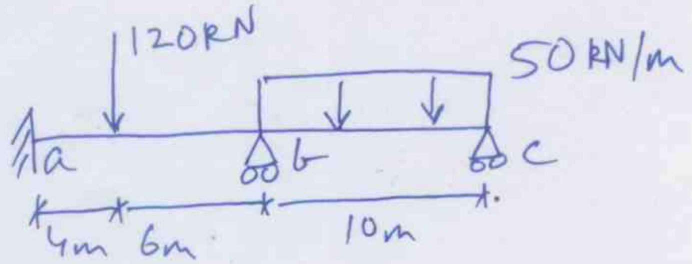
T2/4

Ex. 1

joint	a		b	c
mem-end	ab	ba	bc	cb
rel stiff	k	k	k	k
df	0	0.5	0.5	1
fem	-172.8	115.2	-416.6667	416.6667
			-208.3333	-416.6667
	127.45	254.9	254.9	127.45
			-63.725	-127.45
	15.93125	31.8625	31.8625	15.93125
			-7.965625	-15.93125
	1.991406	3.982813	3.982813	1.991406
			-0.995703	-1.991406
	0.248926	0.497852	0.497852	0.248926
			-0.124463	-0.248926
	0.031116	0.062231	0.062231	0.031116
				-0.031116
convg BM	-27.1473	406.5054	-406.5054	0

k=EI/10

Method-1, modified stiffnesses not used



Method-1, modified stiffnesses used

joint	a		b	c
mem-end	ab	ba	bc	cb
ref stiff	k	k	k	
mod stiff	k	k	0.75k	
df	0	0.571429	0.428571	
fem	-172.8	115.2	-625	
	145.6571	291.3143	218.4857	
convg BM	-27.14286	406.5143	-406.5143	0

Modified fem (rhs table, Hibbeler) used for bc
No carry over to c
Finite steps to convergence in this problem
since co only to joint where no distribution
So Method-2 will also look same

Method-1, modified stiffnesses used

joint	a		b	c
mem-end	ab	ba	bc	cb
rel stiff	k	k	k	k
mod stiff	k	k	0.75k	k
df	0	0.571429	0.428571	1
fem	-172.8	115.2	-416.6667	416.6667
			-208.3333	-416.6667
	145.6571	291.3143	218.4857	
convg BM	-27.14286	406.5143	-406.5143	0

Original fem's used so must release joint c first
So cant use Method-2 when using modified stiffnesses with original fem's.
Finite steps to convergence in this problem
since co only to joint where no distribution

Method-2, modified stiffnesses not used

joint	a		b	c
mem-end	ab	ba	bc	cb
rel stiff	k	k	k	k
df	0	0.5	0.5	1
fem	-172.8	115.2	-416.6667	416.6667
dist		150.7333	150.7333	-416.6667
co	75.36667		-208.3333	75.36667
dist		104.1667	104.1667	-75.36667
co	52.08333		-37.68333	52.08333
dist		18.84167	18.84167	-52.08333
co	9.420833		-26.04167	9.420833
dist		13.02083	13.02083	-9.420833
co	6.510417		-4.710417	6.510417
dist		2.355208	2.355208	-6.510417
co	1.177604		-3.255208	1.177604
dist		1.627604	1.627604	-1.177604
co	0.813802		-0.588802	0.813802
dist		0.294401	0.294401	-0.813802
co	0.147201		-0.406901	0.147201

Takes longer to converge.
More mechanical, so less prone to errors.

T2/5

		0.203451	0.203451	-0.147201
	0.101725		-0.0736	0.101725
		0.0368	0.0368	-0.101725
convg BM	-27.17842	406.48	-406.48	0

Ex.2

joint	a		b
mem-end	ab	ba	bc
rel stiff	k	k	0.75k
mod stiff	k	0.75k	0.375k
df	1	0.666667	0.333333
fem	0	225	-320
		63.33333	31.66667
convg BM	0	288.3333	-288.3333
joint	a		b
mem-end	ab	ba	bc
rel stiff	k	k	0.75k
mod stiff	k	0.75k	0.375k
df	1	0.666667	0.333333
fem	-150	150	-320
	150	75	
		63.33333	31.66667
convg BM	0	288.3333	-288.3333

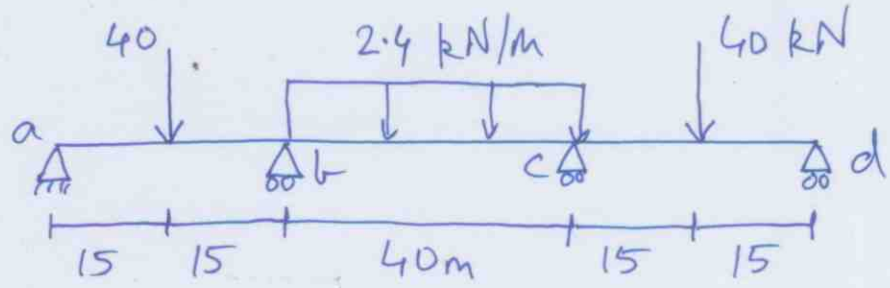
Method-1, modified stiffnesses used

k=I/30
0.75k*0.5=0.375k

Modified fem (rhs table, Hibbeler) used for ab
No carry over to a or c
Finite steps to convergence in this problem since no co.
So Method-2 will also look same

