

ASSIGNMENT # 1
FORECASTING and AGREGATE PLANNING

A group of minimum of two (2) and 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 Assistant or posted on the Blackboard Learn course website “Discussion Area” (viewed by all).

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Problem # 1

The monthly sales for Telco Batteries Inc. were as follows:

Month	Sales (000 units)
January	20
February	21
March	15
April	14
May	13
June	16
July	17
August	18
September	20
October	20
November	21
December	23

- a) Plot the monthly sales data.
- b) Forecast coming January sales using each of the following:
 1. The naïve approach
 2. A 6-month moving average
 3. A 6-month weighted average using 0.1, 0.1, 0.1, 0.2, 0.2 and 0.3, with the heaviest weights applied to the most recent months.

- c) Calculate the mean absolute deviation (MAD) and the mean squared error (MSE) for each of the method above. Which is better among the three methods?

Problem # 2

Lovely lawns, Inc., intends to use sales of lawn fertilizer to predict lawn mower sales. The store manager estimates a relationship between fertilizer sales and mower sales. The pertinent data are:

Period	Fertilizer Sales (tons)	Number of Mowers Sold
1	1.6	10
2	1.3	8
3	1.8	11
4	2.0	12
5	2.2	12
6	1.6	9
7	1.5	8
8	1.3	7
9	1.7	10
10	1.2	6
11	1.9	11
12	1.4	8
13	1.7	10
14	1.6	9

- Determine the correlation between the two variables. Does it appear that a relationship between these variables will yield good predictions? Explain.
- Obtain a linear regression line for the data
- Predict lawn mower sales, given fertilizer sales of 2 tons.

Problem # 3

The following table represents a 5 star hotel occupancy rate during the last 3 years.

	Occupancy (%)		
	2012	2013	2014
Jan	30	42	40
Feb	35	44	49
Mar	42	49	50
Apr	44	40	46
May	57	51	61
Jun	66	74	69
Jul	84	96	93
Aug	79	88	91
Sep	58	63	74
Oct	44	50	66
Nov	32	46	34
Dec	65	60	65

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

- a) Plot the monthly sales data, 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 seasonal indices (i.e. the **adjusted** seasonal indices), the intercept and slope of the trend component. **Fill in the table below (Include four decimal points).**

Seasonal Indices	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Intercept	
Slope	

- c) Analyzing the season indices pattern, does this hotel seem like a business or leisure hotel? Justify.
- d) Using the multiplicative decomposition model, is the forecast of year 2012, 2013 and 2014 (i.e. period 1 to 36) performing adequately? Justify your answer.
- e) Using the multiplicative decomposition model, forecast the 2015 occupancy. Show calculation.

Problem # 4

The classified department of a monthly magazine has used a combination of quantitative and qualitative methods to forecast sales of advertising space. The forecast errors over a 20-month period are as follows:

<u>Month</u>	<u>Error</u>	<u>Month</u>	<u>Error</u>
1	-8	11	1
2	-2	12	6
3	4	13	8
4	7	14	4
5	9	15	1
6	5	16	-2
7	0	17	-4
8	-3	18	-8
9	-9	19	-5
10	-4	20	-1

- Using the first half of the data (period 1 to period 10), construct a control chart with 2σ limits. What can you conclude?
- Plot the last 10 errors on the control chart. Are the errors random? What is the implication of this?

Problem # 5

Andree's All-American manufactures fashionable tennis wear, needs help planning production for next year. Demand for tennis gear is fairly stable, but has peaks during the summer months.

Month	Demand Forecast
January	500
February	300
March	200
April	1500
May	2500
June	3500
July	4500
August	2500
September	500
October	300
November	300
December	2500

Beginning workforce	9 workers
Production per day	9 units per employee
Production cost during regular time	\$50 per unit
Subcontracting cost	\$75 per unit
Increasing production	\$3000 per worker
Decreasing production	\$6000 per worker
Inventory holding cost	\$1 per unit/month
Beginning inventory	300
Ending Inventory requirements:	5% of the forecasted demand

Given the above costs and demand forecasts, **assume that the employee work every day of the year (i.e. 365 days per year)**, test these two strategies for meeting demand:

- Chase plan (i.e. Produce to meet forecasted demand and safety stock requirements).
- Level plan with subcontracting and inventory to meet variation in demand. (Note that **employee work every day of the month and no idle time**).
- Which Aggregate Plan Strategy would you recommend? Justify.

Assumptions:

- Since the cost of stock out or backorder is not provided thus we assume that this is not permissible.
- Since the number of days an employee work in a month vary thus the number of units produced in a month will not be the same. In the EXAMPLES seen in class we assume that the employee work the same number of days each month (for example 21 days/month), thus the number of unit produced each month will be the same, which is not the case for this example (i.e. February is 28 days, March is 31 days,).

Problem # 6

George, the Room Service Supervisor at the London Inn, just received the forecast for the weekend orders. Based on this forecast, he has to decide whether the regular hours of his staff will be sufficient, if he needs to prepare them to do some overtime (maximum 20% of the forecasted demand) or, as a last resort, if he needs to hire temporary workers (subcontracting) to be able to deliver all orders.

The associated costs are:

Regular-time cost per order	\$5.00
Overtime cost per order	\$7.50
Subcontract cost per order	\$10.00
Idle time cost per order	\$15.00

Forecasted requirements are:

Room Service Orders		Capacity		
Period	Forecast	Regular	Overtime	Subcontract
Saturday AM	50	75	25	100
Saturday PM	130	100	30	100
Sunday AM	150	75	25	100
Sunday PM	100	75	25	100

Constraints on overtime are:

Period	Overtime Max (20% of the forecasted demand)
Saturday AM	10
Saturday PM	26
Sunday AM	30
Sunday PM	20

- a. Develop a schedule plan that minimizes costs using the transportation method. Due to the nature of the business, there's no inventory, no stock out and no back order. On the other hand, if the regular staff capacity for the period is larger than the demand, there will be a cost for idle time.
- b. State the corresponding schedule plan and its total costs?

Source:

Problem and Problem 5: J. Heizer and B. Render; *Operations Management*, 10th edition, Prentice Hall, 2010

Problem 2 and Problem 4: Stevenson, W.J. and Hojati, C. 2011. *Operations Management* (4th Canadian edition). McGraw-Hill/Ryerson. Mass. 741p.

Problem 3 and Problem 6: Luiz Perri, former Teaching Assistant for ADM 3301 and MBA alumni at the Telfer School of Management, University of Ottawa.