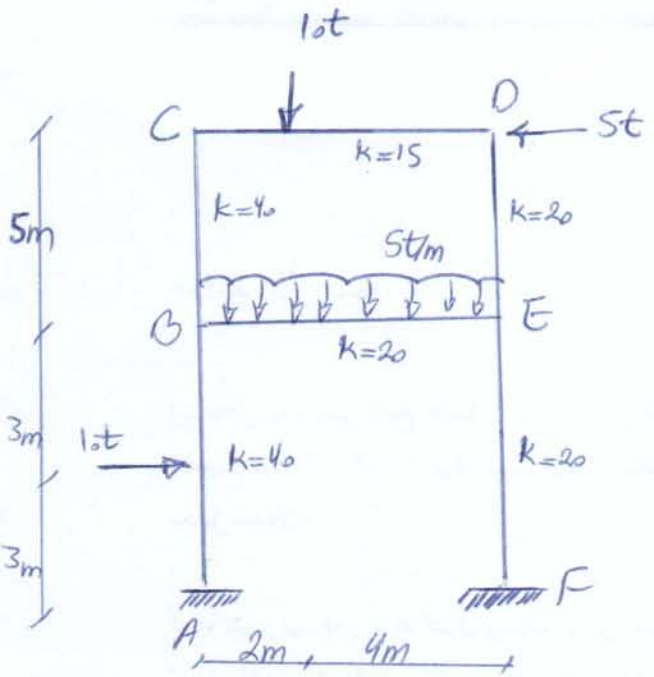
مثال) قاب شکل داده شده در شکل زیر را تحلیل نمایید.



محاسبه ضرایب پخش:

A) $BA : BC : BE$

$\frac{40}{40+40+20} : \frac{40}{100} : \frac{20}{100} \Rightarrow 0.4 : 0.4 : 0.2$

E) $EB : ED : EF \Rightarrow \frac{1}{3} : \frac{1}{3} : \frac{1}{3}$

C) $CB : CD$

$\frac{40}{40+15} : \frac{15}{40+15} \Rightarrow 0.73 : 0.27$

D) $DC : DE$

$\frac{15}{15+20} : \frac{20}{15+20} \Rightarrow 0.43 : 0.57$

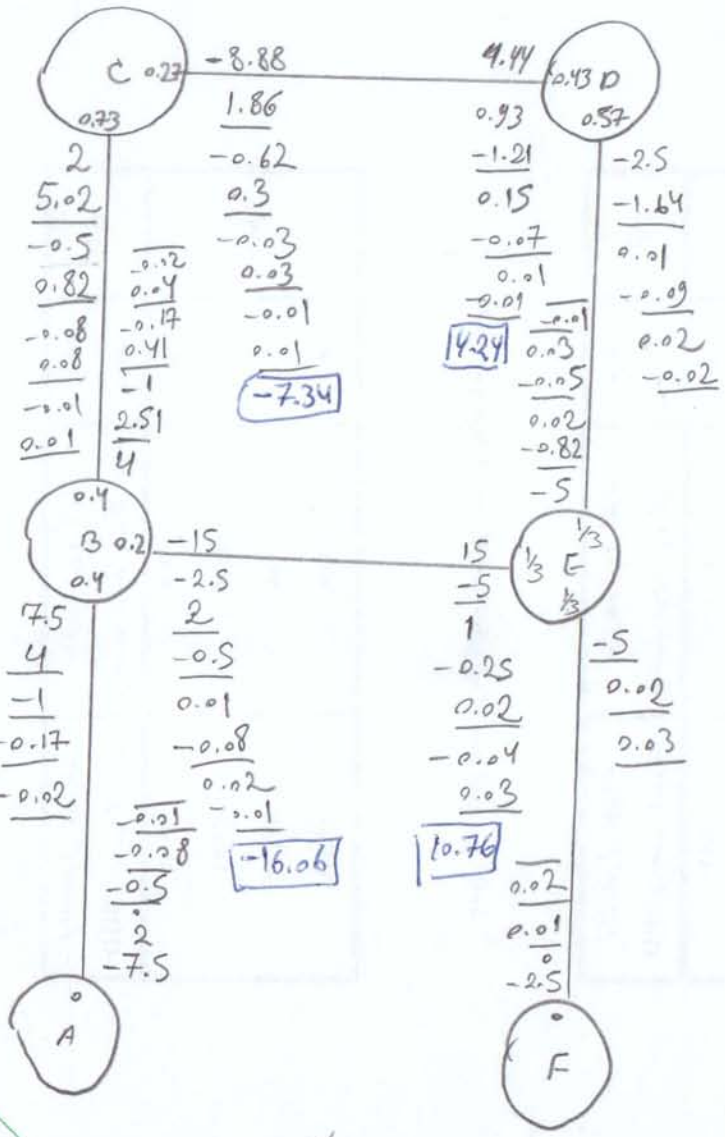
محاسبه لنگرهای گیرداری:

$$\overline{M_{BE}} = -\overline{M_{EB}} = -\frac{5 \times 6^2}{12} = -15$$

$$\overline{M_{CD}} = -\frac{10 \times 4^2 \times 2}{6^2} = -8.88$$

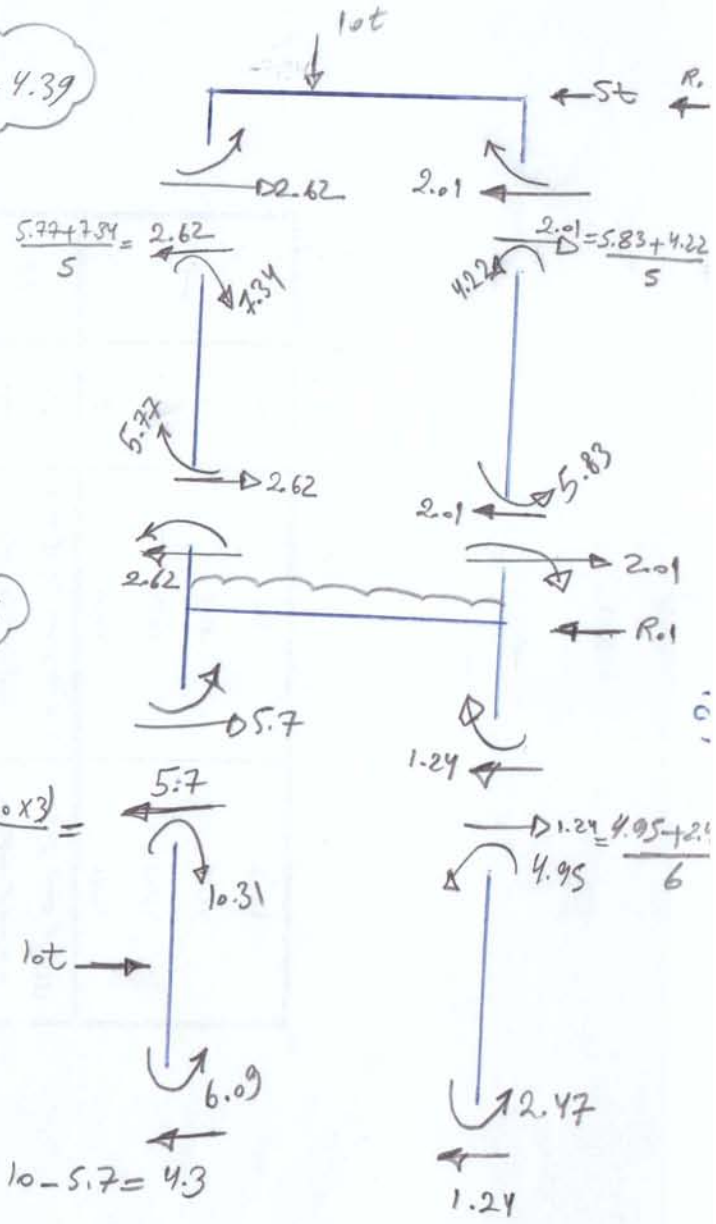
$$\overline{M_{DC}} = \frac{10 \times 2^2 \times 4}{6^2} = 4.44$$

$$\overline{M_{AB}} = -\overline{M_{BA}} = -\frac{10 \times 3^3}{6^2} = -7.5$$



شروع من (E)

