9-27-05

HW Both Parts of Ch 3 due at the end of the week.

Test Thursday

Reading - All available through Weds 9-28, 11:55 PM

Labs Tuesday As scheduled
Thursday Delayed one week.

Tutoring Weds 1-2 PM BH 103
Thurs 10-12 Noon ~~ST~~ CS 101

OH 11-12 W, Th
6-7 W

Lab D P 299

Moving averages smooth out "jumpy" data.

C21 Three Day Centered M.A

$$= \frac{32 + 37 + 42}{3}$$

= average (B20 : B22)

D21 15 day centered MA.

7 days before / after

= average (B14 : B28)

$$7 = \frac{15 - 1}{2}$$

E31 3 day trailing

$$= \frac{77 + 82 + 87}{2}$$

2 days before, current day

= average (B29 : B31)

F31 15 day trailing MA

= average (B17 : B31)

Test 1

- Multiple Choice
- Decide if linear/exponential model appropriate from table
- Finding a Rough/Ready model
- Basics in Excel

Chapters 0-3, Labs 0-8

Linear Models Pg 14

Exponential " Pg 55

- Model from verbal description

(4)

NAME: ____

MATH 1470 Fall 2003 Tintera

TEST 1: Basic Models. Covers Chapters 0-3

You may use calculators and one 8.5 by 11 inch page of notes. Please show all work on this test booklet. Partial credit is awarded only for work shown. Each problem is worth as indicated. Good luck!

In questions 1 – 3, select the best answer by circling the letter marking it.

1. What is used to measure the percentage of data explained by a linear model?

a) correlation
b) residuals
c) point slope form for a line
d) the median slope

2. A modeler starts with a table of data with one column for t (= years since 1990) and one column for y (= number of pickups stolen in Texas). She adds the following columns to her table: one for t-squared, one for t*y, and one for y-squared. Of those three additional columns, which are needed for the calculating r, the correlation coefficient:

a) t-squared and t*y
b) t*y and t-squared and y-squared
c) t*y and y-squared
d) t-squared and y-squared

$$r = \frac{n\sum ty - \sum t \sum y}{\sqrt{n\sum y^2 - (\sum y)^2}\,\sqrt{n\sum t^2 - (\sum t)^2}}$$

3. Which would be done by a modeler finding the rough-and-ready model where a linear model is appropriate ?

a) calculate the correlation
b) find the residuals
c) use the point slope form for a line
d) use median of the slopes from the data table

4. In this morning's Caller-Times, there was an article about the Gross Domestic Product (value of all newly created products and services as measured in dollars) for the USA and how it is increasing. At the current rate of increase, the GDP would double in about 20 years. What is the percentage increase of the GDP?

Constant Doubling ⟺ exponential

DT → % increase

growth factor $= a = 2^{1/DT} = 2^{1/20} = 1.0352$

% change $= r = a - 1 = .0352$
$= 3.5\%$

$a = 2^{1/DT}$

* $DT = \frac{\log 2}{\log a}$

a

DT — r

$a = 1 + r$

$r = a - 1$

*or $DT = \frac{\ln 2}{\ln a}$

6

In questions 5 through 7, identify each scenario below as appropriate for a linear or exponential model or neither. Be sure to justify your selection. If a linear model or exponential model is appropriate, write it in a formula with a complete definition of the variables.

5. There were 400 students who graduated from TAMUCC in 1998 and that number has grown by 14% per year since then.

Model type, with justification: Exponential - A constant % is added each year.

Model formula

$y = 400(1.14)^t$ $(1.14 = 1 + 14\%)$

y = # grads t = yrs since '98

6. There were 5000 registration schedules printed in 1998 and that number has decreased by 50 per year since then.

Model type, with justification: linear - There is a constant decrease each year.

Model formula:

$y = -50t + 5000$

y = # schedules t = yrs since '98

7. The number of trees on campus increased from 1994 to 2003, but later decreased when construction on new buildings began.

Model type, with justification: Neither - #Trees goes up, then down. Linear & Exponential models don't do that.

Model formula:

7

8. A spreadsheet is built to model energy usage at the Tintera house hold. For the cells with ? marks, write formulas in the space provided as they would appear in Excel. Where appropriate, a formula should be written in such a way that it can be copied to other cells.

	A	B	C	D
1		a		
2		k	?	
3	Jan = 0	Avg Kwh/day	EXP Predicted	
4	Month	Energy Usage	Energy usage	Residuals^2
5	0	11.9		?
6	1	13.2	?	
7	?	13.9		
8	3	14.5		
9			RMSR	?

C2 (where k is as in the Rough-and-Ready Method): K = median of ratios

ignore. ~~y~~ Δy/y

D5:

= (B5 - C5)^2 "(actual-pred)^2"

D9: (RMSR)

= sqrt (average(D5 : D8))

A7:

= a6+1

C6: (y = k · a^t)

= C$2 * C$1 ^ a6

exponential (linear: $\Delta y/\Delta t$) 8

9. The following problem models the Tintera's energy usage for January through May. The data is given in the table below. The variable t is the months since January and y is the energy usage (in Average Kwh per day).

t	Y	$\Delta y/y$
0	14	$(16-14)/14 = 1/7 = .14$
1	16	$18/16 = 1.125$
2	34	$10/34 = .29$
3	44	$8/44 = .1818$
4	52	

median → $\frac{.29 + .18}{2} = .245$

a) For the data above, decide if an exponential model is appropriate. Justify your answer.

No. The % change $\Delta y/y$ is not constant.

b) Regardless of your answer to (a) estimate an exponential model for the data set above. Be sure to identify the variables.

K = 14 start value

r = median of $\Delta y/y$

a = 1 + r = 1.24

$y = 14 \cdot 1.245^t$

y = Kwh / day energy used

t = months since Jan

c) Using your model, predict the Average Kwh per day for June (the 5th month since January). (Use $y = 13.5(1.44)^t$ if you don't have a model from (b)).

Prediction (t=5) $y = 13.5(1.44)^5 = 83.59$

d) The actual Average Kwh per day for June was 36.2. Calculate the residual for that prediction.

residual = actual − predicted

= 36.2 − 83.59