Stat 200 Exam 3 April 18, 2017

PRINT NAME_____ _____ _____
(Last name) (First name) (net ID, your UI email)

CIRCLE SECTION L1 (11am) or L2 (2 pm)

Write answers in appropriate blanks. When no blanks are provided **CIRCLE** your answers.

SHOW WORK when requested, otherwise points will be deducted.

No notes or books are allowed. Calculators (including graphing ones) are allowed.
Do not use your own scrap paper. If you need some, ask a proctor.

Make sure you have all 5 pages (7 problems).

DO NOT WRITE BELOW THIS LINE

The numbers written in each blank below indicate how many points you missed on each page. The numbers printed to the right of each blank indicate how many points each page is worth.

Page 1 _____ 15

Page 2 _____ 33

Page 3_____28

Page 4 _____ 18

Page 5 _____ 14

Score _____

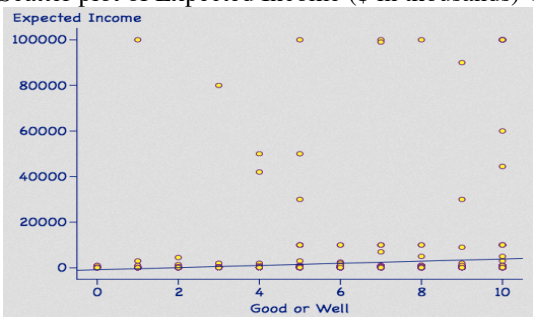
Scores will be posted late tonight and exams returned in class on Thursday.

Question 1 *(15 pts.)* pertains to this semester's 1209 responses to these 2 survey questions:

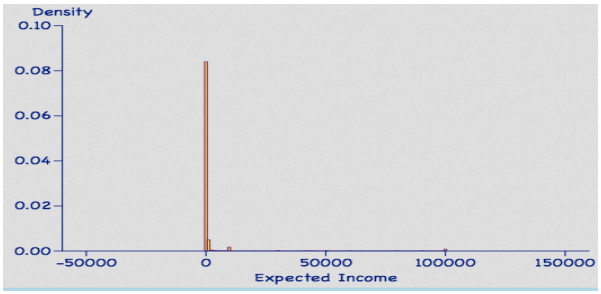
1. (Good or Well) When you graduate are you more interested in "doing good" (helping others) or "doing well" (gaining material resoures)? On a scale of 0-10 rate where you fall:"0" means "doing good" ..... and"10" means "doing well"

2. (Expected Income) Twenty years down the road, how much money do you expect to make per year? ($ in thousands)

Scatter plot of Expected Income ($ in thousands) vs Good or Well Ratings



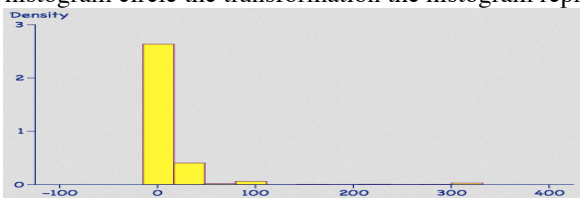
Histogram of Expected Income ($ in thousands)



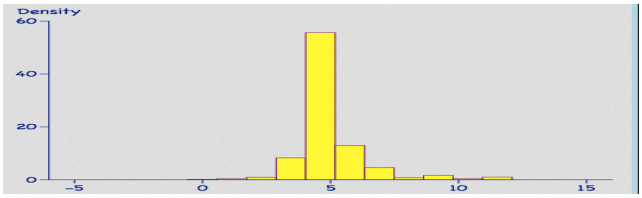
a) *(3 pts.)* Look how the Y values are squished at the bottom of the plot and how skewed the histogram of Expected Income is. I want to transform Y to make its histogram more normal. Which transformations would definitely **not** work? Circle ALL that could NOT work.

i) Y^2 ii) Y^3 iii) e^Y iv) $\sqrt{Y}$ v) ln(Y) vi) 1/Y

b) *(4 pts.)* Below are histograms of the transformed Expected Income. Which of the 6 transformations do the histograms depict? Below each histogram circle the transformation the histogram represents.

