# Assignment One

## ADM3301 D

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Submitted to:

Rim Jaber

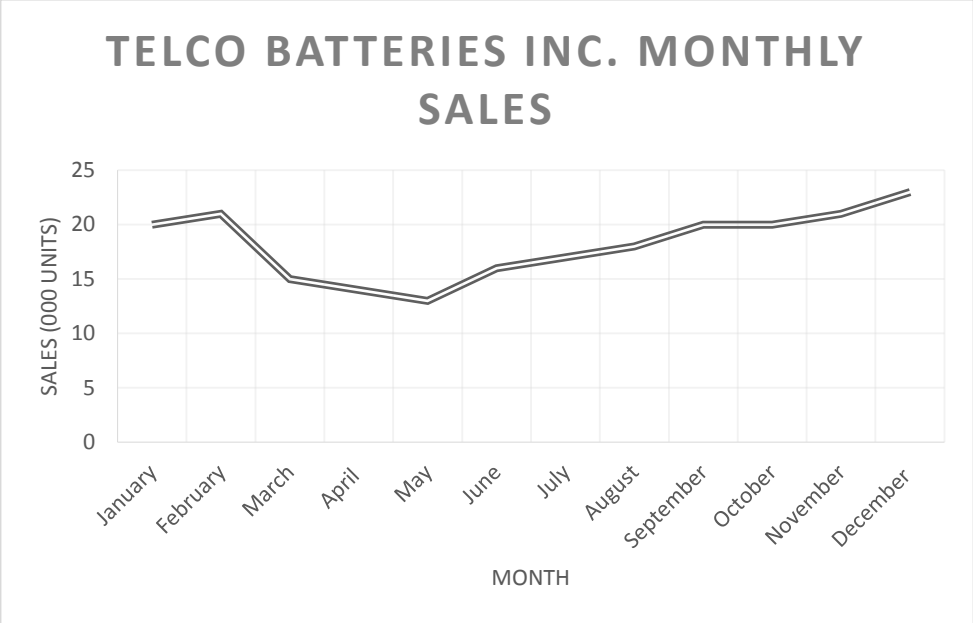
Submitted by:

Kelsi McGuire 7253170
Katie Laurin 7360223

# Assignment One

Problem One

a.)




b.) 1-

| Month | Sales | Naïve Approach | lErrorl | Error^2 |
|---|---|---|---|---|
| **January** | 20 | | | |
| **February** | 21 | 20 | 1 | 1 |
| **March** | 15 | 21 | 6 | 36 |
| **April** | 14 | 15 | 1 | 1 |
| **May** | 13 | 14 | 2 | 4 |
| **June** | 16 | 13 | 3 | 9 |
| **July** | 17 | 16 | 1 | 1 |
| **August** | 18 | 17 | 1 | 1 |
| **September** | 20 | 18 | 2 | 4 |
| **October** | 20 | 20 | 0 | 0 |
| **November** | 21 | 20 | 1 | 1 |
| **December** | 23 | 21 | 2 | 4 |
| **January** | | **23** | | |

| | |
|---|---|
| **MAD** | **1.72727273** |
| **MSE** | **5.636363636** |

2-

| Month | Sales | 6-Month Moving Average | Error | Absolute Error | Error^2 |
|---|---|---|---|---|---|
| January | 20 | | | | |
| February | 21 | | | | |
| March | 15 | | | | |
| April | 14 | | | | |
| May | 13 | | | | |
| June | 16 | | | | |
| July | 17 | 16.5 | 0.5 | 0.5 | 0.25 |
| August | 18 | 16 | 2 | 2 | 4 |
| September | 20 | 15.5 | 4.5 | 4.5 | 20.25 |
| October | 20 | 16.333333 | 3.666666667 | 3.666666667 | 13.4444444 |
| November | 21 | 17.333333 | 3.666666667 | 3.666666667 | 13.4444444 |
| December | 23 | 18.666667 | 4.333333333 | 4.333333333 | 18.7777778 |
| **January** | | 19.833333 | | | |
| | | | **MAD** | **3.111111111** | |
| | | | **MSE** | **11.69444444** | |

