Complete the MRP record for item A

| | | | Lot Size: | | | POQ (P=3) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Item:** A | | | **Lead Time:** | | | 2 weeks | | | | |
| **Description:** | | | **Safety Stock:** | | | 100 | | | | |
| **Week** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Gross requirements | | | 70 | | 50 | | | 55 | 80 | |
| Scheduled receipts | | | | | | | | | | |
| Projected on hand 100 | 100 | 100 | 150 | 150 | 100 | 100 | 100 | 180 | 100 | 100 |
| Planned receipts | / | / | 120 | / | / | / | / | 135 | / | / |
| Planned order releases | 120 | | | | | 135 | | | | |

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Complete the MPS record for item A

| Item: A | Lot Size: 95<br>LT = 1 weeks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Week | | | | | | | | | |
| **Quantity on Hand: 55** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** |
| Forecast | 45 | 45 | 45 | 45 | 45 | 50 | 50 | 50 | 50 | 50 |
| Customer orders (booked) | 10 | 0 | 50 | 48 | 7 | 0 | 0 | 0 | 0 | 0 |
| Projected on-hand inventory | 10 | 60 | 10 | 57 | 12 | 57 | 7 | 52 | 2 | 47 |
| MPS quantity | 0 | 95 | 0 | 95 | 0 | 95 | 0 | 95 | 0 | 95 |
| MPS start | 95 | / | 95 | / | 95 | / | 95 | / | 95 | / |
| ATP | 10 | 45 | | 40 | | 95 | | 95 | | 95 |

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## Forecast Error

1. Forecast error measures:

$$E_t = D_t - F_t$$

$$\text{CFE} = \sum E_t$$

$$\bar{E} = \frac{\text{CFE}}{n}$$

$$\text{MSE} = \frac{\sum E_t^2}{}$$

$$\sigma = \sqrt{\frac{\sum (E_t - \bar{E})^2}{n-1}}$$

$$\text{MAD} = \frac{\sum |E_t|}{n}$$

$$\text{MAPE} = \frac{(\sum |E_t|/D_t)(100\%)}{n}$$

## Causal Methods: Linear Regression

2. Linear regression:

$$Y = a + bX$$

## Time-Series Methods

3. Naïve forecasting:

$$\text{Forecast} = D_t$$

4. Simple moving average:

$$F_{t+1} = \frac{D_t + D_{t-1} + D_{t-2} + \cdots + D_{t-n+1}}{n}$$

5. Weighted moving average:

$$F_{t+1} = \text{Weight}_1(D_t) + \text{Weight}_2(D_{t-1}) + \text{Weight}_3(D_{t-2}) + \cdots + \text{Weight}_n(D_{t-n+1})$$

6. Exponential smoothing:

$$F_{t+1} = \alpha D_t + (1 - \alpha)F_t$$

7. Trend Projection using Regression

$$F_t = a + bt$$

8. Tracking signal:

$$\frac{\text{CFE}}{\text{MAD}} \text{ or } \frac{\text{CFE}}{\text{MAD}_t}$$

9. Exponentially smoothed error:

$$\text{MAD}_t = \alpha |E_t| + (1 - \alpha)\text{MAD}_{t-1}$$

The number of customers at a service company for the past 6 months are shown in the table.

| Month | Number of customers | Forecast | $E_t$ | $\lvert E_t \rvert$ | $\frac{\lvert E_t \rvert}{D_t} * 100\%$ |
|---|---|---|---|---|---|
| 1 | 810 | | | | |
| 2 | 790 | | | | |
| 3 | 840 | | | | |
| 4 | 825 | 827 | -2 | 2 | .24% |
| 5 | 800 | 825 | -25 | 25 | 3.1% |
| 6 | 890 | 809 | 81 | 81 | 4.1% |
| | | | | Total | 12.44% |

a) Use a 3-months weighted moving average to forecast the number of customers for month 4 through 6. Use weights of 0.7, 0.2 and 0.1, giving more weight to more recent data.

b) Calculate the mean absolute percent error as of the end of month 6 (i.e. from month 4 until 6)

c) Calculate the mean bias?

d) Comment on the type of bias.