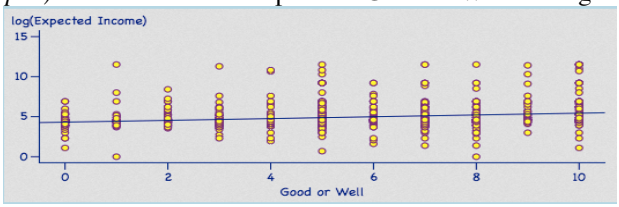


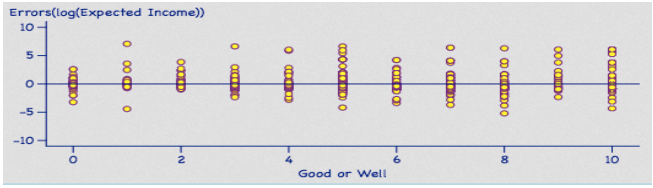
i)Y^2 ii) Y^3 iii) e iv) $\sqrt{Y}$ v) ln(Y) vi) 1/Y



i)Y^2 ii) Y^3 iii) e iv) $\sqrt{Y}$ v) ln(Y) vi) 1/Y

c) *(8 pts.)* Below is the scatter plot of "Good or Well" ratings vs ln (Expected Income) on the left and the residual plot on the right.





The regression equation is: **Predicted ln(Expected Income) = 4.3 + 0.11 * (Good or Well rating) and SD_{errors} = 1.3**

i. *(2 pts.)* Use the above equation to estimate the **ln(Exp. Income)** of a student with a "Good or Well" rating of = **5**

ln (Expected Income) = _____ Don't round answer.

ii. *(2 pts.)* Now estimate that students' expected income ($ in thousands) . (Use the result from (i) to find ii.) **Show work.**

Expected Income = $ _____ (in thousands). *Round answer to 2 decimal places.*

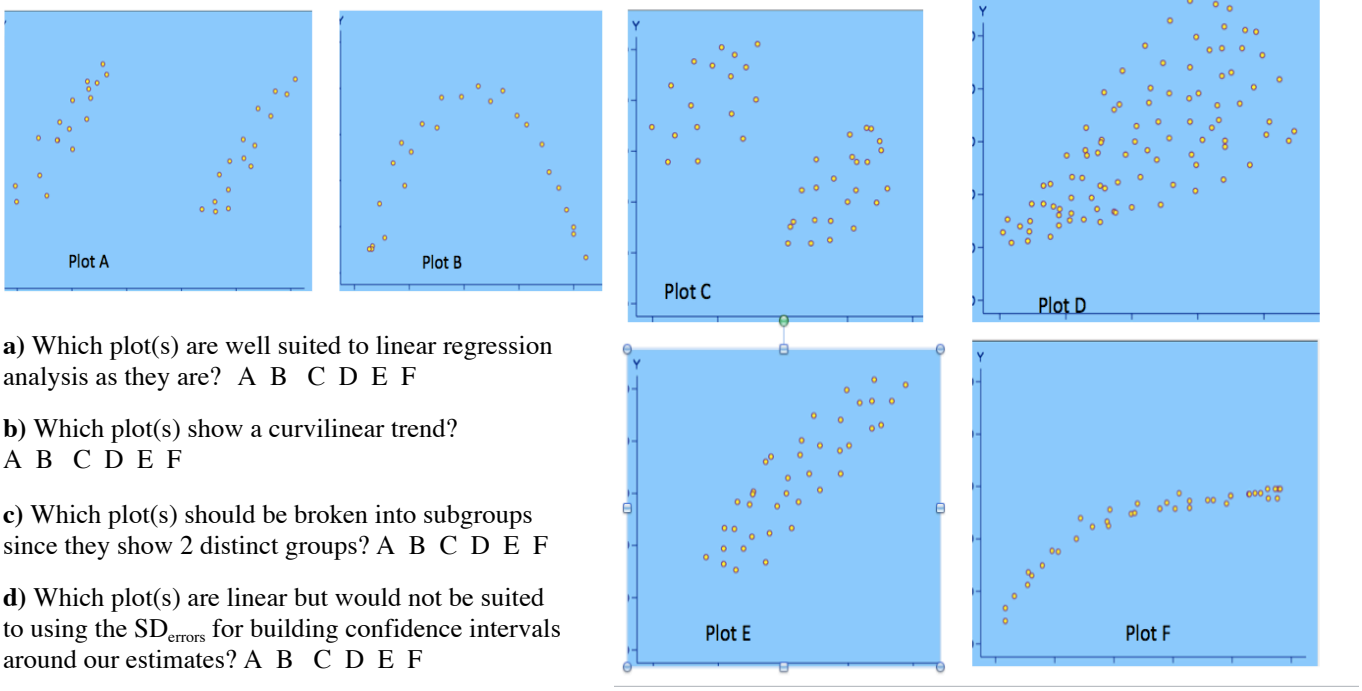
iii. *(2 pts.)* Compute a 95% Confidence Interval for your estimate in part ii. (You may use Z=2 as the critical value for 95%) **Show work.** *Round to 2 decimal places.*