3-

| Month | Sales | 6 Month Weighted Moving Average | Error | Absolute Error | Error^2 |
|---|---|---|---|---|---|
| January | 20 | | | | |
| February | 21 | | | | |
| March | 15 | | | | |
| April | 14 | | | | |
| May | 13 | | | | |
| June | 16 | | | | |
| July | 17 | 15.8 | 1.2 | 1.2 | 1.44 |
| August | 18 | 15.9 | 2.1 | 2.1 | 4.41 |
| September | 20 | 16.2 | 3.8 | 3.8 | 14.44 |
| October | 20 | 17.3 | 2.7 | 2.7 | 7.29 |
| November | 21 | 18.2 | 2.8 | 2.8 | 7.84 |
| December | 23 | 19.4 | 3.6 | 3.6 | 12.96 |
| **January** | | 20.6 | | | |
| | | | **MAD** | **2.7** | |
| | | | **MSE** | **8.0633333** | |

c.) Out of the three methods, the **naive method** is the better method to choose as it has the lowest MAD. It is also the method with the lowest MSE. The method with the lowest MAD is the better one to choose since it has the least deviation away from the mean, and a low MSE is also preferred as the goal is to minimize MSE because it exaggerates errors by squaring them.

## Problem Two

a.) The correlation between the two variables is **0.95924096**. It appears that the relationship between these two variables will yield a good prediction as a correlation of **0.95924096** indicates that approximately 95.92% of the variation in the dependent variable can be explained by the regression equation.

b.) The following equation is a linear regression line that has been obtained for the data:

**Y = -0.67166213 + 6.158038147(X)**

SUMMARY OUTPUT

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.95924096 |
| R Square | 0.92014322 |
| Adjusted R Sc | 0.91348849 |
| Standard Err | 0.53626437 |
| Observations | 14 |

ANOVA

| | *df* | *SS* | *MS* | *F* | *Significance F* |
|---|---|---|---|---|---|
| Regression | 1 | 39.763332 | 39.763332 | 138.26902 | 6.0617E-08 |
| Residual | 12 | 3.45095368 | 0.28757947 | | |
| Total | 13 | 43.2142857 | | | |

| | *Coefficients* | *tandard Erro* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* | *Lower 95.0%* | *Upper 95.0%* |
|---|---|---|---|---|---|---|---|---|
| Intercept | -0.6716621 | 0.86483623 | -0.776635 | 0.45241149 | -2.5559784 | 1.21265415 | -2.5559784 | 1.21265415 |
| Fertilizer Sale | 6.15803815 | 0.52369681 | 11.7587848 | 6.0617E-08 | 5.01700081 | 7.29907548 | 5.01700081 | 7.29907548 |

c.) The following equation will predict how many lawnmowers will be sold given that 2 tons of fertilizer has already been sold:

Y = -0.67166213 + 6.158038147(X)

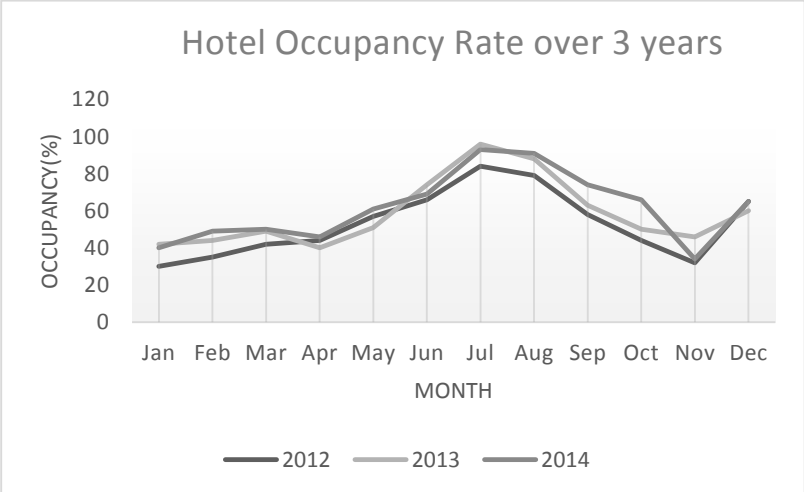
Y = -0.67166213 + 6.158038147(2)

Y =**11.6444142**

Therefore, given that 2 tons of fertilizer has been sold, it's predicted that 12 lawnmowers will be sold.

## Problem Three

a.)