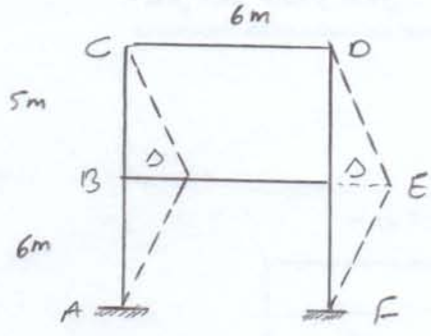
$\Sigma F_x = 0 \Rightarrow R_{02} = -4.39$



$\Sigma F_x = 0 \Rightarrow R_{01} = 3.85$

حالتی که طبقه اول درست جابجایی داشته باشد بقیه طبقات ثابت

محاسبه لنگر گیرداری

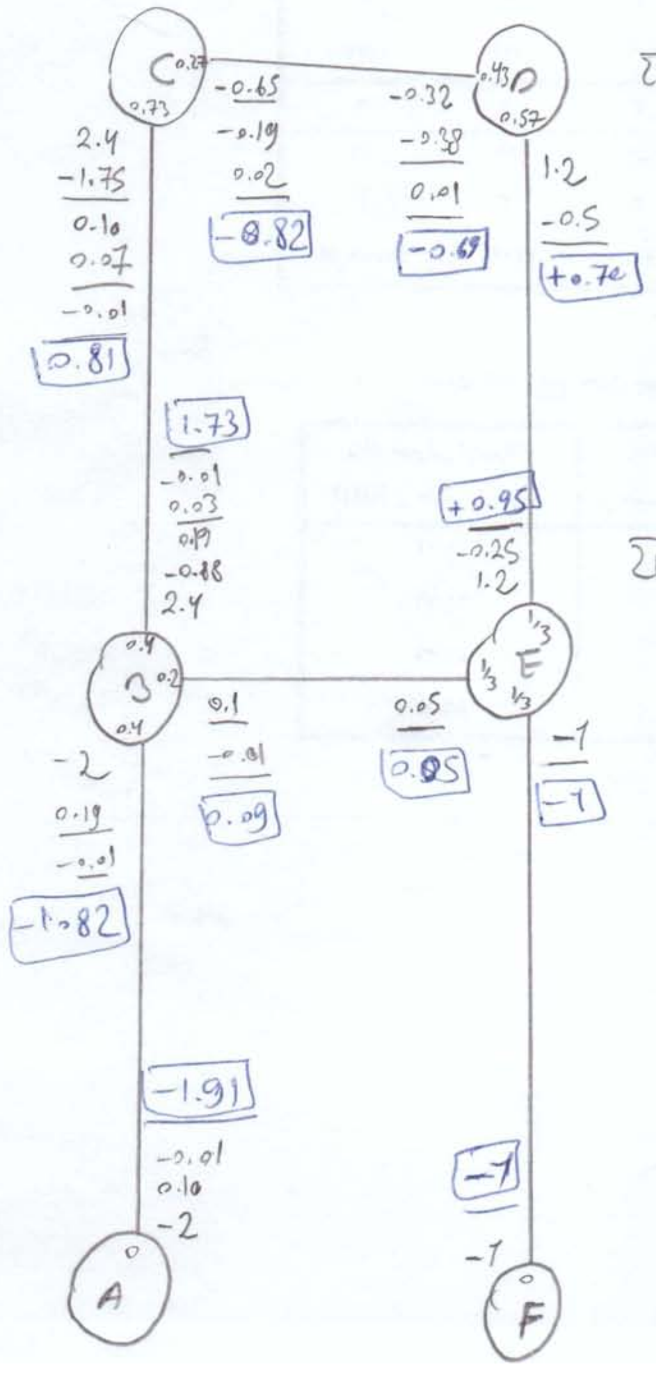


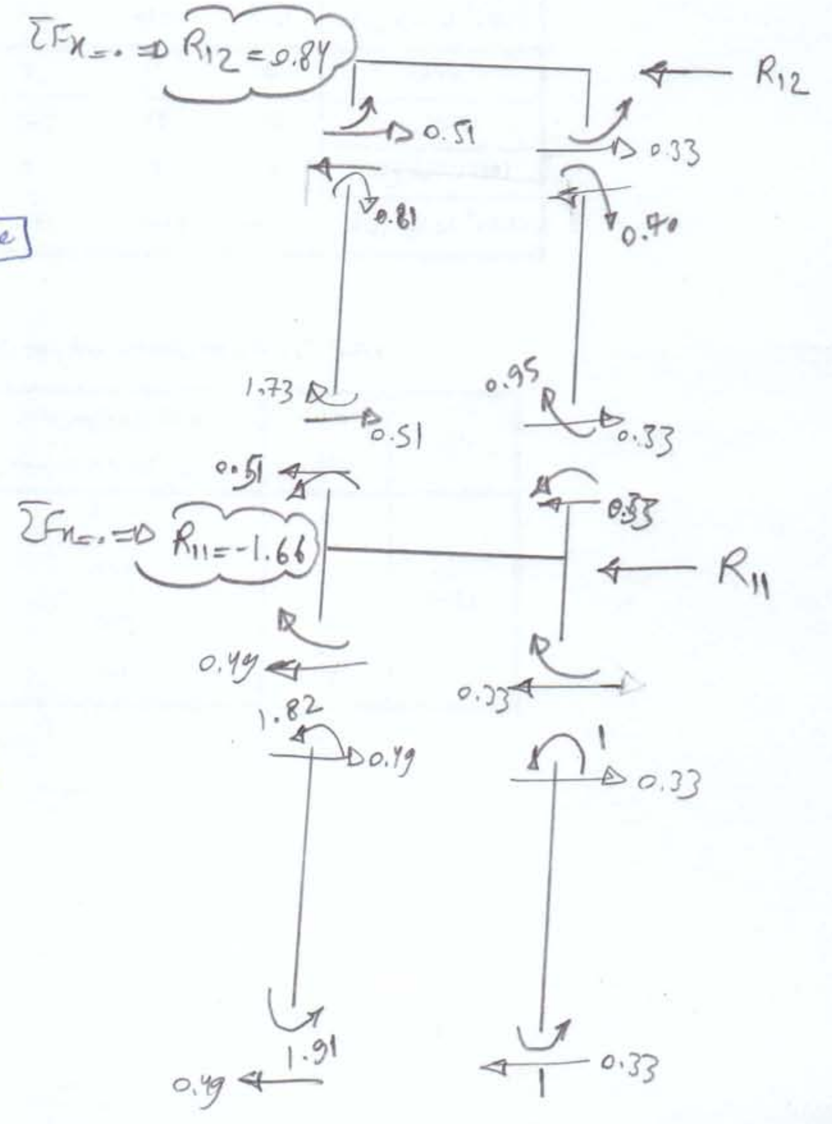
$$\overline{M}_{AB} = \overline{M}_{BA} = -\frac{6EI}{L} \times \frac{\Delta}{L} = -6 \times 40 \times \frac{\Delta}{6} = -40\Delta = -2$$

$$\overline{M}_{EF} = \overline{M}_{FE} = -\frac{6EI}{L} \times \frac{\Delta}{L} = -6 \times 20 \times \frac{\Delta}{6} = -20\Delta = -1$$

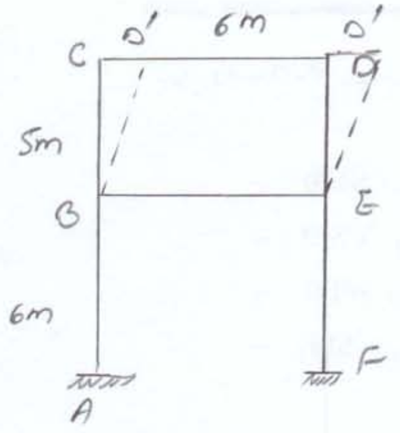
$$\overline{M}_{CB} = \overline{M}_{BC} = -\frac{6EI}{L} \times \left(-\frac{\Delta}{L}\right) = -60 \times 40 \times \left(-\frac{\Delta}{5}\right) = +48\Delta = 2.4$$

$$\overline{M}_{DE} = \overline{M}_{ED} = -6 \times 20 \times \left(-\frac{\Delta}{5}\right) = +24\Delta = 1.2$$