($_____, $_____) ($ in thousands)

iv. *(2 pts.)* A 95% Confidence Interval for the **expected Income** of another student is ($5.47 to $992.27) ($ in thousands), what is his estimated Expected Income? **Show work.** *Round to 2 decimal places.*

Estimated Expected Income = _____($ in thousands)

Question 2 *(8 pts.)* **Each plot will be the answer to *exactly* one of the questions.**



a) Which plot(s) are well suited to linear regression analysis as they are? A B C D E F

b) Which plot(s) show a curvilinear trend? A B C D E F

c) Which plot(s) should be broken into subgroups since they show 2 distinct groups? A B C D E F

d) Which plot(s) are linear but would not be suited to using the SD_{errors} for building confidence intervals around our estimates? A B C D E F

Question 3 *(10 pts.)* For which of following would it be appropriate to use either simple or multiple logistic regression? **Circle Yes if appropriate, No if not.**

- **i)** Predicting whether you get an A, B, or C on a test from hours studying. **a)**Yes **b)**No
- **ii)** Predicting whether you get an A on a test from hours of studying **a)**Yes **b)**No
- **iii)** Predicting surviving breast cancer 5 years after diagnosis based on type of treatment. **a)**Yes **b)**No
- **iv)** Predicting years of survival after breast cancer diagnosis based on type of treatment. **a)**Yes **b)**No
- **v)** Predicting ln(Income) from years of education. **a)**Yes **b)**No

Question 4: *(15 pts.)* For the following problems p is defined as the probability of "success" and 1-p is the probability of "failure". **Fill out the 15 missing values in the table below.**

p					
1-p		**5/9**			**0.2**
odds	**0.25**			**5/4**	
ln(odds)			**0**		

Express p, 1-p and odds as fractions for 2nd and 4th columns.

← Round ln(odds) to 2 decimal places.

Question 5 *(28 pts.)*

On our last survey, **1427** students anonymously answered these 3 questions:

1. Would you date someone who is transgender? (No = 0, Yes =1)
2. How many children would you ideally like to have?
3. Are you male or female? (Males=0, Females=1)

	Slopes	SE	Z	p-values
Intercept	-1.604	0.2169	-7.397	< .005%
Gender	1.002	0.1907	5.252	< .005%
children	-0.3823	0.06538	-5.848	< .005%