The recommended forecasting method would be the **multiplicative model** since there seems to be a cyclical and seasonal component to the observed periods. The multiplicative model uses seasonal indices estimated from the history of the data series to include seasonality in the forecasts, in addition to removing such effects from the observed values (deseasonalize the data) in order to get a clearer picture of non-seasonal components.

b.)

| Seasonal Indices | Adj Seasonal Indices |
|---|---|
| 1 | 0.7160 |
| 2 | 0.8037 |
| 3 | 0.8481 |
| 4 | 0.72569988 |
| 5 | 0.93679951 |
| 6 | 1.1986 |
| 7 | 1.6142 |
| 8 | 1.4849 |
| 9 | 1.0676 |
| 10 | 0.8257 |
| 11 | 0.6803 |
| 12 | 1.0982 |
| | |
| | |
| **Intercept** | 48.2873 |
| **Slope** | 0.5085 |

To calculate the intercept and slope, the following equations were used:
$\hat{Y}$= a +bx
Where $\hat{Y}$= value computed of the dependent variable
a= y-axis intercept
b = Slope of the regression line
x = independent variable
The slope will be found by

$$b = (\sum xy - n\overline{xy})/(\sum x^2 - n\overline{x^2})$$

Where b = Slope of the regression line
Y= Known values of the dependent variable
$\bar{x}$= Average of the x values
$\bar{y}$= Average of the y values
n= Number of data points of observations.
x = known values of independent variable
The y-intercept a is computed using the equation: a = *yhat – b(xhat)*

c.) This hotel seems to be a leisure hotel, because the seasonal indices indicate a higher occupancy % in the summer months (from June to August and somewhat into September). This would make sense for a leisure hotel, as the summer months are generally when individuals and families are able to take vacations and would need to use hospitality services.

d.) Using the multiplicative decomposition model, the forecast of years of 2012, 2013, and 2014 seem to be performing inadequately. We can say this as both the sigmas for the MAD (**4.8920**) and for the MSE **(5.1036**) as they are both greater than the rel. errors which have a max of **1.2189** and a min of **0.7563**. The multiplicative model will be enclosed at the end of the assignment

e.)

| Month | (7) Adj S | (9) Trend a+b*(1) | (10) Forecast (7)*(9) |
|---|---|---|---|
| 37 | 0.71604139 | 67.1015873 | 48.04751381 |
| 38 | 0.80372536 | 67.6100815 | 54.33993738 |
| 39 | 0.84807631 | 68.1185757 | 57.76975041 |
| 40 | 0.72569988 | 68.6270699 | 49.80265656 |
| 41 | 0.93679951 | 69.1355641 | 64.76616236 |
| 42 | 1.19864178 | 69.6440583 | 83.47827794 |
| 43 | 1.61420329 | 70.1525526 | 113.2404813 |
| 44 | 1.48492129 | 70.6610468 | 104.926093 |
| 45 | 1.06762234 | 71.169541 | 75.98219162 |
| 46 | 0.82574847 | 71.6780352 | 59.18802814 |
| 47 | 0.68028133 | 72.1865294 | 49.10714826 |
| 48 | 1.09823904 | 72.6950236 | 79.83651301 |

To find the trend of each month, use the following equation:

**T = a + b (1)**

This means that for each month, take the slope and multiply it by the month before adding the intercept.
For example (Month 37):
T = a + b (1)
T = 48.2873 + 0.5085 (37)
**T = 67.1018**

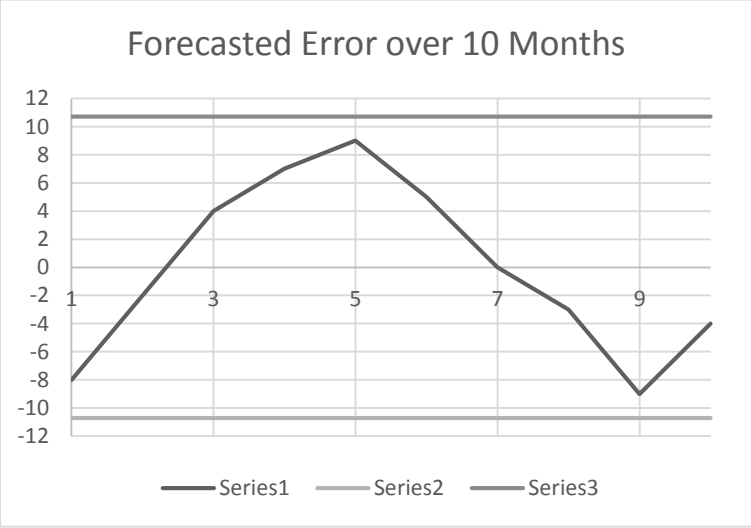
To find the Forecast for each month, us the following equation:

**F = (Adj S) x (T)**

This means that for each month, take the adjusted S and multiply it by the trend to get the forecast.
For example (Month 37):
F = (Adj S) x (T)
F = (0.7160) x (67.1018)
**F = 48.0475**

## Problem Four

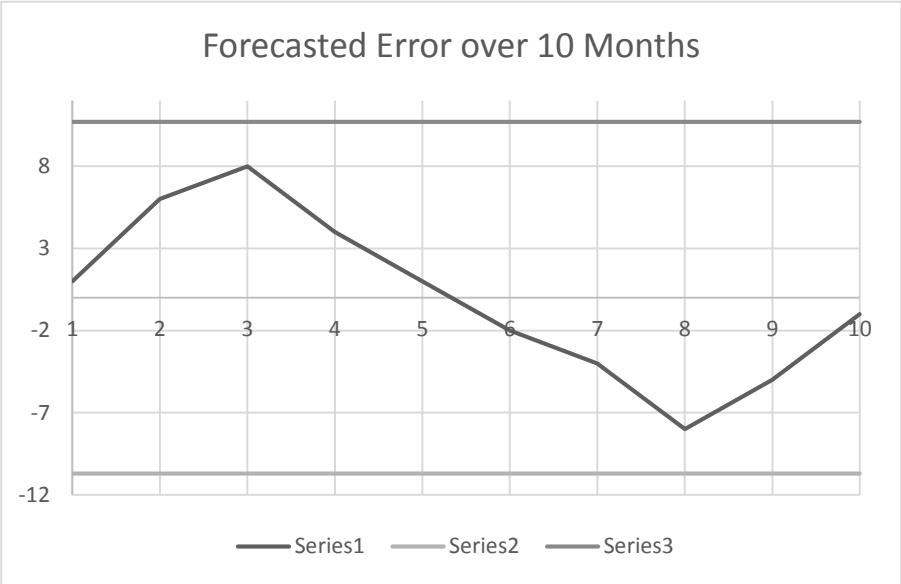
a.)




Mean:
**-0.1**
Standard deviation: **5.3523**
Upper Limit:
**10.7046**
Lower Limit:
**-10.7046**

From this control chart it can be concluded that the forecast is in control is there are no outliers and therefore, all forecasts lie within the limits.

b.)




The errors are not random meaning that there is a cyclical and trend component to the errors in the forecasts. This means that it is easier to forecast in future events given that there is a cyclical and trend component. It would be harder to forecast if there was no trend and just random components.

## Problem Five

a.)

| MONTH | # DAYS/ MONTH | BEG. INV. | FORECAST | END. INV. | PRODUCTION | PRODUCTION/ MONTH/ EMPLOYEE | LABOUR REQ | INTEGER LABOUR REQ | HIRING | FIRING | HIRING COST | FIRING COST | PRODUCTION COST | TOTAL COST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 9 | 9 | | | | | | |
| 1 | 31 | 300 | 500 | 25 | 225 | 279 | 0.81 | 1 | 0 | 8 | $0.00 | $48,000.00 | $13,950.00 | $61,950.00 |
| 2 | 28 | 25 | 300 | 15 | 290 | 252 | 1.15 | 2 | 1 | 0 | $3,000.00 | $0.00 | $25,200.00 | $28,200.00 |
| 3 | 31 | 15 | 200 | 10 | 195 | 279 | 0.70 | 1 | 0 | 1 | $0.00 | $6,000.00 | $13,950.00 | $19,950.00 |
| 4 | 30 | 10 | 1,500 | 75 | 1,565 | 270 | 5.80 | 6 | 5 | 0 | $15,000.00 | $0.00 | $81,000.00 | $96,000.00 |
| 5 | 31 | 75 | 2,500 | 125 | 2,550 | 279 | 9.14 | 10 | 4 | 0 | $12,000.00 | $0.00 | $139,500.00 | $151,500.00 |
| 6 | 30 | 125 | 3,500 | 175 | 3,550 | 270 | 13.15 | 14 | 4 | 0 | $12,000.00 | $0.00 | $189,000.00 | $201,000.00 |
| 7 | 31 | 175 | 4,500 | 225 | 4,550 | 279 | 16.31 | 17 | 3 | 0 | $9,000.00 | $0.00 | $237,150.00 | $246,150.00 |
| 8 | 31 | 225 | 2,500 | 125 | 2,400 | 279 | 8.60 | 9 | 0 | 8 | $0.00 | $48,000.00 | $125,550.00 | $173,550.00 |
| 9 | 30 | 125 | 500 | 25 | 400 | 270 | 1.48 | 2 | 0 | 7 | $0.00 | $42,000.00 | $27,000.00 | $69,000.00 |
| 10 | 31 | 25 | 300 | 15 | 290 | 279 | 1.04 | 2 | 0 | 0 | $0.00 | $0.00 | $27,900.00 | $27,900.00 |
| 11 | 30 | 15 | 300 | 15 | 300 | 270 | 1.11 | 2 | 0 | 0 | $0.00 | $0.00 | $27,000.00 | $27,000.00 |
| 12 | 31 | 15 | 2,500 | 125 | 2,610 | 279 | 9.35 | 10 | 8 | 0 | $24,000.00 | $0.00 | $139,500.00 | $163,500.00 |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | TOTAL | $1,265,700.00 |

