FORECASTING EQUATIONS - Prof. Richard B. Goldstein

MOVING AVERAGE:

$$F_{t+1} = \frac{\sum(\text{most recent k data values})}{k}$$

$$F_{t+1} = \frac{Y_t + Y_{t-1} + \ldots + Y_{t-k+1}}{k}$$

WEIGHTED MOVING AVERAGE:

$$F_{t+1} = \frac{w_1 Y_t + w_2 Y_{t-1} + \ldots + w_k Y_{t-k+1}}{w_1 + w_2 + \ldots + w_k}$$

EXPONENTIAL SMOOTHING:

Usually $F_1 = Y_1$

$F_{t+1} = \alpha Y_t + (1 - \alpha) F_t$ where $0 < \alpha < 1$ is a smoothing constant

SIMPLE REGRESSION:

$F_t = b_0 + b_1 t$ where

$$b_1 = \frac{n \sum t Y_t - (\sum t)(\sum Y_t)}{n \sum t^2 - (\sum t)^2}$$

$$b_0 = \overline{Y} - b_1 \bar{t}$$

$$\bar{t} = \frac{\sum t}{n}, \overline{Y} = \frac{\Sigma Y_t}{n}$$

REGRESSION WITH TREND AND SEASONAL COMPONENTS:

(1) FIND CENTERED MOVING AVERAGE (using 4 time periods)

$$u_t = \frac{Y_{t-2} + 2Y_{t-1} + 2Y_t + 2Y_{t+1} + Y_{t+2}}{8} \quad \text{for } t = 3, 4, \ldots, N-2$$

(2) FIND DATA/CMA RATIO $J_t = \frac{Y_t}{u_t}$

(3) FIND THE MEAN (FOR EACH SEASON) OF THE J_t=s

(4) ADJUST THE VALUES IN STEP (3) TO ADD TO 4.0
THE RESULTS ARE THE SEASONAL INDICES

(5) DESEASONALIZE THE DATA VALUES: $\hat{Y}_t = \frac{Y_t}{\text{Index}_t}$

(6) FIND THE TREND LINE OF REGRESSION
USE LINEAR REGRESSION ON THE $\hat{Y}_t$ VALUES

(7) FORECASTS: $F_t = (b_0 + b_1 t) * \text{Seasonal Index}$

ERROR ANALYSIS:

Deviations: $d_t = Y_t - F_t$

Mean Square Error (MSE): $\frac{\sum d_t^2}{\text{no. of forecasts}}$

Mean Absolute Deviation (MAD): $\frac{\sum |d_t|}{\text{no. of forecasts}}$

Prof. Richard B. Goldstein FORECASTING

				Moving Averages			α	Simple	Ctr Mov	Data/CMA	Seasonal	Deseas.		Regress
Period	Year	Qtr	Data	3-Qtr	5-Qtr	3-Qtr Wt	0.3	Regression	Average	Ratio	index	Values	Regress	* S.Ind.
1	1	1	105			(5-3-2)	105.00	121.99			1.046424	100.3418	117.35	122.80
2	1	2	150				105.00	123.96			1.212537	123.7076	120.21	145.76
3	1	3	93				118.50	125.93	121.625	0.76465	0.749770	124.0380	123.07	92.27
4	1	4	121	116.00		112.50	110.85	127.90	128.500	0.94163	0.991269	122.0657	125.93	124.83
5	2	1	140	121.33		118.40	113.90	129.88	132.500	1.05660	1.046424	133.7890	128.79	134.77
6	2	2	170	118.00	121.80	124.90	121.73	131.85	137.625	1.23524	1.212537	140.2019	131.65	159.63
7	2	3	105	143.67	134.80	151.20	136.21	133.82	142.500	0.73684	0.749770	140.0429	134.51	100.85
8	2	4	150	138.33	125.80	131.50	126.85	135.79	143.750	1.04348	0.991269	151.3212	137.37	136.17
9	3	1	150	141.67	137.20	140.50	133.79	137.76	144.375	1.03896	1.046424	143.3454	140.23	146.73
10	3	2	170	135.00	143.00	141.00	138.65	139.74	142.500	1.19298	1.212537	140.2019	143.08	173.50
11	3	3	110	156.67	149.00	160.00	148.06	141.71			0.749770	146.7116	145.94	109.42
12	3	4	130	143.33	137.00	136.00	136.64	143.68			0.991269	131.1450	148.80	147.50
13	4	1		136.67	142.00	132.00	134.65	145.65			1.046424		151.66	158.70
14	4	2						147.62			1.212537		154.52	187.37
15	4	3						149.60			0.749770		157.38	118.00
16	4	4						151.57			0.991269		160.24	158.84
17	5	1						153.54			1.046424		163.10	170.67
18	5	2						155.51			1.212537		165.96	201.23

