Case Study

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Cell Phone Case Study

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1. Project description

In Digital Cell manufactures a broad line of phones for the consumer market. The chief operations officer, has asked Paul who has just been hired as a management analyst to do an assignment about the stock of the end of each month, handing the analyst a table that shown here the actual order entered for the three years with 144 phones per case.

The COO wants to know what the business will look like over the next 6 to 12 months by creating a report using regression analysis, providing a summary of the cell phone industry outlook and how does the analysis change by adding seasonality into the model.

Table 1 Orders Received by Month

Orders Received, by Month

Month	Cases 2007	Cases 2008	Cases 2009
January	480	575	608
February	436	527	597
March	482	540	612
April	448	502	603
May	458	508	628
June	489	573	605
July	498	508	627
August	430	498	578
September	444	485	585
October	496	526	581
November	487	552	632
December	525	587	656

2. The solution methodology

We approach the solution using regression analysis (**least square method)** it helps us to minimize the sum of squared errors

We the received orders data by month from 2007 to 2009 to calculate forecasted demand for the next 6 to 12 months without adding seasonality into our model for the first part.

To calculate the forecasted demand using regression analysis we need to find y-axis intercept (a) and the slope of the regression line (b)

We need to use the following equations to calculate the demand at a given month :

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Equation 1 Linear regression

$$\hat{y} = a + bx$$

where :

y = computed value of the variable to be predicted (dependent variable)

a = y-axis intercept

b = slope of the regression line

x = the independent variable

To calculate ***a*** **and** ***b*** we need to use the following equations :

Equation 2 Slope

$$b = \frac{\sum xy - n\overline{xy}}{\sum x^2 - n\overline{x}^2}$$

Equation 3 y-axis intercept

$$a = \overline{y} - \overline{b}x$$

Where : $\overline{x}$ and $\overline{y}$ are the months mean and cases mean respectively

We used Microsoft Excel to organize the date and to do the needed calculations and the data as follow :

Table 2 Organized data for year 2007

Year	Month	X	Y (Cases)
2007	January	1	480
2007	February	2	436
2007	March	3	482
2007	April	4	448
2007	May	5	458
2007	June	6	489
2007	July	7	498
2007	August	8	430
2007	September	9	444
2007	October	10	496
2007	November	11	487
2007	December	12	525

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Table 3 Organized data for year 2008

Year	Month	X	Y (Cases)
2008	January	13	575
2008	February	14	527
2008	March	15	540
2008	April	16	502
2008	May	17	508
2008	June	18	573
2008	July	19	508
2008	August	20	498
2008	September	21	485
2008	October	22	526
2008	November	23	552
2008	December	24	587

Table 4 Organized data for year 2009

Year	Month	X	Y (Cases)
2009	January	25	608
2009	February	26	597
2009	March	27	612
2009	April	28	603
2009	May	29	628
2009	June	30	605
2009	July	31	627
2009	August	32	578
2009	September	33	585
2009	October	34	581
2009	November	35	632
2009	December	36	656

From the tables above we calculated the following :

$\sum xy = 378661$ $\quad \overline{y} = 537.944$ $\quad n\overline{xy} = 342.25$

$\sum x^2 = 16206$ $\quad b\overline{x} = 97.09524$ $\quad n\overline{x}^2 = 12321$