b.) Please refer to back of assignment for answer.

c.) The aggregate plan strategy that is recommended would be the chase strategy since it yields a lower total cost.

## Problem Six

a.)

| | Saturday AM | | Saturday PM | | Sunday AM | | Sunday PM | | Excess Capacity | Idle Cost/ Order | Capacity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Saturday AM | 50 | $5.00 | | | | | | | 25 | $15.00 | 75 |
| (Regular) | | | | | | | | | | | |
| Saturday AM | | $7.50 | | | | | | | 10 | | 10 |
| (Overtime) | | | | | | | | | | | |
| Saturday AM | | $10.00 | | | | | | | 100 | | 100 |
| (Sub Cont) | | | | | | | | | | | |
| Saturday PM | | | 100 | $5.00 | | | | | | $15.00 | 100 |
| (Regular) | | | | | | | | | | | |
| Saturday PM | | | 26 | $7.50 | | | | | | | 26 |
| (Overtime) | | | | | | | | | | | |
| Saturday PM | | | 4 | $10.00 | | | | | 96 | | 100 |
| (Sub Cont) | | | | | | | | | | | |
| Sunday AM | | | | | 75 | $5.00 | | | | $15.00 | 75 |
| (Regular) | | | | | | | | | | | |
| Sunday AM | | | | | 30 | $7.50 | | | | | 30 |
| (Overtime) | | | | | | | | | | | |
| Sunday AM | | | | | 45 | $10.00 | | | 55 | | 100 |
| (Sub Cont) | | | | | | | | | | | |
| Sunday PM | | | | | | | 75 | $5.00 | | $15.00 | 75 |
| (Regular) | | | | | | | | | | | |
| Sunday PM | | | | | | | 20 | $7.50 | | | 20 |
| (Overtime) | | | | | | | | | | | |
| Sunday PM | | | | | | | 5 | $10.00 | 95 | | 100 |
| (Sub Cont) | | | | | | | | | | | |
| | | | | | | | | | | | 811 |
| Demand | 50 | | 130 | | 150 | | 100 | | 381 | | 811 |

b.) The schedule plan is as follows:

On Saturday morning, there will be 50 orders required that can be covered under regular time. This corresponds a cost of $**250.00**. There was an extra 25 staff capacity leftover resulting in an idle cost of **$15.00.** There was an excess capacity of 25 which generates the total cost on Saturday morning as **$625.00.**

During Saturday night, there was a demand of 130, resulting in 100 orders covered under regular time while the remaining 30 were under overtime. This results in a cost of **$735.00.**

On Sunday morning, there was a demand of 150, requiring that 75 orders be placed under regular time, 25 under over time, and 50 under sub-contracting. The corresponding cost for Sunday morning is **$1050.00.**

During Sunday evening, there was a demand of 100 causing 75 of those orders to be placed under regular time while the remaining 25 be placed under overtime. This means that there was a cost of $**575.00**