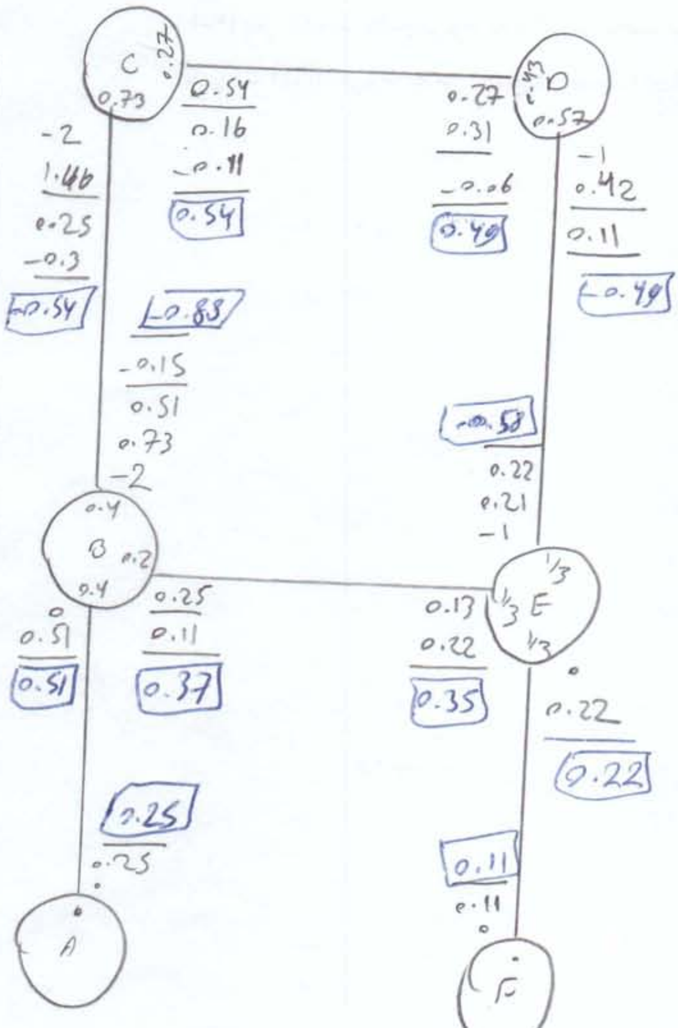


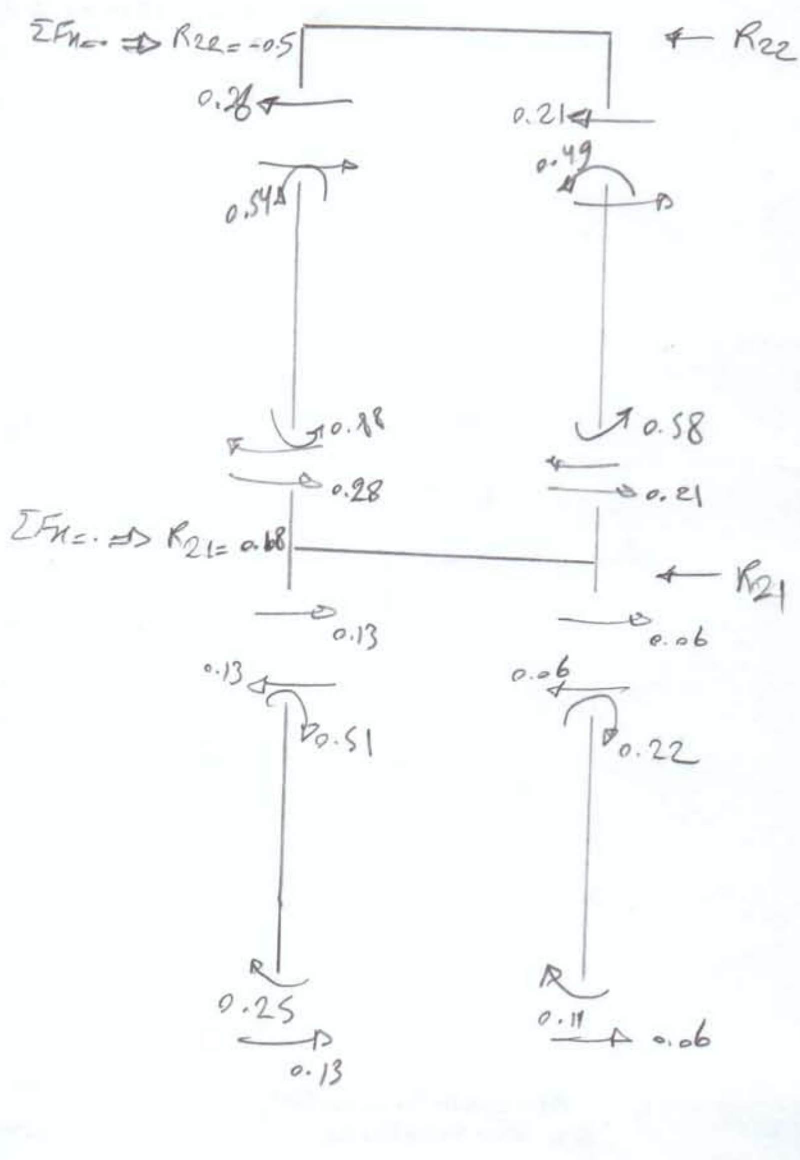
حالتی که طبقه دوم حرکت جانبی داشته باشد ، بقیه طبقات ثابت