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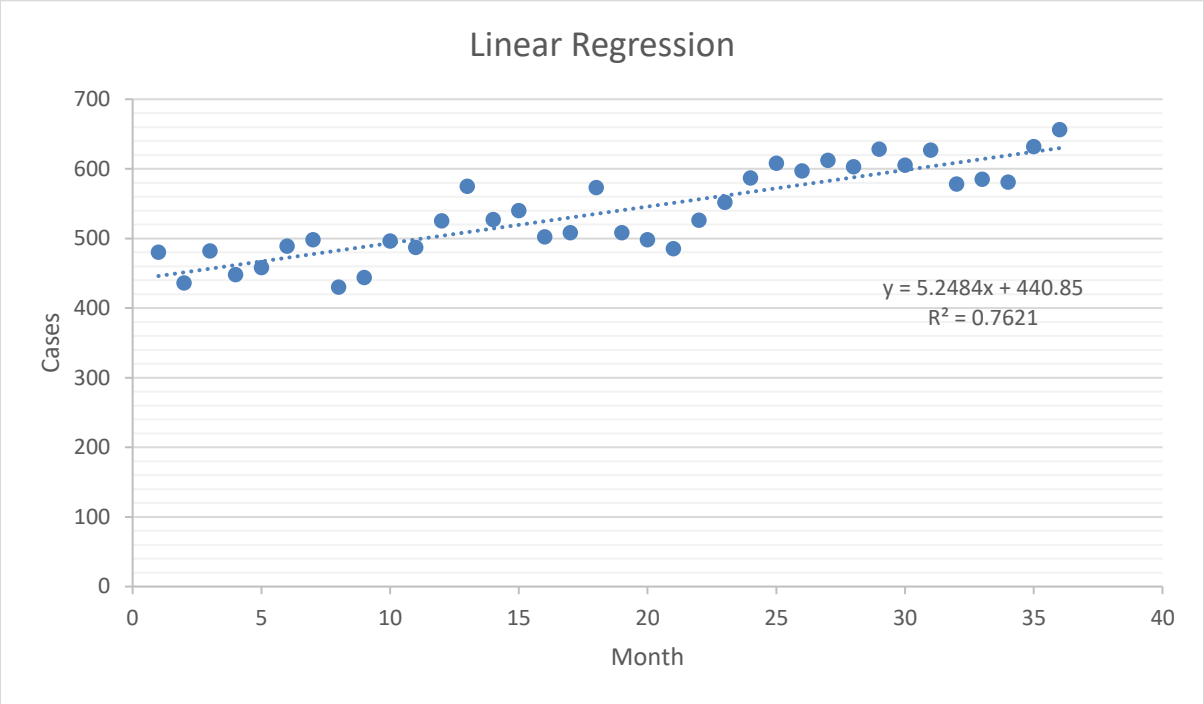
We get $\boldsymbol{b}$ = **5.24839** and $\boldsymbol{a}$ **= 440.849** and thus**,**

$$\hat{y} = 440.95 + 5.25x$$

Figure 1 Linear Regression Graph



Method 2

In method 2 we include seasonality, so we need to calculate the seasonal index using the **avg yearly demand** and the **avg monthly demand** using the following equations :

Equation 4 Avg monthly demand

$$Avg\ monthly\ demand = \frac{Total\ avg\ yearly\ demand}{12}$$

Equation 5 Seasonal indix

$$\text{Seasonal Index} = \frac{\text{Avg yearly demand of month i}}{\text{Avg monthly demand}}$$

$$Forcast = Avg\ monthly\ forcasted\ demand\ x\ Seasonal\ index$$

Also, we need **forecasted yearly demand of year 4 (2010)** and we get it from **table 5**

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3. The results and recommendations

For Method 1 we used least square method to find the trend line and we used the trend line to forecast the demand for the next year which is from month 37 to month 48 and we got the following results :

Table 5 Least square method results

		Forcast		Round
2010	January	37	635.1	635
2010	February	38	640.35	640
2010	March	39	645.6	646
2010	April	40	650.85	651
2010	May	41	656.1	656
2010	June	42	661.35	661
2010	July	43	666.6	667
2010	August	44	671.85	672
2010	September	45	677.1	677
2010	October	46	682.35	682
2010	November	47	687.6	688
2010	December	48	692.85	693

We see that the from the trend line and the forecasted demand that the demand is increasing continuously over the years we recommend the Digital Cell Phone to increase there production of the cell phone and manage the inventory to meet that continuous change in demand we advise them to **Lead the demand with incremental expansion** to avoid stockouts

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For method 2 We added seasonality into our model which required to calculate the seasonal index and the yearly demand of year 2010 which we get from

Table 6 Seasonality model results

Month	2007	2008	2009	Avg Yearly demand	Avg Monthly Demand	Seasonal index	Forcast	Round
January	480	575	608	554.33	537.94	1.030	684.23	684
February	436	527	597	520.00	537.94	0.967	641.86	642
March	482	540	612	544.67	537.94	1.013	672.30	672
April	448	502	603	517.67	537.94	0.962	638.98	639
May	458	508	628	531.33	537.94	0.988	655.85	656
June	489	573	605	555.67	537.94	1.033	685.88	686
July	498	508	627	544.33	537.94	1.012	671.89	672
August	430	498	578	502.00	537.94	0.933	619.64	620
September	444	485	585	504.67	537.94	0.938	622.93	623
October	496	526	581	534.33	537.94	0.993	659.55	660
November	487	552	632	557.00	537.94	1.035	687.53	688
December	525	587	656	589.33	537.94	1.096	727.44	727
Total				6455				

We see that December has the highest seasonal index and the highest forecasted demand with around 9.553% demand more than the avg we conclude that we get the highest demand in the year around December (also we get high demand in January and November) so we advise Digital Cell Phone inc should increase it is production at these 3 months .