NONLINEAR REGRESSION

Fall 2017

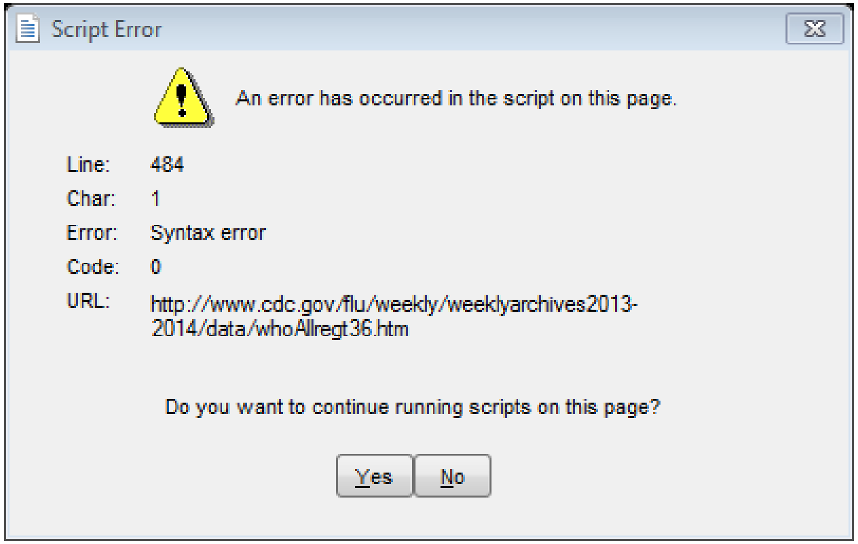
Nonlinear Regression

- Often times, relationships are nonlinear and we need a different type of graph to fit the data.
- Excel provides us with different types of nonlinear functions that we can use to fit data. These functions include:
  - Polynomial
  - Exponential
  - Logarithmic
  - Power

P6.3

http://www.cdc.gov/flu/weekly/weeklyarchives2013-2014/data/whoAllregt36.htm

Import the table from the link above, and you may get the script error, but click **No** multiple times.



P6.3 Continued

- Add a column called totals and sum up the number of total flu infections that have occurred.

Week	A(H1)	A(2009 H1N1)	A(H3)	A(unable to sub-type)	A(Subtyping not performed)	B	Total # Tested	% Positive	Totals
40	0	68	13	0	83	27	4772	4.02	191
41	0	57	23	0	116	29	5636	3.99	225
42	0	49	15	0	94	26	5716	3.22	184
43	0	70	17	0	100	14	5650	3.56	201
44	0	87	26	0	136	42	6163	4.72	291

P6.3 Continued

- The flu season can be broken into two phases, flu growth and flu decline.
  1. Create a graph of weeks 40 through 1. Properly label the graph.
  2. Create a graph of weeks 2 through 36. Properly label the graph.

- Fit different types of nonlinear functions to the growth data. Don’t include week column. Why?
- Which works best?
- How do we know?

P6.3 Continued

Using the exponential trendline:

1. If the growth phase did not end, how many infections would we expect in week 15?

2. If the growth phase did not end, in what week would we expect 10,000 infections?

Solving Exponential and Logarithmic Equations

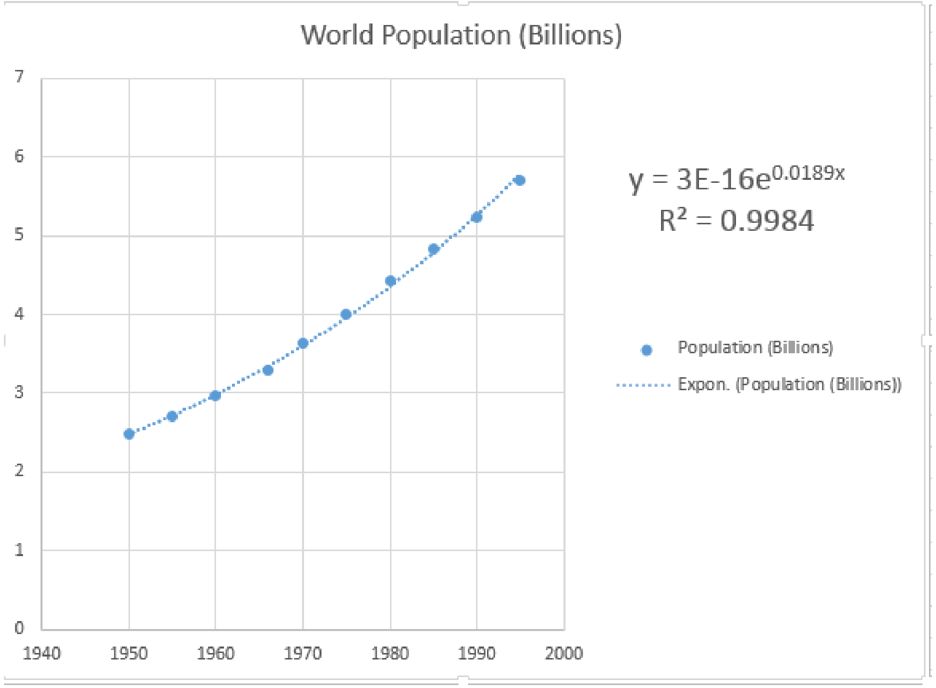
- Recall that to solve an equation of the form $y = ae^{bx}$ for x (where a and b are just constants), you first divide by a to obtain $y/a = e^{bx}$. Now, you must take the natural logarithm of each side to obtain $\ln(y/a)=bx$. Dividing by b yields $x = (1/b)\ln(y/a)$.

- Recall that to solve an equation of the form $y = a \ln(bx)$ for x (where a and b are just constants), you again divide by a to obtain $y/a = \ln(bx)$. Now, you must exponentiate each side to obtain $e^{y/a} = bx$. Dividing by b yields $x = (1/b)e^{y/a}$.

P6.4

http://zeus.cs.pacificu.edu/ryand/cs130/fall17/Problem64.html

- Import this data into Excel and run an exponential regression.



The equation contains a good deal of rounding.

We know this from **E-16**

In order to use the equation to predict values:

Right Click Equation
Format Trendline Label
Number
Decimal Places: 18

6.4 Continued

- What is the predicted population in 2000?
- When will the population hit 7.0 billion people?
- Check WorldOMeters to see when the world hit 7 billion people. How accurate was the model?

http://www.worldometers.info/world-population/

P6.5

- The following data is from an actual study that considered how memory decreases with time.
- Read a list of 20 words slowly aloud
- later, at different time intervals, how many can you recognize?
- The percentage, P, of words recognized was recorded as a function of the time t elapsed in minutes.

P6.5 Continued

http://zeus.cs.pacificu.edu/ryand/cs130/fall17/Problem65.html

T,min	5	15	30	60	120	240	480	720	2880	5760
P%	73.0	61.7	58.3	55.7	50.3	46.7	38.3	29.0	24.0	18.7

1. What is the logarithmic trendline for the given data?
2. At what time T can we expect 40% of the words to be remembered? In order to solve this problem, rewrite the logarithmic equation solving for x. Then using Excel, find the answer to the given question.
3. Check your answer using Goal Seek. The two answers should be very close.