

Teaching Notes

All Excel worksheets and charts should be printed in landscape (print preview-> setup->landscape->ok->print). In addition to the Excel and TI links listed in the Draft Handouts section VII, some additional comments are listed below for the Dry Goods assignment. These comments are usable for all other assignments as well.

Dry Goods

1. Some techniques to help format the Excel graph follow:
 - a) To select the color background for the chart, right click the chart-> format plot area-> select color-> background
 - b) To select the color for the points, double left click on a point-> patterns-> marker-> select the style wanted, set foreground to no color (the option I selected), set background to the desired color
 - c) An optional way to change the appearance of the data point marker is to single left click the line with the data markers you want to change, then from the menu bar select format-> selected data series -> patterns-> marker. Selecting the line enables you to change its color.
 - d) Setting foreground to no color and background to red generated The Sales vs. Weeks chart.

2. In addition to Excel modeling techniques discussed in http://faculty.uml.edu/mstick/92.122/material/least_squares_regression_document.pdf some optional techniques are included here with samples results.
 - a) Right click any point on the chart-> add trendline-> select linear.
 - b) Double left click the line created-> options->check both the options to display the equation and display R^2 . Click the patterns tab to change the color of the modeled data.
 - c) Repeat the above process and add a polynomial or order 2. Use the drawing toolbar to include identifying lines with arrows for each model, i.e. from the menu bar select insert-> picture-> autosshapes.
 - d) Compute the derivative of each model to find the marginal sales.

Sample modeled output appears in this section and can be found at the *Teaching notes model* link. The worksheet data is the same as that used for the weekly sales within the dry goods department study.

Tell the students that we are going to use real data to investigate sales related types of decisions. Upon completion of the assignments, students should be able to compute marginals (rates of change) from actual data, model the data and analytically compute marginals by differentiating the various models generated. Students will use the TI and Excel to help analyze the data and display results.

The assignments for the Candy Item and the End Cap deal with data patterns and maximum sales periods. The Dry Goods and Boxed Foods data sets address marginal

sales and modeling. The Corporate Financial Data builds upon the previous assignments by performing marginal analyses and data modeling on cost and sales data to generate profit predictions.

Sample answers to items 8-14 in the pretest and posttest follow. Backup computation and displays should be provided wherever deemed necessary.

- Item 8: Computation for the marginal cost should begin with $\frac{12-10}{1994-1993}$ to find the rate of change in cost from 1993 to 1994. Associate the result with the year 1993. Following this type of procedure, we will not be able to compute the marginal cost for 1997.
- Items 9-10: Using 1990 as the base year, a linear model for the cost data is $y=2.3x+3.1$. Even though the correlation coefficient $r=.945$, one might argue that the cost in 1996, i.e. the point (6, 19) could be considered an outlier.
- Items 11-12: Profit=Revenue-Cost. After generating a linear model for profit, examine the correlation coefficient to check if a higher degree polynomial is required (it won't be), and predict profit in 2003 by setting $x=13$.
- Items 13-14: Assuming linear models are used for the cost, revenue and profit, the derivative of each model is just the slope of each linear equation. The marginals found in item 8 reflect rates of change based on actual data whereas the derivatives in item 13 reflect rates of change using the best linear models for the data.

Assignments

1. A candy item

- a) Since February 1 represents week 1 for Wal*Mart's fiscal year, the first holiday period is Valentine's Day. This holiday appears as week 55, i.e. 2 weeks into fiscal 2003.
- b) When identifying only the peaks in the data, the intent is to exclude outliers at non-holiday and restocking periods.
- c) To discuss the impact of this product on the entire dry goods department, further study of the dry goods department data is required. Also the relative contribution in sales dollars must be examined.
- d) The data for units sold vs. weeks was available but not presented in order to stimulate some problem solving. The issue is that pricing remains at a fixed level regardless of the units sold. Often students are presented with a situation in which price depends upon units sold.

2. End cap item – chocolate cookies

- a) Use the Wal*Mart fiscal year as a guide. The major spikes at weeks 50 and 76 appear to be around New Year's Day and around July 4th.
- b) Exclude apparent outliers at zero or near zero values to get a reliable model for sale predictions. This will also require elimination of the major spikes mentioned above.

- c) To discuss the impact of this product on the entire dry goods department, further study of the dry goods department data is required. Also the relative contribution in sales dollars must be examined. Rates of change for the end cap data and dry goods department can easily be addressed with the models chosen.
3. Dry goods department
- a) July 4th appears to be the absolute maximum, but other smaller spikes can probably be traced to specific holiday periods.
 - b) Obviously there is a growth pattern to the data. A linear model won't capture the spikes, especially not the spike at week 75. Have students consider inclusion and exclusion of this data value and examine its impact on future predictions.
4. Boxed foods – cereal
- a) Note the overall similarity between the trend for the cereal data and that for the entire department.
 - b) Weeks 38 to 52 do not exhibit the growth apparent in department sales. Consider the relative impact on department sales for this product regarding the use of an end cap during this time period.
5. Financial summary
- a) Address the issue that when computing rates of change from the data, students are computing marginals as slopes of secant lines.
 - b) When evaluating derivatives of a model, students are computing slopes of tangent lines.
 - c) Have discussions regarding actual differences when using data driven rates of change versus derivatives, and how these relate to future year's predictions.
 - d) Access 2004 data and include this in an extended analysis.

Note: In a conversation with Wal*Mart corporate headquarters, I asked if calculus is used to generate predictions for sales related issues. The response from several representatives was that it is not used in the sense of differentiating and integrating a function. However, the analytic concepts of calculus are used continuously when making predictions in spreadsheet analyses. In further discussions with Management academics, they confirmed that calculus is not used in accounting related financial statements, but is used in sophisticated modeling. The purpose of management calculus at the undergraduate level is one of critical thinking, having students learn to learn.