Supply Chain — Mohsen NAbian — HW2

PJ:

3 month moving average: $F(t+1) = \frac{D(t) + D(t-1) + D(t-2)}{3}$

5 ~ ~ ~ : $F(t+1) = \frac{D(t) + D(t-1) + D(t-2) + D(t-3) + D(t-4)}{5}$

3 month:

$F(year=2, april) = \frac{205 + 230 + 205}{3} = 213.3$

$F(year=2, may) = 213.3$

$F(year=2, June) = 213.3$

$F(year=2, Jan) = \frac{200 + 190 + 180}{3} = 190$

$F(year=2, Feb) = \frac{190 + 180 + 205}{3} = 191.6$

$F(year=2, Mar) = \frac{180 + 205 + 230}{3} = 205$

5 month moving average :

$$F(year=2, Jan) = \frac{180+190+200+215+235}{5} = 204$$

$$F(year=2, Feb) = \frac{205+180+190+200+215}{5} = 198$$

$$F(year=2, Mar) = \frac{230+205+180+190+200}{5} = 201$$

$$F(year=2, Apr) = \frac{240+230+205+180+190}{5} = 209$$

$$F(year=2, May) = 209$$

$$F(year=2, June) = 209$$

P2 :

$D_t = 100$ for $t = 1, 2, 3, \dots, 10$ $\quad F_1 = 40$

Exponential Smoothing :

$$F(t) = F(t-1) + \alpha \left[D(t-1) - F(t-1) \right]$$

$$F_2 = 40 + \alpha (100 - 40)$$

$\alpha = 0.2 \rightarrow F_2 = 40 + 0.2(60) = 52$

$\alpha = 0.6 \rightarrow F_2 = 40 + 0.6(60) = \underline{76}$

$\alpha = 0.2$

$F_3 = 52 + 0.2(100 - 52) = 61.6$

$\alpha = 0.6$

$F_3 = 76 + 0.6(100 - 76) = \underline{90.4}$

Therefore $\underline{\alpha = 0.6}$ is damping error Faster !

P3

$$Y(t) = a e^{bt}$$

$$\log y = \log a + b t$$

z ← $\log y$, c ← $\log a$

$$\Rightarrow z = c + bt$$

$$\Rightarrow b = \frac{N \sum X \log Y - \sum X \sum \log Y}{N \sum X^2 - \left(\sum X\right)^2} \surd\surd$$

$$c = \frac{\sum \log Y}{N} - b \frac{\sum X}{N}$$

$$a = e^{c} \surd\surd$$

P4 :

$t=$	1	2	3	4	5
$Y(t)=$	2.72	5.50	7.40	10	12.20
$\log Y$	1	1.704	2	2.30	2.50

$$\sum X = 1+2+3+4+5 = 15$$

$$\sum X^2 = 1+4+9+16+25 = 55$$

$$N = 5$$

$$\sum \log Y = 1 + 1.704 + 2 + 2.30 + 2.5 = 9.5$$

$$= 9.5$$

$$\sum X \log Y = 1\times1 + 2\times1.7 + 3\times2 + 4\times2.3 + 5\times2.5$$

$$= 1 + 3.4 + 6 + 9.2 + 12.5 = 32.1$$

$$\Rightarrow b = \frac{5\times32.1 - 15\times9.5}{5\times55 - 15\times15} = 0.36$$

$$c = \frac{9.5}{5} - 0.36\,\frac{15}{5} = \underline{0.82}$$

$$\Rightarrow a = e^{0.82} = 2.27 = a$$

$$\Rightarrow \boxed{y = 2.27\,e^{0.36t}}$$

(P5)

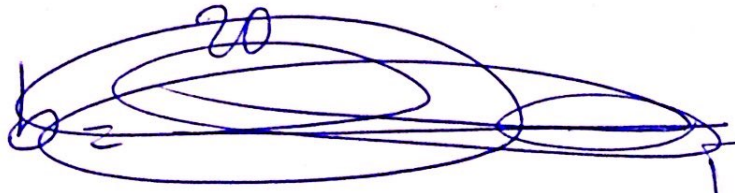
P5

Year	I	II	III	IIII	Total
1	50	62	45	30	187
2	56	51	22	31	160
3	75	79	62	70	286
4	86	73	55	46	260
5	95	81	86	91	353
Totals	362	346	270	268	1246
Qtr Ave	72.4	69.2	54	53.6	249.2
$1	0.29	0.28	0.22	0.22	

Step II :

Year	I	II	III	IIII
1	172.41	221.4	204.54	136.3
2	193.10	182	100	147
3	258.6	281.8	281.8	318
4	296.55	260.7	250	209.07
5	327.58	368	390.9	473.6

	Y	X	X^2	XY		Y	X	X^2	XY
Y1Q1	172	1	1	172	Y4Q4	209	16	256	3344
Y1Q2	221	2	4	442	Y5Q1	327	17	289	5559
Y1Q3	204	3	9	612	Y5Q2	368	18	324	6624
Y1Q4	136	4	16	544	Y5Q3	390	19	361	7410
Y2Q1	193	5	25	965	Y5Q4	413	20	400	8260
Y2Q2	182	6	36	1092					
Y2Q3	100	7	49	700					
Y2Q4	141	8	64	1128					
Y3Q1	258	9	81	2322					
Y3Q2	282	10	100	2820					
Y3Q3	281	11	121	3091					
Y3Q4	318	12	144	3816					
Y4Q1	296	13	169	3848					
Y4Q2	260	14	196	3640					
Y4Q3	250	15	225	3750					



$$\sum XY = 60130$$

$$\sum X^2 = 3592$$

$$\sum X = \frac{20 \times 21}{2} = 210$$

$$\sum Y = 5001$$

$$b_2 \frac{N\sum XY - \sum X \sum Y}{N\sum X^2 - (\sum X^2)}$$

$$a_2 \frac{\sum Y}{N} - b\frac{\sum X}{N}$$

$$\Rightarrow b = \frac{20 \times 60130 - (210)(5001)}{20 \times 3592 - (210)^2} = 5.49$$

$$a = \frac{5001}{5} - 5.49 \frac{210}{5} = 769.62$$

$$\Rightarrow \boxed{Y = aX + b = 769.6X + 5.5}$$

year 7

	I	II	III	IV
X	25	26	27	28
Y	430	450	465	480