02/02

PP1 – ✓

Today – Moving Average ≡ MA(k)

Chapter 4 – MA(k), Smoothing – Simple/Single
– Double ?
– Winters.

PP2 – Feb 20

Exam 1 → Chapter 1-5 Feb. 25

✓MA(k), PP2 ✓, MINITAB ✓

= ↖ PP2 → 3-5 → Error comparisons MSD, MAD MAPE, etc.

Moving Averages = MA(k)

y_t {revenue, income, unemployment ...}

Qtr.	y_t
1	100
2	120
3	150
4	160
5	200
6	250
7	300
8	400
9	500

$\{y_t\}$ $t = 1, 2, \ldots 9$ } time series data

aside

vs. Cross section data.

snapshot at a point in time

$y_{(i)} =$ i = Alabama, Arkansas, ..., Wyom.

(states)

If $t=6$

$y_1 = 100$

$y_6 = 250$

Let's MA(4)

Let $k=4$

MA(4)

$$\hat{y}_t = \frac{y_{t-1} + y_{t-2} + y_{t-3} + y_{t-4}}{4}$$

t	$\hat{y}_t$
1	-
2	-
3	-
4	-
5	132.5
6	157.5
⋮	⋮

if $t=5$

$$\hat{y}_5 = \frac{y_4 + y_3 + y_2 + y_1}{4} = \frac{530}{4}$$

$$= 132.5$$

$$\hat{y}_6 = \frac{y_5 + y_4 + y_3 + y_2}{4} =$$

$$= \frac{120 + 150 + 160 + 200}{4} = \frac{630}{4}$$

MA(1) ≡
MA(2)
MA(4)

} average across ≡ observations

$\hat{y}_t \equiv y_{t-1}$ > Naive Method.