Mean Square Error	928.74	894.25	946.31	912.54	578.96	85.26
Sqrt(Mean Square Error):	30.48	29.90	30.76	30.21	24.06	9.23
Mean Absolute Deviation:	25.48	26.86	26.04	27.42	21.84	7.09

Regression Output (#1):

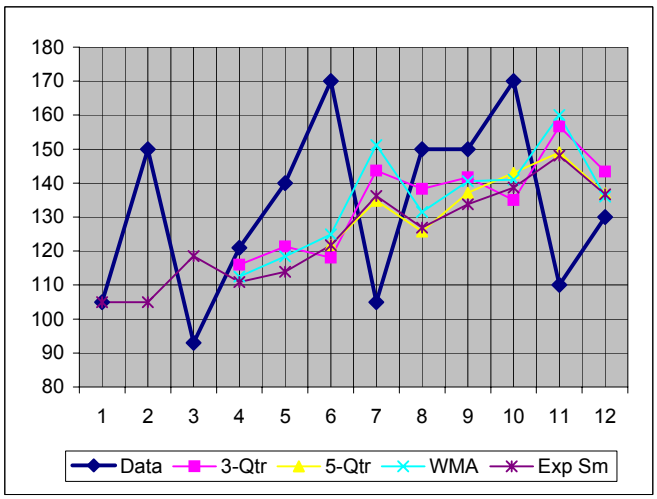
Constant	120
Std Err of Y Est	26.36
R Squared	0.074
No. of Observations	12
Degrees of Freedom	10
X Coefficient(s)	1.972
Std Err of Coef.	2.204

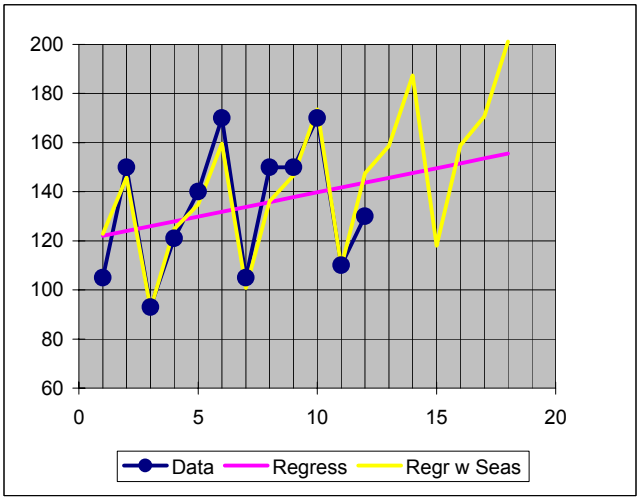
Quarter Values

Qtr	Data/CMA Ratio		Qtr Avg	Adj Qt Av
1	1.05660	1.03896	1.047782	1.046424
2	1.23524	1.19298	1.214112	1.212537
3	0.76465	0.73684	0.750744	0.749770
4	0.94163	1.04348	0.992556	0.991269
SUM			4.005194	4.000000

Regression Output (#2):

Constant	114.5
Std Err of Y Est	9.856
R Squared	0.546
No. of Observations	12
Degrees of Freedom	10
X Coefficient(s)	2.860
Std Err of Coef.	0.824





	$\sqrt{MSE}$	MAD
best α= 0.257106	30.13	27.32
best α= 0.257106	30.61	27.28