a) $F_4 = (840)(.7) + 790(.2) + 810(.1) = 827$ customer

$F_5 = 825(.7) + 840(.2) + 790(.1) = 824.5 \approx 825$ customer

$F_6 = 800(.7) + 825(.2) + 840(.1) = 809$ customer

b) $MApE = \frac{\Sigma\left(\frac{\lvert E_t \rvert}{D_t} * 100\%\right)}{n} = \frac{12.44\%}{3} = 4.146\%$

c) $CFE = \Sigma E_t = 54 \Rightarrow \bar{E} = \frac{CFE}{n} = 18$ customer

d) since it is positive then it's under estimated

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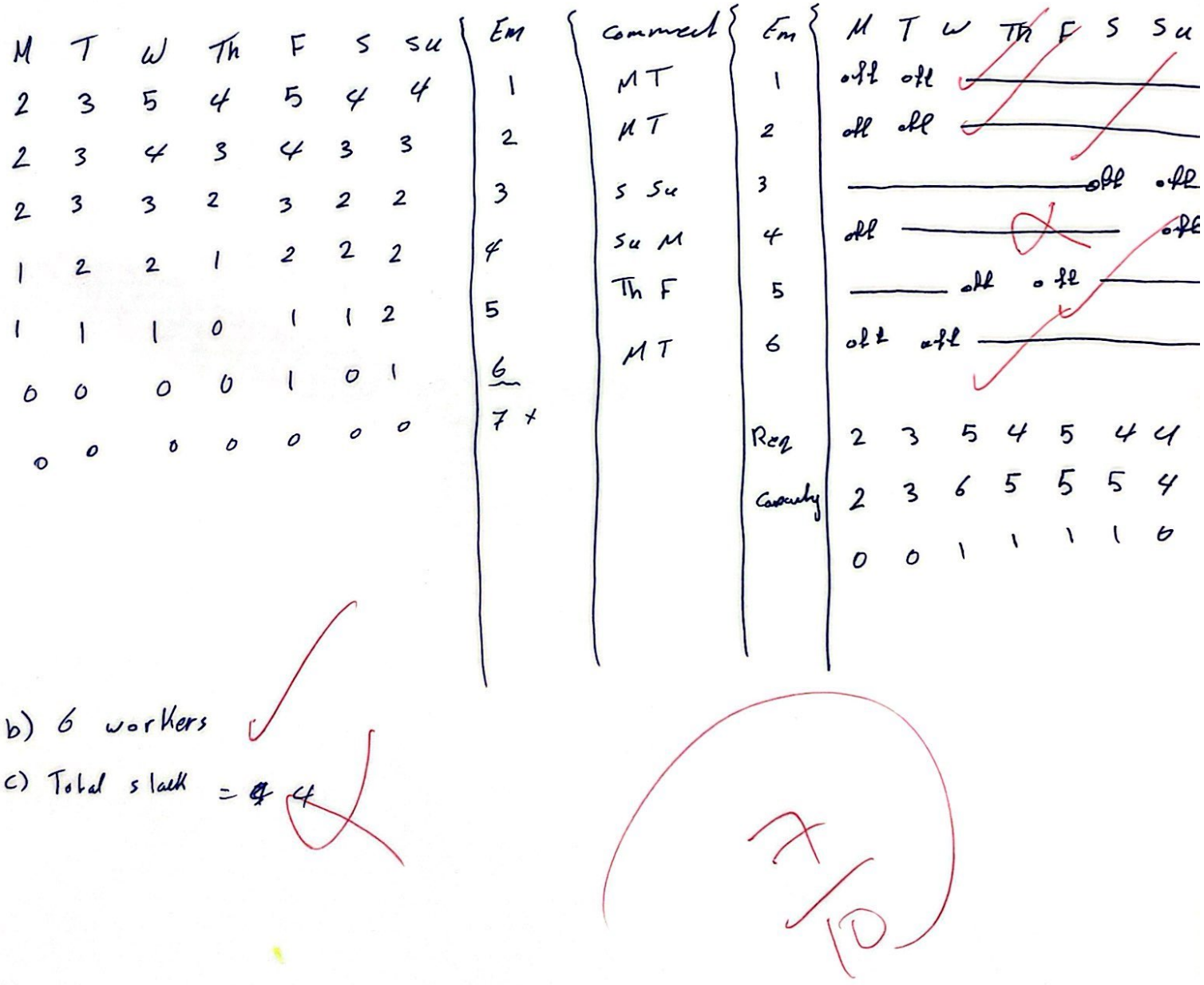
A restaurant operates seven days a week. The daily requirements (in workers) are estimated as follows:

| | M | T | W | Th | F | S | Su |
|---|---|---|---|---|---|---|---|
| Base Requirements | 2 | 3 | 5 | 4 | 5 | 4 | 4 |

Each worker is required to work five days per week, and each must have two days off.

a) Develop a workforce schedule that covers all the above requirements.
b) Determine the minimum number of workers needed.
c) Determine the amount of total slack capacity.




b) 6 workers

c) Total slack = 4

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