With all of these costs added together, it gives us a total cost of **$2985.00**

Problem 3.d

| (1) Month | (2) Occupancy (3 | (3) MA | (4) T*C CM | (5) S*R (2)/ | (6) S | (7) Adj S | (8) Des De | (9) Trend a | (10) Forecast (7)*(3 | (11) Errors (2)-(10 | (12) Abs Errors | (13) Errors Sq | (14) Rel. Errors (2)/(10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 30 | | | | 0.712207 | 0.716041 | 41.89702 | 48.7958 | 34.93980943 | -4.939809427 | 4.939809427 | 24.4017172 | 0.858619451 |
| 2 | 35 | | | | 0.799422 | 0.803725 | 43.54721 | 49.30429 | 39.62710843 | -4.627108434 | 4.627108434 | 21.4101325 | 0.883233761 |
| 3 | 42 | | | | 0.843535 | 0.848076 | 49.52385 | 49.81278 | 42.24504228 | -0.245042282 | 0.245042282 | 0.06004572 | 0.994199502 |
| 4 | 44 | | | | 0.721814 | 0.7257 | 60.63112 | 50.32128 | 36.51814582 | 7.481854182 | 7.481854182 | 55.978142 | 1.204880451 |
| 5 | 57 | | | | 0.931783 | 0.9368 | 60.84546 | 50.82977 | 47.61730591 | 9.382694087 | 9.382694087 | 88.0349483 | 1.197043783 |
| 6 | 66 | 53 | | | 1.192223 | 1.198642 | 55.06232 | 51.33827 | 61.53619145 | 4.463808546 | 4.463808546 | 19.9255867 | 1.072539565 |
| 7 | 84 | 54 | 53.5 | 1.570093 | 1.60556 | 1.614203 | 52.03806 | 51.84676 | 83.69121238 | 0.308787616 | 0.308787616 | 0.09534979 | 1.003689606 |
| 8 | 79 | 54.75 | 54.375 | 1.452874 | 1.47697 | 1.484921 | 53.20147 | 52.35526 | 77.74343337 | 1.25656663 | 1.25656663 | 1.57895969 | 1.016162994 |
| 9 | 58 | 55.33333 | 55.04167 | 1.053747 | 1.061905 | 1.067622 | 54.32633 | 52.86375 | 56.43851972 | 1.561480277 | 1.561480277 | 2.43822065 | 1.027666925 |
| 10 | 44 | 55 | 55.16667 | 0.797583 | 0.821327 | 0.825748 | 53.28499 | 53.37224 | 44.07204875 | -0.072048748 | 0.072048748 | 0.00519102 | 0.998365205 |
| 11 | 32 | 54.5 | 54.75 | 0.584475 | 0.676639 | 0.680281 | 47.03936 | 53.88074 | 36.65406006 | -4.65406006 | 4.65406006 | 21.660275 | 0.873027434 |
| 12 | 65 | 55.16667 | 54.83333 | 1.18541 | 1.092358 | 1.098239 | 59.18566 | 54.38923 | 59.7323781 | 5.267621898 | 5.267621898 | 27.7478405 | 1.088187045 |
| 13 | 42 | 56.16667 | 55.66667 | 0.754491 | 0.712207 | 0.716041 | 58.65583 | 54.89773 | 39.30904422 | 2.690955777 | 2.690955777 | 7.24124299 | 1.068456403 |
| 14 | 44 | 56.91667 | 56.54167 | 0.778187 | 0.799422 | 0.803725 | 54.74507 | 55.40622 | 44.53138475 | -0.531384748 | 0.531384748 | 0.28236975 | 0.988067186 |
| 15 | 49 | 57.33333 | 57.125 | 0.857768 | 0.843535 | 0.848076 | 57.77782 | 55.91471 | 47.41994499 | 1.580055007 | 1.580055007 | 2.49657382 | 1.033320473 |
| 16 | 40 | 57.83333 | 57.58333 | 0.694645 | 0.721814 | 0.7257 | 55.1192 | 56.42321 | 40.94631606 | -0.946316064 | 0.946316064 | 0.89551409 | 0.976888859 |
| 17 | 51 | 59 | 58.41667 | 0.873039 | 0.931783 | 0.9368 | 54.44068 | 56.9317 | 53.3335914 | -2.333591396 | 2.333591396 | 5.4456488 | 0.956245373 |
