times 225 + 0.3 \times 25 + 0.6 \times 25 = 22.5 + 7.5 + 15 = 45$.
$\sigma = \sqrt{45} = 6.71$.

(c) Mean of $\bar{x} \simeq 200$ since $\mathrm{E}[\bar{X}] = \mathrm{E}[X] = 200$.
Standard deviation of $\bar{x} \simeq 1.41$ since $\mathrm{SD}[\bar{X}] = \mathrm{SD}[X]/\sqrt{50} = 10/\sqrt{50} = 1.41$.

(d) 0.4 since variable `x` equals 1 with probability 0.4 and equals 0 with probability 0.6.

Multiple Choice for Versions A and B

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

For 3. unemployment rate = 100×Unemp/(Emp+Unemp)$= 100 \times 40/(40 + 160)$.
For 4. it is a market-value weighted index and is for the largest companies.
For 5. it is $T = (\bar{X} - \mu)/(s/\sqrt{n})$ that is $T(n-1)$ distributed.

Version B

1.(a) For variable `growth` interquartile range $= 6.306 - 2.106 = 4.200$.

(b) No. `growth` does not appear to be normally distributed.
This is a judgement call but the data appear to be right-skewed.
Skewness $0.59 > 0$ by a fair bit OR mean 4.42 greater than the median 3.42 OR e.g. the 5th percentile is 2.4 below the median but the 95th percentile is 6.6 above the median.

(c) Use a histogram OR smoothed histogram OR kernel density estimate.

(d) This question meant to ask for the change in the overall price level. Nominal and real were the same in 2014. In 1986 their ratio was $2739/1259 = 2.176$. Prices are 2.176 times higher, an increase of 117.7 percent.
Alternative correct answer if you interpreted it as change in tuition and fees is 8026-1259=6767.

(e) Since average growth rate is 4.42%, real tuition and fees double in $72/4.42 = 16.29$ years. So doubled in year $2012 + 16 = 2028$.

(f) From 1986 to 2012 Δ lnNominal$= (8.9904 - 7.1381) = 1.8253$ in 26 years.
So increase at $1.8253/26 = 0.070$ per year or 7.0% per year.

2.(a) A 99 percent confidence interval is $4.417446 \pm t_{.005;25} \times 2.923442/\sqrt{26}$
$= 4.417446 \pm 2.7874358 \times 0.573334 = 4.417446 \pm 1.5981312 =$ (2.8193, 6.0156).

(b) $H_0 : \mu = 5$ against $H_0 : \mu \neq 5$.
$t = (4.417446 - 5)/(2.923442/\sqrt{26}) = -1.01608$.
Since $|t| = 1.0161 < t_{.025;25} = 2.0595$ do not reject H_0.
We do not reject $H_0 : \mu = 5$ at significance level .05.

(c) `tsset year` and `generate growth = 100*(real-l.real)/l.real`
OR `generate growth = 100*(real[_n]-real[_n-1])/real[_n-1]`

(d) `import delimited using fees.csv` OR `insheet using fees.csv`

3.(a) $\bar{x} = (7 + 1 + 3 + 5)/4 = 16/4 = 4$.
$s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2 = \frac{1}{3}[(3)^2 + (-3)^2 + (-1)^2 + (1)^2] = \frac{1}{3}[9 + 9 + 1 + 1] = 20/3 = 6.667$.
(b) $\mu = \mathrm{E}[X] = 0.7 \times 10 + 0.1 \times 20 + 0.2 \times 30 = 7 + 2 + 6 = 15$.
$\sigma^2 = \mathrm{E}[(X - \mu)^2] = 0.7 \times (10 - 15)^2 + 0.1 \times (20 - 15)^2 + 0.2 \times (30 - 15)^2$
$= 0.7 \times 25 + 0.1 \times 25 + 0.2 \times 225 = 17.5 + 2.5 + 45 = 65$. So $\sigma = \sqrt{65} = 8.06$.

(c) Mean of $\bar{x} \simeq 400$ since $\mathrm{E}[\bar{X}] = \mathrm{E}[X] = 400$.
Standard deviation of $\bar{x} \simeq 2.83$ since $\mathrm{SD}[\bar{X}] = \mathrm{SD}[X]/\sqrt{50} = 20/\sqrt{50} = 2.83$.

(d) 0.6 since variable `x` equals 1 with probability 0.6 and equals 0 with probability 0.4.

Multiple Choice for Version B: See previous page.

The course grade will be based on a curve from the combined scores of midterm 1 (22.5%), midterm 2 (22.5%), final (45%) and assignments (10%). **The curve for this exam is only a guide**. Suggested average GPA for this course is 2.4. Curve below has average GPA 2.55 for this exam.

Scores out of	30
75*th* percentile	24.5 (82%)
Median	22 (73%)
25*th* percentile	10 (67%)

A+	28 and above	C+	21 and above
A	26 and above	C	20 and above
A-	25 and above	C-	19 and above
B+	24 and above	D+	18 and above
B	23 and above	D	17 and above
B-	22 and above	D-	16 and above