$$\bar{M}_{CB} = \bar{M}_{BC} = -6 \times 40 \times \frac{\Delta'}{5} = -48\Delta' = -2$$

$$\bar{M}_{DE} = \bar{M}_{ED} = -6 \times 20 \times \frac{\Delta'}{5} = -24\Delta' = -1$$





$$[R] = \begin{bmatrix} R_{11} & R_{12} \\ R_{21} & R_{22} \end{bmatrix} = \begin{bmatrix} -1.66 & 0.84 \\ 0.68 & -0.5 \end{bmatrix} \Rightarrow R^T = \begin{bmatrix} -1.66 & 0.68 \\ 0.84 & -0.5 \end{bmatrix}$$

$$\{R_0\} = \begin{Bmatrix} 3.85 \\ -4.39 \end{Bmatrix}$$

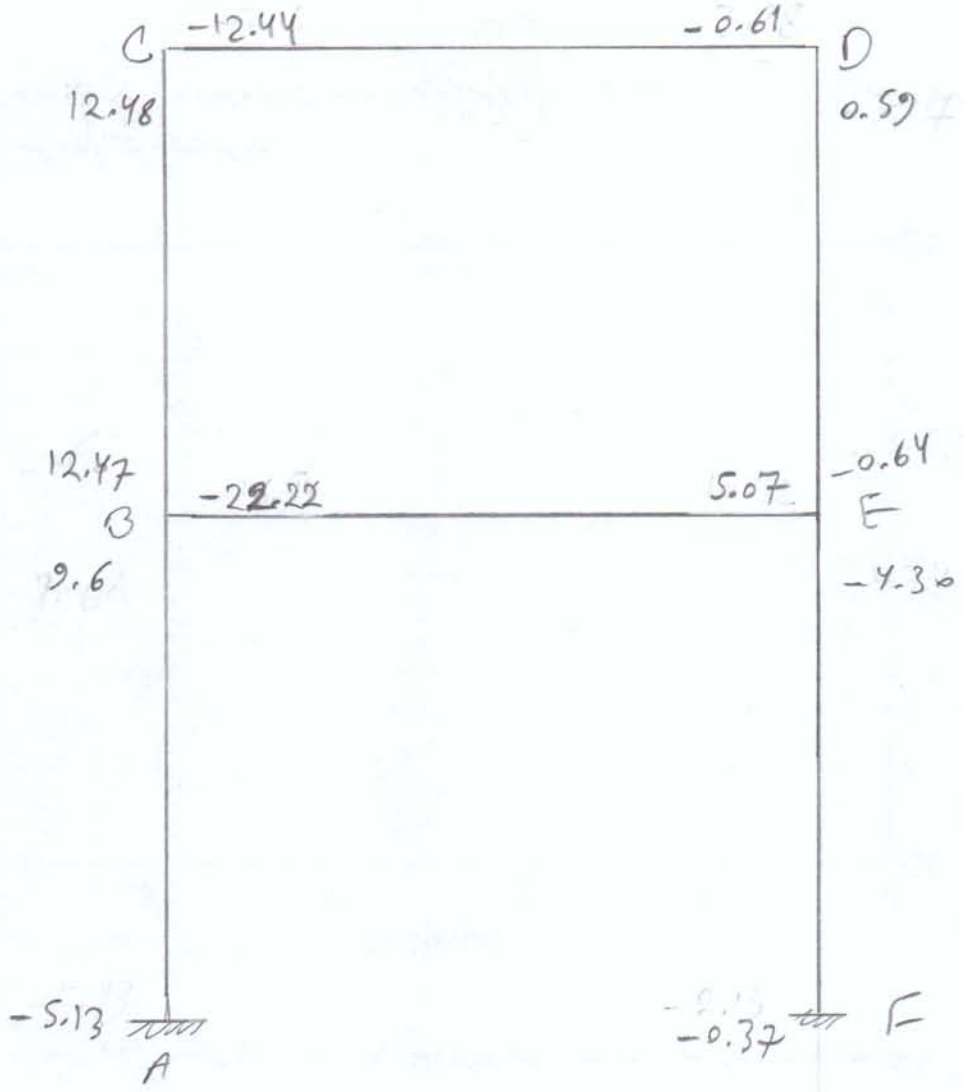
تذکر $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \Rightarrow A^{-1} = \frac{1}{ad-bc} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