| 18 | 74 | 58.58333 | 58.79167 | 1.258682 | 1.192223 | 1.198642 | 61.73654 | 57.4402 | 68.85022028 | 5.149779718 | 5.149779718 | 26.5202311 | 1.074796852 |
| 19 | 96 | 58.41667 | 58.5 | 1.641026 | 1.60556 | 1.614203 | 59.47206 | 57.94869 | 93.54096869 | 2.459031309 | 2.459031309 | 6.04683498 | 1.026288281 |
| 20 | 88 | 58.83333 | 58.625 | 1.501066 | 1.47697 | 1.484921 | 59.2624 | 58.45719 | 86.80431991 | 1.195680094 | 1.195680094 | 1.42965089 | 1.013774431 |
| 21 | 63 | 58.91667 | 58.875 | 1.070064 | 1.061905 | 1.067622 | 59.00963 | 58.96568 | 62.95307702 | 0.046922977 | 0.046922977 | 0.00220177 | 1.000745364 |
| 22 | 50 | 59.41667 | 59.16667 | 0.84507 | 0.821327 | 0.825748 | 60.55113 | 59.47417 | 49.11070855 | 0.889291454 | 0.889291454 | 0.79083929 | 1.018107893 |
| 23 | 46 | 60.25 | 59.83333 | 0.768802 | 0.676639 | 0.680281 | 67.61908 | 59.98267 | 40.80508946 | 5.194910538 | 5.194910538 | 26.9870955 | 1.127310358 |
| 24 | 60 | 59.83333 | 60.04167 | 0.999306 | 1.092358 | 1.098239 | 54.63291 | 60.49116 | 66.43375641 | -6.433756406 | 6.433756406 | 41.3932215 | 0.903155312 |
| 25 | 40 | 59.58333 | 59.70833 | 0.669923 | 0.712207 | 0.716041 | 55.86269 | 60.99966 | 43.67827902 | -3.678279019 | 3.678279019 | 13.5297365 | 0.915786998 |
| 26 | 49 | 59.83333 | 59.70833 | 0.820656 | 0.799422 | 0.803725 | 60.9661 | 61.50815 | 49.43566106 | -0.435661062 | 0.435661062 | 0.18980056 | 0.991187312 |
| 27 | 50 | 60.75 | 60.29167 | 0.829302 | 0.843535 | 0.848076 | 58.95696 | 62.01665 | 52.5948477 | -2.594847704 | 2.594847704 | 6.73323461 | 0.950663462 |
| 28 | 46 | 62.08333 | 61.41667 | 0.748982 | 0.721814 | 0.7257 | 63.38708 | 62.52514 | 45.37448631 | 0.62551369 | 0.62551369 | 0.39126738 | 1.013785582 |
| 29 | 61 | 61.08333 | 61.58333 | 0.990528 | 0.931783 | 0.9368 | 65.11532 | 63.03363 | 59.04987688 | 1.950123122 | 1.950123122 | 3.80298019 | 1.033025016 |
| 30 | 69 | 61.5 | 61.29167 | 1.125765 | 1.192223 | 1.198642 | 57.56516 | 63.54213 | 76.16424911 | -7.164249109 | 7.164249109 | 51.3264653 | 0.905936851 |
| 31 | 93 | | | | 1.60556 | 1.614203 | 57.61356 | 64.05062 | 103.390725 | -10.390725 | 10.390725 | 107.967166 | 0.899500415 |
| 32 | 91 | | | | 1.47697 | 1.484921 | 61.28271 | 64.55912 | 95.86520644 | -4.865206442 | 4.865206442 | 23.6702337 | 0.949249507 |
| 33 | 74 | | | | 1.061905 | 1.067622 | 69.3129 | 65.06761 | 69.46763432 | 4.532365676 | 4.532365676 | 20.5423386 | 1.065244278 |
| 34 | 66 | | | | 0.821327 | 0.825748 | 79.92749 | 65.5761 | 54.14936834 | 11.85063166 | 11.85063166 | 140.437471 | 1.218850783 |
| 35 | 34 | | | | 0.676639 | 0.680281 | 49.97932 | 66.0846 | 44.95611886 | -10.95611886 | 10.95611886 | 120.036541 | 0.756293044 |
| 36 | 65 | | | | 1.092358 | 1.098239 | 59.18566 | 66.59309 | 73.13513471 | -8.13513471 | 8.13513471 | 66.1804167 | 0.888765711 |

| ME= | MAD= | MSE= | MAX= |
|---|---|---|---|
| -0.1420907 | 3.913650381 | 26.0465412 | 1.218850783 |
| | SIGMA= | SIGMA= | MIN= |
| | 4.892062976 | 5.10358122 | 0.756293044 |