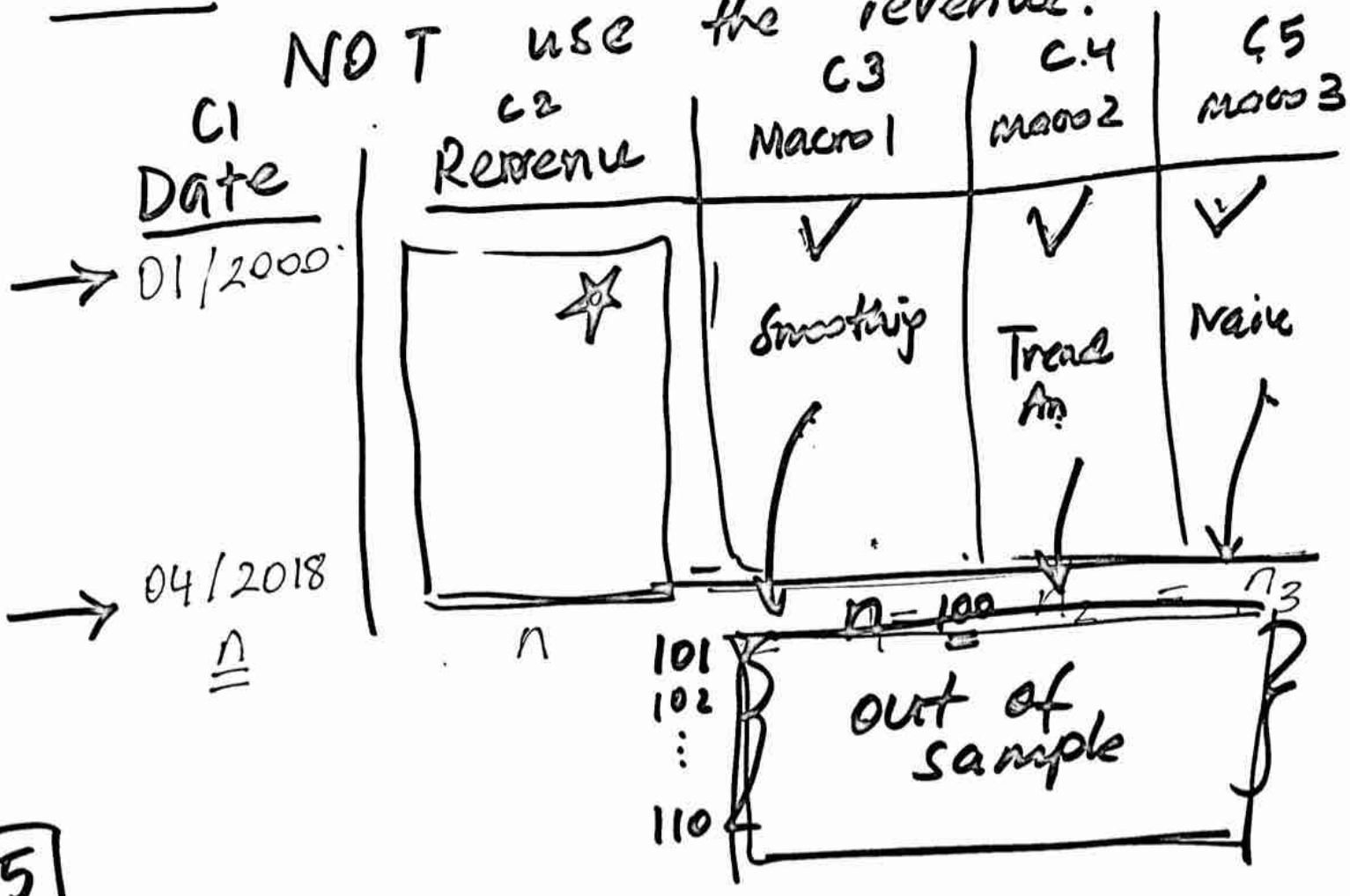
groceries

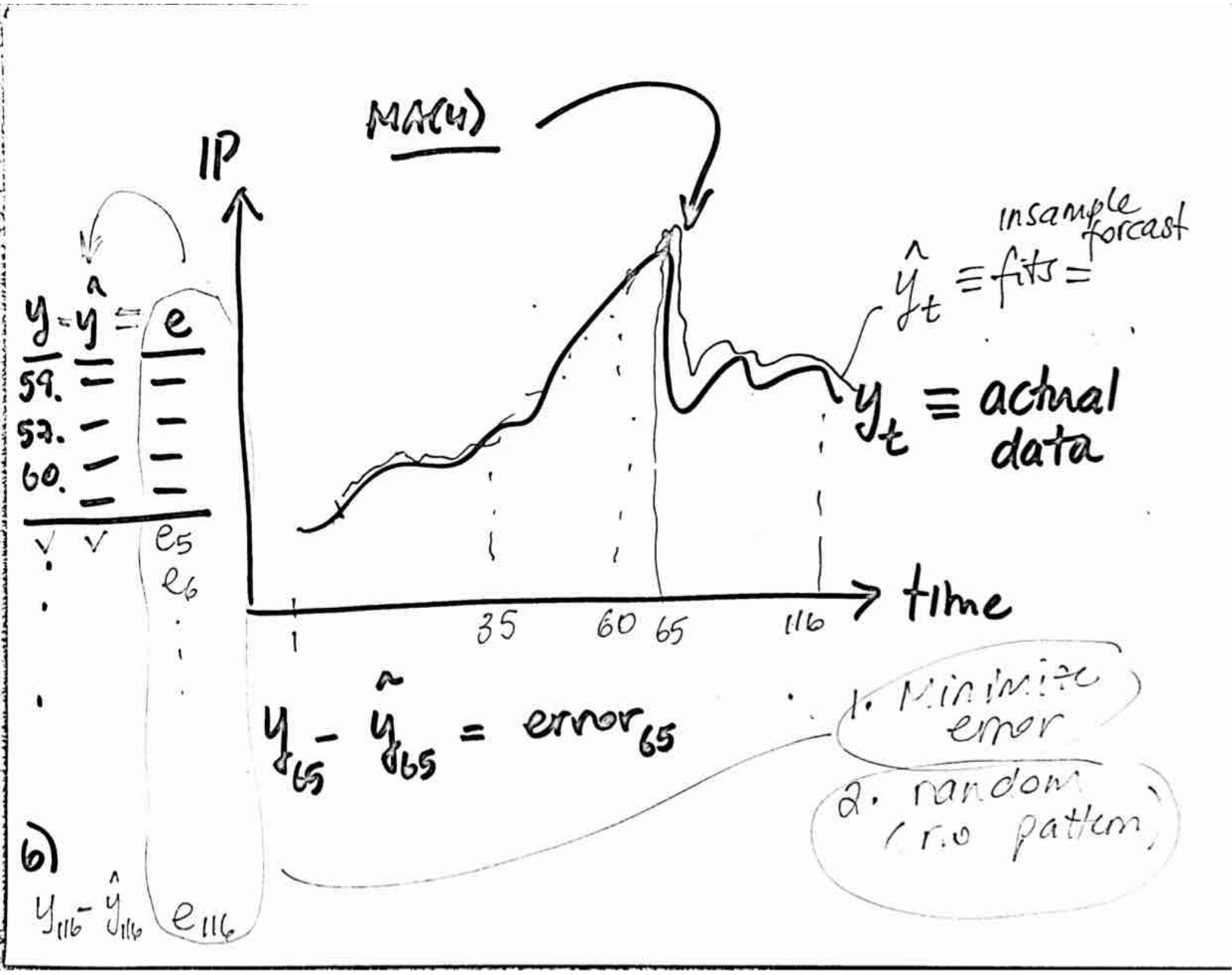
ex: utilities → 2nd qtr → 3rd qtr

$\hat{y}_t \equiv y_{t-4}$ } seasonality

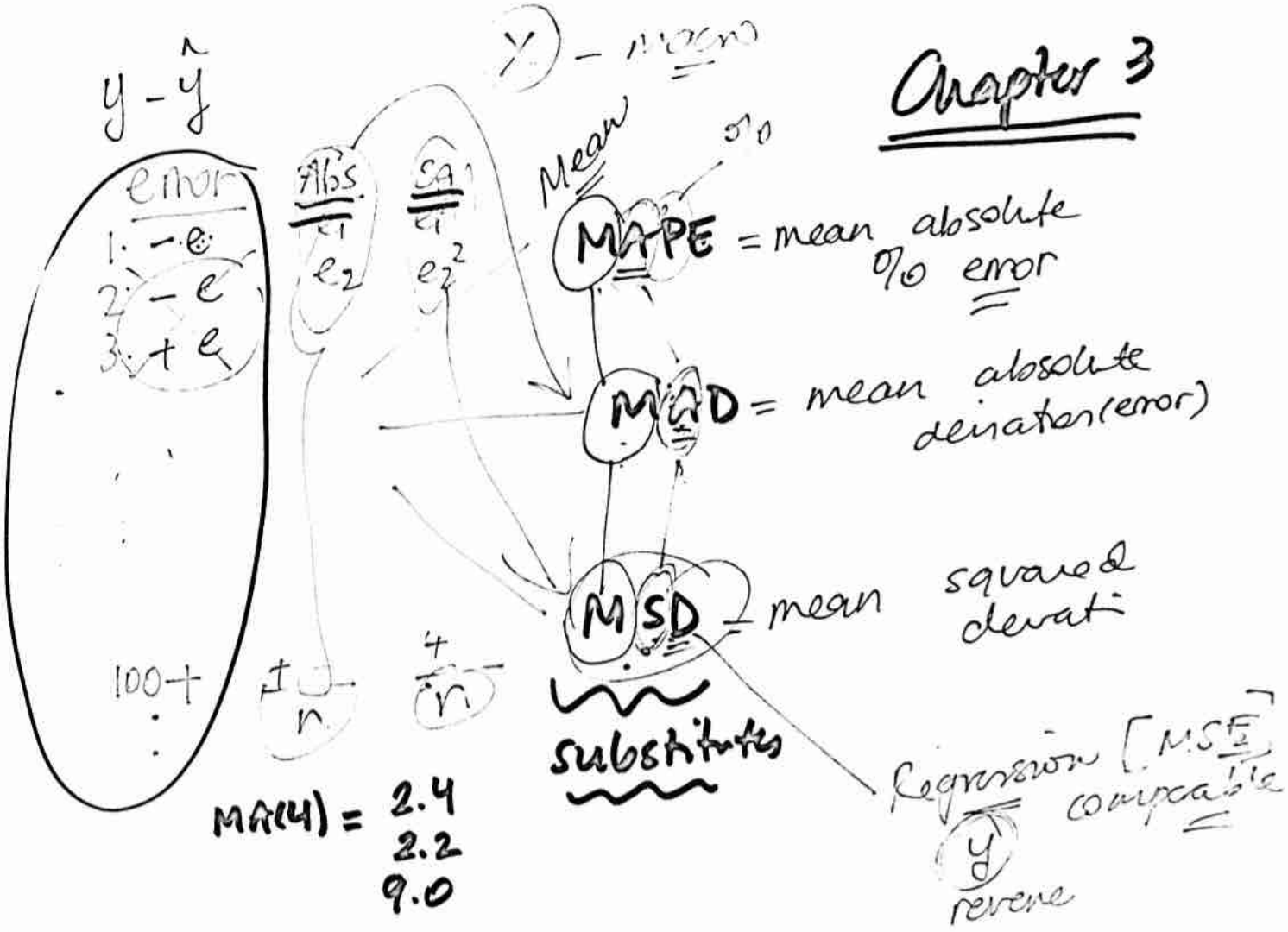
PP2: on macro variables.

NOT use the revenue.




MA(4)
IP
insample forcast
$\hat{y}_t \equiv$ fits $=$
$y_t \equiv$ actual data
time
1
35
60
65
116
$y - \hat{y} = e$
59. — —
52. — —
60. — —
e_5
e_6
$y_{65} - \hat{y}_{65} = error_{65}$
1. Minimize error
2. random (no pattern)
6)
$y_{116} - \hat{y}_{116}$
e_{116}

Chapter 3



MA(4) = 2.4
2.2
9.0

Exponential Smoothing

$$\hat{y}_{t+1} = \alpha(y_t) + (1-\alpha)\hat{y}_t$$

- α: alpha
- y_t: last observation
- $\hat{y}_t$: last forecast (fit)

$0 < \alpha < 1$

Let $\alpha = 0.5$

(i) $0.1 - 0.3$ ✓

(ii) Let Minitab pick ✓

Let $\alpha = 0$ ✗ $\Rightarrow \hat{y}_{t+1} = \hat{y}_t$ ✗

Let $\alpha = 1$ ✗ $\Rightarrow \hat{y}_{t+1} = y_t$

✗

Naïve?

MA(1)

t	y_t	$\hat{y}_t$	e_t
1	100	50	50
2	200	65	135
3	300		
4	400		

SES ≡ 1st method

$\hat{y}_{t+1} = \alpha \cdot y_t + (1-\alpha)\hat{y}_t$

⇒ let $\alpha = 0.3$

$\hat{y}_2 = [0.3 * 100] + [0.7 * 50]$

$(\hat{y}_{t+1})$

$= 30 + 35 = 65$

Level data ≡ stationary data

Minitab

#2 - Double (L, T)

#3 - Winters (L, T, S)

9