Handout 2: Chapter 1

If I ask for a linear model, I am expecting the least squares line unless I state differently.

1. **Heart Attacks** Surviving a heart attack often depends on how quickly you get medical attention. The following table gives the percent of all heart attack victims who die compared to the time it took to get those victims to a hospital.

Minutes	13	15	17	19	21	23	25
Deaths	43	50	49	55	60	67	65
Minutes	27	29	31	33	35	37	39
Deaths	70	75	76	80	78	85	83

1. Calculate a linear model for this data.
2. Interpret the slope of your model with regard to this application.
3. Interpret the *y*-intercept with regard to this application.
4. If it took five minute to get a heart attack victim to the hospital, what are their chances of survival according to your model?
5. What is the error associated with the point $(19, 55)$?

2. **Newspapers** The following data gives the number of newspapers published each year.

Number of Newspapers	2580	2042	2008	1942	1950	1878	1749	1772
Year	1915	1920	1925	1930	1935	1940	1945	1950
Number of Newspapers	1760	1763	1751	1748	1756	1745	1676	1611
Year	1955	1960	1965	1970	1975	1980	1985	1990

1. Calculate a linear model to fit this data.
2. According to your model how many newspapers were published in the year 2005?
   How many will be published in 2025? Does this seem reasonable?
3. Interpret the slope of the model.
4. Interpret the *y*-intercept for your model. Does it seem reasonable?
5. Interpret the *x*-intercept for your model. Does it seem reasonable?

3. **TV Stations.** The following is the number of on air TV stations each year.

Number of Stations	98	411	515	569	677	706	734	883	1092
Year	1950	1955	1960	1965	1970	1975	1980	1985	1990

1. Calculate a linear model for this data.
2. Use your model to predict how many TV stations were on the air in the year 2005.
   How close do you think this value is to the actual number in 2005?
3. Interpret the slope of your model.
4. Interpret the *y*-intercept for your model. Does it seem reasonable?
5. Interpret the *x*-intercept for your model. Does it seem reasonable?
6. When will there be the same number of TV stations on air as there are newspapers published?

4. **Postage Stamp Rates**

Year	1995	1999	2001	2002	2006	2007	2008	2009	2012	2013	2014	2016
Cost (cents)	32	33	34	37	39	41	42	44	45	46	49	47

1. Find a linear model for this data.
2. Does a linear model seem appropriate?
3. According to your model, what will be the cost of a postage stamp in the year 2025?
4. According to your model when will the cost of a postage stamp be $0.75?
5. Interpret the slope of your model.
6. Interpret the y-intercept for your model. Does it seem reasonable?
7. What is the maximum error for your model?
8. Use the error to predict the maximum price of a postage stamp in the year 2025.

5. **Recycling** The data below associates the percentages of residents who recycle in Manhattan's twelve districts with their median income.

District	1	2	3	4	5	6	7	8	9	10	11	12
Percentage who recycle	32.4	44	18.3	31.5	45.1	41.9	47.4	53	18.8	6.4	8	15.2
Median Income	27557	27093	14707	20442	27213	35183	25445	37383	16651	10872	12235	18143

1. Which variable should be considered independent and which dependent?
2. Find a linear model for recycling versus income in Manhattan.
3. Interpret the slope of your model.
4. Interpret the y-intercept for your model.
5. Calculate the average value for your independent variable. Call it $\overline{x}$.
6. Calculate the average value for your dependent variable. Call it$\overline{y}$.
7. Is the point $(\overline{x}, \overline{y})$ on your model?
8. What could you say about a district whose data point was above the line?
9. What is the error associated with district 6?
10. What is the maximum error for your model? Use the error to predict a range of the recycling percentages for a median income of $15,000.

6. **Residuals** can help you find points that are not true to the data. The data below was gathered in a lab by measuring the current through a circuit with constant resistance as the voltage was varied.

Volts	5	7.5	10	12.5	15	17.5	20
Milliamps	2.354	3.527	4.698	5.871	7.151	8.225	9.403

1. Calculate a linear model to fit this data.
2. Sketch the residual plot for this model.
3. Discuss what the residuals tell you.

7. **Leaning Tower of Pisa**. The table below shows the amount of lean (in mm) of the Leaning Tower of Pisa and the year of measurement.

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983
Lean (mm)	2964.2	2964.4	2965.6	2966.7	2967.3	2968.8	2969.6	2969.8	2971.3

1. Plot the data and find a linear model.
2. State the maximum error for the model.
3. User the error to create the error bounds for your model.
4. Use the error bounds to determine the maximum lean we would expect in 1994 if the amount the tower is leaning each year continues to follow the observed pattern.
5. Use the error bounds to determine the earliest year we would expect to observe a lean of 2975mm if the observed pattern continues.