Problem 5.b

| MONTH | # DAYS/ MONTH | BEG. INV. | FORECAST | PRODUCTION | END. REQ. INV | END INV. | Subcontract | End Stock | Production Cost | Subcontracting Cost | IHC | # of Employees | # of Employees Rounded up | Fixed COST | TOTAL COST |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | 9 | 9 | | |
| 1 | 31 | 300 | 500 | 1,578 | 25 | 1,378 | | 1378.00 | 78,900 | 0 | 1,378 | 5.844444444 | 6 | $18,000.00 | |
| 2 | 28 | 1,378 | 300 | 1,578 | 15 | 2,656 | | 2656.00 | 78,900 | 0 | 2,656 | 5.844444444 | 6 | | |
| 3 | 31 | 2,656 | 200 | 1,578 | 10 | 4,034 | | 4034.00 | 78,900 | 0 | 4,034 | 5.844444444 | 6 | | |
| 4 | 30 | 4,034 | 1,500 | 1,578 | 75 | 4,112 | | 4112.00 | 78,900 | 0 | 4,112 | 5.844444444 | 6 | | |
| 5 | 31 | 4,112 | 2,500 | 1,578 | 125 | 3,190 | | 3190.00 | 78,900 | 0 | 3,190 | 5.844444444 | 6 | | |
| 6 | 30 | 3,190 | 3,500 | 1,578 | 175 | 1,268 | | 1268.00 | 78,900 | 0 | 1,268 | 5.844444444 | 6 | | |
| 7 | 31 | 1,268 | 4,500 | 1,578 | 225 | -1,654 | 1,879 | 225.00 | 78,900 | 140,925 | 225 | 5.844444444 | 6 | | |
| 8 | 31 | -1,654 | 2,500 | 1,578 | 125 | -2,576 | 2,701 | 125.00 | 78,900 | 202,575 | 125 | 5.844444444 | 6 | | |
| 9 | 30 | -2,576 | 500 | 1,578 | 25 | -1,498 | 1,523 | 25.00 | 78,900 | 114,225 | 25 | 5.844444444 | 6 | | |
| 10 | 31 | -1,498 | 300 | 1,578 | 15 | -220 | 235 | 15.00 | 78,900 | 17,625 | 15 | 5.844444444 | 6 | | |
| 11 | 30 | -220 | 300 | 1,578 | 15 | 1,058 | | 1058.00 | 78,900 | 0 | 1,058 | 5.844444444 | 6 | | |
| 12 | 31 | 1,058 | 2,500 | 1,567 | 125 | 125 | | 125.00 | 78,350 | 0 | 125 | 5.803703704 | 6 | | |
| | | | | | | | | | | | | | | | |
| | | | | 18,925 | | | | | 946,250 | 475,350 | 18,211 | | | TOTAL | $1,457,811.00 |

**Personal Ethics Agreement Concerning Telfer School Assignments**

**Group Assignment**

By signing this Statement, I am attesting to the fact that I have reviewed not only my own work, but the work of my colleagues, in its entirety.

I attest to the fact that my own work in this project meets all of the rules of quotation and referencing in use at the Telfer School of Management at the University of Ottawa, as well as adheres to the fraud policies as outlined in the Academic Regulations in the University's Undergraduate Studies Calendar. Academic Fraud Webpage

To the best of my knowledge, I also believe that each of my group colleagues has also met the rules of quotation and referencing aforementioned in this Statement.

I understand that if my group assignment is submitted without a signed copy of this Personal Ethics Statement from each group member, it will be interpreted by the Telfer School that the missing student(s) signature is confirmation of non-participation of the aforementioned student(s) in the required work.

| | |
|---|---|
| _____ | _____ |
| Signature | Date |
| _____ | _____ |
| Last Name (print), First Name (print) | Student Number |
| _____ | _____ |
| Signature | Date |
| _____ | _____ |
| Last Name (print), First Name (print) | Student Number |