Suppose the 1427 students were randomly selected from all 40,000 UI undergrads. Above is the output of the logistic regression model used for predicting the probability of dating a transgender from gender and ideal number of children:

a) *(2 pts.)* Are Males more or less likely than Females to date a transgender given the same # of children they want? ***Choose one:***

i) More **ii)** Less **iii)** Same **iv)** Not enough info

b) *(2 pts.)* The more children desired the _____ the probability of dating a transgender given the same sex? ***Choose one:***

i) Higher **ii)** Lower **iii)** Same **iv)** Not enough info

c) *(2 pts.)* Fill in the 3 missing blanks in the ln(odds) regression equation:

$$\textbf{Predicted } \ln\left(\frac{\hat{p}}{1-\hat{p}}\right) = \_\_\_\_\_ + \_\_\_\_\_ * \text{Gender} + \_\_\_\_\_ * \text{Children}$$

d) *(4 pts.)* What's the estimated odds ratio for Gender? _____ for Children? _____ *Round to 2 decimal places.* ***Show work.***

e) *(12 pts.)* Use the regression equation to predict the ln(odds), odds, and probability of dating a transgender for the individuals in the table below: ***Show work and round all answers to 3 decimal places. You may use rounded answers in your calculations.***

Gender	Children	ln(odds)	Odds	p
Male	0			
Female	0			
Male	3			
Female	3			

f) *(2 pts.)* Kate wants 3 more children than Sarah , compare their **odds** of dating a transgender.

The odds of Kate dating a transgender is _____ times the **odds** of Sarah dating a transgender.

i) 0.68 x 3 **ii)** 0.68^3 **iii)** 1.47 x 3 **iv)** 1.47^3 **v)** Not enough info

g) *(2 pts.)* Kate wants 3 more children than Sarah , compare their **probability** of dating a transgender.

The probability of Kate dating a transgender is _____ times the **probability** of Sarah dating a transgender.

i) $\frac{\text{answer to f above}}{1+\text{ answer to f above}}$ **ii)** $\frac{1}{0.6177}$ iii) $\frac{0.68}{1.68}$ **iii)** Not enough info

h) *(2 pts.)* The odds of a female dating a transgender are the same as the odds of a male dating a transgender when the female wants _____ more children than the male. ***Show work.*** *Round answer to 2 decimal places. (The answer won't be a whole number.)*

Question 6 *(18 pts.)* A fourth question asked on the same survey was: Are you a US citizen? (No=0 and Yes=1)
Let's add Citizen as a predictor variable to the example in Question 5. Below is the output from the logistic regression model predicting the probability of dating a transgender from Gender (Female=1, Male=0), Citizen (No=0, Yes=1) and # Children wanted.

Y	R	n	# X's	Chi-square	df	p-value
Date Transgender?	0.2538	1427	3	76.59		< .005%

	Slopes	SE	Z	p-values
Intercept	-2.136	0.2829	-7.550	< .005%
Gender	0.9997	0.1916	5.217	< .005%
citizen	0.7664	0.2414		
children	-0.4360	0.06759	-6.451	< .005%

a) *(2 pts.)* A Chi Square test was done for the overall regression effect. If the sample size were smaller would it have been appropriate to do an F test instead? ***Circle one***: **i)** Yes **ii)** No

b) (2 pts.) How many degrees of freedom for the Chi-square test? ___

c) *(2 pts.)* Calculate the Z stat to test $\mathbf{H_0 : Slope_{citizen} = 0}$ $\mathbf{H_A: Slope_{citizen} \neq 0}$

Z= _____ **Is the p-value < 5%? _____**
(*Round to 2 decimals*.)

d) *(2pts.)* If the sample size were smaller would it have been appropriate to do a t test for the slope instead of a z test? ***Circle one:*** **i)** Yes **ii)** No

e) *(2 pts.)* To test whether the individual slopes are significant the program does 2-sided Z tests:
H_0: Slope = 0 and the alternative hypothesis is H_A: Slope ≠0. How would the p-values change if we did one-sided Z tests?
i) They would double. **ii)** They'd be halved. **iii)** They'd stay the same

f) *(2 pts.)* Compute a 95% Confidence Interval for the Gender slope. (You may use Z= 2 as the critical value for 95%.) ***Show work.***

