

Homework: Sinusoidal Regression

1) The following table shows the number, in millions, of unemployed people in the labor force for 1984-1995.

	4	5	6	7	8	9	10	11	12	13	14	15
Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Unemp	8.539	8.312	8.237	7.425	6.701	6.528	7.047	8.628	9.613	8.940	7.996	7.404

Enter the data in your calculator and get a scatterplot, with $x = 0$ corresponding to 1980.

a) Does the data appear to be periodic? If so, find a model using sine regression.

yes $y = 1.22 \sin(.812x - 2.21) + 7.8$

b) Do you think this model is likely to be accurate much beyond the year 1995? Why?

NO Factors affecting unemployment are constantly changing.

c) What is the period of the function?

$$\frac{2\pi}{.812} = 7.79 \text{ years}$$

d) What is the average number of unemployed people and what part of the model did you use to find it?

7.8 million / vertical shift

2) The table shows the average sales S (in millions of dollars) of an outerwear manufacturer for each month t , where $t = 1$ represents January.

T	1	2	3	4	5	6	7	8	9	10	11	12
S	13.46	14.15	8.00	4.85	2.54	1.70	2.54	4.85	8.00	11.15	13.46	14.3

a) Create a scatter plot of the data.

Done in calc.

b) Find a trigonometric model that fits the data. Graph the model on your scatter plot.

How well does the model fit?

$$S(t) = 6.47 \sin(.56t + 1.32) + 7.88$$

The model approximates the data well.

c) What is the period of the model? Do you think it is reasonable given the context? Explain

$$\frac{2\pi}{.56} = 11.22 \text{ months}$$

yes, sales of outerwear would typically cycle through in one full year.

d) Interpret the meaning of the model's amplitude in the context of the problem.

$$\text{Amp} = \$6.47 \text{ million}$$

Sales of outerwear varies $\pm \$6.47$ million

Above and below the average of $\$7.88$ million.

(More Fun on the Back)

3) The table shows the average monthly temperature in Chicago, IL, based on data from 1961 to 1990.

	1	2	3	4	5	6	7	8	9	10	11	12
Month	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Temp(F)	21.2	25.7	36.7	48.6	59.0	68.4	73.0	71.8	64.2	52.5	39.7	27.3

a) Use the 12 data points (with $x = 1$ corresponding to January) to find a periodic model of the data.

$$y = 26.4 \sin(.48x - 1.9) + 46.9$$

b) What is the period of the function found in part a)? Is this reasonable?

$$\frac{2\pi}{.48} = 13.1 \quad \text{yes: temp cycles yearly}$$

c) What is the average annual temperature in Chicago? Which constant in the model did you use?

$$46.9 / \text{v.s}$$

d) What is the amplitude and what does it mean?

26.4° is the variability above/below the average temp.

4) The table shows the average monthly precipitation in inches, in San Francisco, CA, based on data from 1961 to 1990.

Month	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Nov	Dec
Precipitation	4.4	3.2	3.1	1.4	0.2	0.1	0	0.1	0.2	1.2	2.9	3.1

a) Make a scatter plot of the data. Use the sine regression feature on a calculator to find another sinusoidal model for the data.

$$y = 2.5 \sin(.41x + 1.8) + 2.3$$

b) What is the period of the function?

$$\frac{2\pi}{.41} = 15.3$$

c) By how much does the precipitation vary in this period?

2.5 inches