$$[R^T]^{-1} = \frac{1}{(1.66)(0.5) - (0.68)(0.84)} \begin{bmatrix} -0.5 & -0.68 \\ -0.84 & -1.66 \end{bmatrix} = \begin{bmatrix} -1.93 & -2.63 \\ -3.25 & -6.41 \end{bmatrix}$$

$$\{a\} = -\left([R]^T\right)^{-1} \{R_0\} = \begin{bmatrix} -1.93 & 2.63 \\ -3.25 & 6.41 \end{bmatrix} \begin{Bmatrix} 3.85 \\ -4.39 \end{Bmatrix} = \begin{Bmatrix} -4.12 \\ -15.63 \end{Bmatrix} = \begin{Bmatrix} a_1 \\ a_2 \end{Bmatrix}$$

$$M_T = M_0 + a_1 M_1 + a_2 M_2$$

		ج) دقیق کامپیوتری
$M_{AB} = -6.09 - 4.12(-1.91) - 15.63(0.25) =$	-5.13	-3.16
$M_{BA} = 10.13 - 4.12(-1.82) - 15.63(0.51) =$	9.6	8.62
$M_{BC} = 5.77 - 4.12(1.73) - 15.63(-0.88) =$	12.47	12.85
$M_{CB} = 7.34 - 4.12(0.81) - 15.63(-0.54) =$	12.48	12.83
$M_{CD} = -7.34 - 4.12(-0.82) - 15.63(0.54) =$	-12.44	-12.83
$M_{DC} = 4.24 - 4.12(-0.69) - 15.63(0.49) =$	-0.61	-0.28
$M_{BE} = -16.06 - 4.12(0.09) - 15.63(0.37) =$	-22.22	-21.47
$M_{EB} = 10.76 - 4.12(0.05) - 15.63(0.35) =$	5.07	$+6.042$
$M_{FE} = -2.47 - 4.12(-1) - 15.63(0.11) =$	-0.37	-0.28
$M_{EF} = -4.95 - 4.12(-7) - 15.63(0.22) =$	-4.30	-5.18
$M_{ED} = -5.83 - 4.12(0.95) - 15.63(-0.58) =$	-0.64	-0.96
$M_{DE} = -4.22 - 4.12(0.70) - 15.63(-0.49) =$	0.59	0.28


C
-12.44
-0.61
D
12.48
0.59
12.47
-22.22
5.07
-0.64
B
E
9.6
-4.30
-5.13
A
-0.37
F