(_____ to _____) *Put lower number first and round to 2 decimal places.*

g) *(2 pts.)* Compute a 95% Confidence Interval for the **Odds Ratio** for Gender. ***Show work.***

(_____ to _____) *Put lower number first and round to 2 decimal places.*

h) (4 pts.) In general, if the 2 sided p-value for the slope of X in the ln(odds) equation < 5% then …

i. a 95% Confidence interval for the **slope** of X _____ ***Choose one:***
a. Includes 0 **b.** Doesn't include 0 **c.** Includes 1 **d.** Doesn't include 1 **e.** Includes 1.96 **f.** Doesn't include 1.96

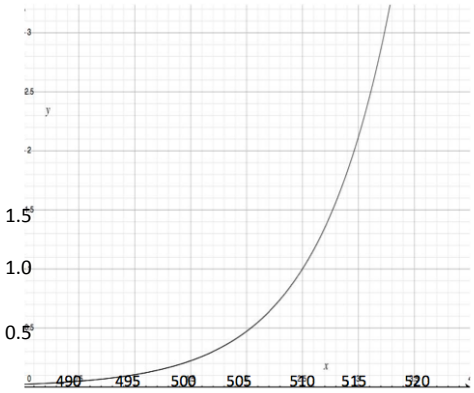
ii. and a 95% Confidence Interval for the **Odds Ratio** of X _____ ***Choose one:***
a. Includes 0 **b.** Doesn't include 0 **c.** Includes 1 **d.** Doesn't include 1 **e.** Includes 1.96 **f.** Doesn't include 1.96

Question 7 *(14 pts.)*

Let's say we're predicting acceptance to medical school based on MCAT scores. All the graphs below depict MCAT on the X-axis. The Y-axis is either the probability, the odds or the ln(odds) of acceptance to med school.

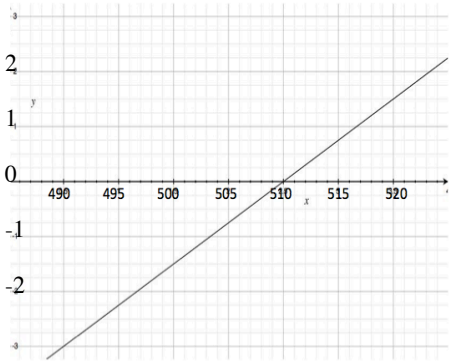
Which is which?

Plot A



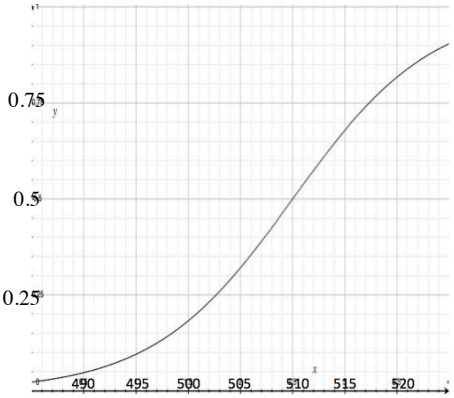
MCAT

Plot B



MCAT

Plot C



MCAT

a) *(6 pts.)* Plot ____ depicts **ln(odds)**; Plot ____ depicts **odds;** and Plot ____ depicts **probabilities.**
Fill in the 3 blanks with A, B, or C.

b) *(4 pts)* The equation for Plot _____is of the form $y = \frac{e^{b_0+b_1 MCAT}}{1+e^{b_0+b_1 MCAT}}$ and the equation for Plot _____is of the form $y = e^{b_0+b_1 MCAT}$

Fill in the 2 blanks with A, B, or C.

c) *(2 pts.)* Judging from the plots, what MCAT score gives a 50-50 chance of getting into Med School? _____

d) *(2 pts.)* The score that gives a 50-50 chance of getting acceptance has a y-value=_____ in Plot A and a y-value=_____ in Plot B.

Fill in the 2 blanks with the correct numbers.