Method-1, modified stiffnesses used

Original fem's used
Here must release joint c first
So cant use Method-2 when using modified stiffnesses but original fem's.
Finite steps to convergence in this problem since no co back to jt a as it is SS, and no co to jt c



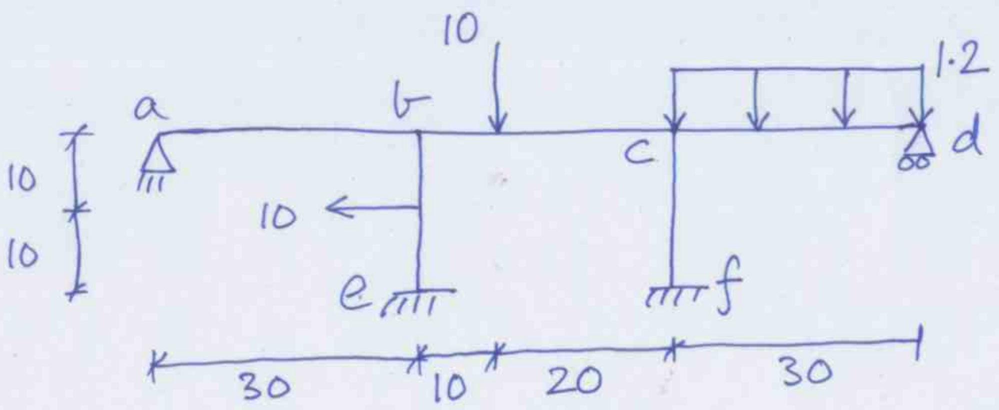
Ex. 3

joint	a		b			c		d	e	f
mem-end	ab	ba	be	bc	cb	cf	cd	dc	eb	fc
rel stiff	k	k	1.5k	k	k	1.5k	k	k	inf	inf
mod stiff	k	.75k	1.5k	k	k	1.5k	.75k	k	inf	inf
df	1	0.230769	0.461538	0.307692	0.307692	0.461538	0.230769	1	0	0
fem	0	0	-25	-44.44444	22.22222	0	-135	0	25	0
		16.02564	32.05128	21.36752	10.68376				16.02564	
				15.70677	31.41354	47.12032	23.56016			23.56016
		-3.62464	-7.249279	-4.832853	-2.416426				-3.62464	
				0.371758	0.743516	1.115274	0.557637			0.557637
		-0.08579	-0.171581	-0.114387	-0.057194				-0.08579	
					0.017598	0.026397	0.013199			
convg BM	0	12.31521	-0.369578	-11.94563	62.60702	48.26199	-110.869	0	37.31521	24.11779
sum jt b,c			0			0				

Method-1.
Modified stiffnesses used.
Modified fem (rhs table, Hibbeler) used for cd.
No carry over to a, d.
Be careful in co since corresponding farther joint not contiguous in table.

joint	a		b			c		d	e	f
mem-end	ab	ba	be	bc	cb	cf	cd	dc	eb	fc
rel stiff	k	k	1.5k	k	k	1.5k	k	k	inf	inf
mod stiff	k	.75k	1.5k	k	k	1.5k	.75k	k	inf	inf
df	1	0.230769	0.461538	0.307692	0.307692	0.461538	0.230769	1	0	0
fem	0	0	-25	-44.44444	22.22222	0	-90	90	25	0
							-45	-90		
		From here on same as above								

Method-1.
Modified stiffnesses used.
Original fem's used so must release joint d first.
So cant use Method-2 when using modified stiffnesses with original fem's.
No carry over to a, d.
Be careful in co since corresponding farther joint not contiguous in table.



