Nebraska Wesleyan University	Due April 6
Math 1100	Project 2
Instructor: Austin Mohr	Spring 02015

Please indicate your solutions clearly in the document using complete sentences and brief explanations. The point is that you indicate to me what the solution is and how it relates to the context of the question being asked. See the example spreadsheet I posted to the course website and the related video (https://www.youtube.com/watch?v=1wNrxiCeAiQ) for details on what I consider good form.

Email your spreadsheet file to amohr@nebrwesleyan.edu by 11:59 pm on the due date.

A Note about Excel and Exponential Functions

Excel will most likely give you a function of the form $f(x) = Ce^{rt}$, where e is a constant approximately equal to 2.71828. We will talk more about this form later in the course. For now, you can turn this into our more familiar form $f(x) = Ca^t$ using $a = e^r$. For example,

$$\begin{aligned} 100e^{0.69t} &\approx 100\left(2.71828^{0.69}\right)^t \\ &\approx 100 \cdot 1.9937^t. \end{aligned}$$

You may find this useful to answer questions about growth rate.

Exponential Growth of Healthcare Spending

For this problem, you'll need the National Health Expenditure data available at:

http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/Downloads/tables.pdf

1. Make a scatter plot using *only the data from 1960 through 2010.* Use the year since 1960 as the input and the National Health Expenditures (the very first line) as the output. (Unfortunately, the data is not well-formatted in the file, so you'll have to type it in manually.)
2. Use correlation coefficients to explain why an exponential model is a better fit than a linear one.
3. Display the trendline, equation, and correlation coefficient of the exponential regression.
4. Label all axes and make various other aesthetic changes.
5. According to your regression function, what is the annual growth rate in National Health Expenditures?
6. According to your regression function, what are the expenditures in 2012? How does this compare with the reported expenditures in the data set? What sorts of real-world concerns might account for the difference? (Incidentally, this example shows that forecasting even a short time into the future can be frought with peril, particularly when exponential functions are involved.)

Exponential Decay of Iodine-131

For this problem, use the data in problem 16 on page 302 in the text.

1. Make a scatter plot using all the data in the table.
2. Use correlation coefficients to explain why an exponential model is a better fit than a linear one.
3. Display the trendline, equation, and correlation coefficient of the exponential regression.
4. Label all axes and make various other aesthetic changes.
5. According to your regression function, what is the hourly decay rate in the mass of iodine-131?

6. According to your regression function $f(x)$, what is the half-life of iodine-131? (Use WolframAlpha to solve $f(x) = \frac{C}{2}$, where C is the initial value suggested by your regression function.)

7. According to your regression function, what is the remaining mass after four weeks? Why might you be more confident in this prediction than the prediction involving National Healthcare Expenditures?