

ASSIGNMENT # 1

1. Due Date for Section X: Tuesday, June 16, 2015 before 15:00 hrs in the Class.
2. You MUST 'Cut and Paste' the necessary associated Excel worksheet to justify your solution.
3. You MUST attach the Group Integrity statement signed by all the group members.

A group of minimum of two (2) and preferably a maximum of three (3) students must submit their assignment. Students must work in groups. No individual assignment is allowed unless approved by the professor.

Students are reminded that submitted assignments must be neat, readable, and well-organized. Assignment marks will be adjusted for sloppiness, poor grammar and spelling, as well as for technical errors. Plagiarism on assignments will not be accepted, *each student must sign the statement of integrity.*

E-mail questions related to the assignment should be sent to the Teaching Assistants; Shirin Geranmayeh: sgera065@uottawa.ca (Group X) and Matthew Masaro: [mmas068@uottawa.ca](mailto:mmasa068@uottawa.ca) (Group Y).

Problem # 1

National Mixer, Inc. sells can openers. Monthly sales can openers for seven-month periods were as follows:

| Month | Sales (000 units) |
|--------------|------------------------------|
| February | 19 |
| March | 18 |
| April | 15 |
| May | 20 |
| June | 18 |
| July | 22 |
| August | 20 |

- a) Plot the monthly data.
- b) Forecast September sales volume using each of the following:
 1. A linear trend equation. (use regression analysis)
 2. A Four-month moving average.
 3. Exponential smoothing with a smoothing constant equal to 0.20, assuming a February forecast of 19(000).
 4. The naïve approach
 5. A weighted average using 0.6 for August, 0.3 for July, and 0.10 for June.
- c) Which method seems least appropriate? Why?

Problem # 2

Management of the Jackson Manufacturing Corporation wishes to choose a statistical forecasting method for forecasting total sales for the corporation. Total sales (in million of dollars) for each month of last year are shown below.

| Month | Sales | Month | Sales | Month | Sales |
|----------|-------|--------|-------|-----------|-------|
| January | 126 | May | 153 | September | 147 |
| February | 137 | June | 154 | October | 151 |
| March | 143 | July | 148 | November | 159 |
| April | 150 | August | 145 | December | 166 |

- Starting at period 3 and using the initial estimates of **131 for the exponentially smoothed forecast** (i.e. the average of the 1st two periods) and **11 for the exponentially smoothed trend** (i.e. $A_2 - A_1 = 137 - 126$), apply exponential smoothing with trend adjustment (double exponential smoothing) to the last year's sales. Where $\alpha = 0.1$ or 0.5 and $\beta = 0.1$ or 0.5 . Compare both MAD and MSE for these 4 combinations. Which value of α and β would you recommend?
- Using the recommended value of α and β from part a), what is the forecast of total sales for January of the New Year?
- When plotting the data. Note how the sales level is shifting significantly from month to month – first trending upward and then dipping downwards before resuming an upward trend. Assuming that similar patterns would continue in the future, evaluate how well you feel that exponential smoothing with trend adjustment method would perform in forecasting future sales.

Problem # 3

| Period (DAY) | Number Served | Period (DAY) | Number Served |
|--------------|---------------|--------------|---------------|
| 1 | 80 | 15 | 94 |
| 2 | 75 | 16 | 87 |
| 3 | 78 | 17 | 93 |
| 4 | 95 | 18 | 106 |
| 5 | 130 | 19 | 145 |
| 6 | 136 | 20 | 150 |
| 7 | 40 | 21 | 49 |
| 8 | 87 | 22 | 102 |
| 9 | 82 | 23 | 97 |
| 10 | 85 | 24 | 113 |
| 11 | 99 | 25 | 103 |
| 12 | 130 | 26 | 159 |
| 13 | 140 | 27 | 159 |
| 14 | 47 | 28 | 58 |

Given the data above use Excel to answer the following questions:

- a) Plot the daily data of the number of customers served for the evening meal, which forecasting method would you recommend and why?
- b) Use the multiplicative decomposition model discussed in class and NOT in the book, to calculate the seven seasonal indices (Hint: Use a seven-day centered moving average), and the intercept and slope of the trend component (Hint: deseasonalize the data, fit an appropriate model to the deseasonalized data). **Fill in the table below.**

| | |
|-------------------------------|--|
| Seasonal Indices (Day) | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| 6 | |
| 7 | |
| | |
| Intercept | |
| Slope | |

- c) Using the multiplicative decomposition model, is the forecast of period 1 to 28 performing adequately? Justify your answer.
- d) Using the multiplicative model, forecast the “Number Served” for the next two weeks (e.g. forecast the “Number Served” for period 29 to period 42). Show calculation.

Problem # 4

New Brunswick’s Soda Pop, Inc. has a new fruit drink for which it has high hopes. Steve Allen, the production planner, has assembled the following data and demand forecast:

| Quarter | Forecast |
|---------|----------|
| 1 | 1,800 |
| 2 | 1,100 |
| 3 | 1,600 |
| 4 | 900 |

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- Previous quarter’s output = 1,200 cases
 - Beginning Inventory = 100 cases
 - Backorder cost = \$60 per case
 - Inventory holding cost = \$40 per case at the end of quarter
 - Hiring employees = \$40 per case
 - Firing employees = \$80 per case
 - Subcontracting cost = \$90 per case
 - Unit cost on regular time = \$30 per case
 - Overtime cost = \$15 extra per case
 - Capacity on regular time = 1,800 cases per quarter
 - Capacity on overtime = 200 cases per quarter
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Steve's job (**i.e. your job for this assignment**) is to develop an aggregate plan and calculate its cost. The three initial options he wants to evaluate are:

- a) Plan A: Chase strategy that hires and fires personnel as necessary to meet the forecast.
- b) Plan B: Level strategy.
- c) Plan C: Level strategy that produces 1,200 units per quarter and meets the forecasted demand with inventory and subcontracting.
- d) If you are Steve's boss, the VP for operations, which plan do you implement and why?

Problem # 5

Forrester and Cohen is a small accounting firm, managed by Joseph Cohen since the retirement in December of his partner Brad Forrester. Cohen and his three CPAs can together bill 640 hours per month. When Cohen or another accountant bill more than 160 hours per month, he or she can get an additional "overtime" pay of \$62.50 for each extra hour: this is above and beyond the \$5,000 salary each draws during the month. (Cohen draws the same base pay as his employees). Cohen strongly discourages any CPA from working (billing) more than 240 hours in any given month. The demand for the billable hours for the firm over the next 6 months is estimated below:

| Month | Estimate of Billable hours |
|----------|----------------------------|
| January | 600 |
| February | 500 |
| March | 1,000 |
| April | 1,200 |
| May | 650 |
| June | 590 |

Cohen has an arrangement with Forrester, his former partner, to help out during the busy tax season, if needed, for an hourly fee of \$125. Cohen will not even consider laying off one of his colleagues in the case of a slow economy. He could, however, hire another CPA at the same salary, as business dictates.

- a) Develop an aggregate plan for the six-month period and compute its corresponding cost (i.e. the cost of Cohen's plan of using overtime and Forrester).
- b) Should the firm remain as is, with a total of four CPAs?