T2/7

joint	a		b			c		d	e	f
mem-end	ab	ba	be	bc	cb	cf	cd	dc	eb	fc
rel stiff	k	k	1.5k	k	k	1.5k	k	k	inf	inf
mod stiff	k	.75k	1.5k	k	k	1.5k	.75k	k	inf	inf
df	1	0.230769	0.461538	0.307692	0.307692	0.461538	0.230769	1	0	0
fem	0	0	-25	-44.44444	22.22222	0	-135	0	25	0
dist		16.02564	32.05128	21.36752	34.70085	52.05128	26.02564			
co				17.35043	10.68376				16.02564	26.02564
dist		-4.003945	-8.00789	-5.338593	-3.287311	-4.930966	-2.465483			
co				-1.643655	-2.669297				-4.003945	-2.465483
dist		0.379305	0.75861	0.50574	0.821322	1.231983	0.615992			
co				0.410661	0.25287				0.379305	0.615992
dist		-0.094768	-0.189536	-0.126357	-0.077806	-0.116709	-0.058355			
co				-0.038903	-0.063179				-0.094768	-0.058355
dist		0.008978	0.017955	0.01197	0.01944	0.029159	0.01458			
convg BM	0	12.31521	-0.369578	-11.94563	62.60288	48.26475	-110.8676	0	37.30623	24.11779

Method-2.
Modified stiffnesses used.
Modified fem (rhs table, Hibbeler) used for cd.
No carry over to a, d.
Be careful in co since corresponding farther joint not contiguous in table.

T2/8

Ex. 4

joint	a		b		c		d
mem-end	ab	ba	bc	cb	ce	cd	dc
rel stiff	k	k	3k	3k	0	k	k
df	0	0.25	0.75	0.75	0	0.25	0
fem	-22.22222	44.44444	-288	192	-250	0	0
dist		60.88889	182.6667	43.5		14.5	
co	30.44444		21.75	91.33333			7.25
dist		-5.4375	-16.3125	-68.5		-22.83333	
co	-2.71875		-34.25	-8.15625			-11.41667
dist		8.5625	25.6875	6.117188		2.039063	
co	4.28125		3.058594	12.84375			1.019531
dist		-0.764648	-2.293945	-9.632813		-3.210938	
co	-0.382324		-4.816406	-1.146973			-1.605469
dist		1.204102	3.612305	0.860229		0.286743	
co	0.602051		0.430115	1.806152			0.143372
dist		-0.107529	-0.322586	-1.354614		-0.451538	
co	-0.053764		-0.677307	-0.161293			-0.225769
dist		0.169327	0.50798	0.12097		0.040323	
co	0.084663		0.060485	0.25399			0.020162
dist		-0.015121	-0.045364	-0.190493		-0.063498	
Bmprime	10.03535	108.9445	-108.9445	259.6932	-250	-9.693178	-4.81484
ax	-1.265321	from momt equil of ab, left +ve					
dx	0.967201	from momt equil of cd, left +ve					
r	-20.29812	from horz ext-equil, right +ve					

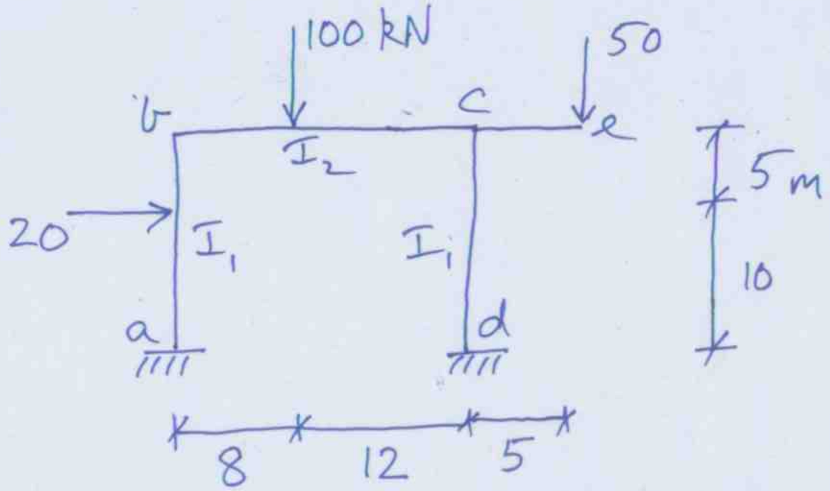
Method-2.

k=500/15

Sway restraint using pin at c.

Note overhang rel stiff and df.

Joint e is free end, so not in table



$I_1 = 500$ mm^4

$I_2 = 2000$ mm^4

joint	a		b				
mem-end	ab	ba	bc				
rel stiff	k	k	3k				
mod stiff	k	k	4.5k				
df	0	0.181818	0.818182				
fem	-100	-100	0				
dist		18.18182	81.81818				
co	9.090909						
Bmdash	-90.90909	-81.81818	81.81818	81.81818		-81.81818	-90.90909
axprime	11.51515	from momt equil of ab, left +ve					
dxprime	11.51515	from momt equil of cd, left +ve					
rprime	23.0303	from horz ext-equil, right +ve					
BM	-70.08881	36.83272	-36.83272	331.8049	-250	-81.80492	-84.939

Method-2

Note mod stiff due to antisymmetry in bc.
Finite steps to convergence in this problem
since no co. to b.

Due to antisymmetry, by observation, BM for cb, cd, dc has
same magnitude and direction as BM for bc, ba, ab,
respectively, so no need to generate them thru table.

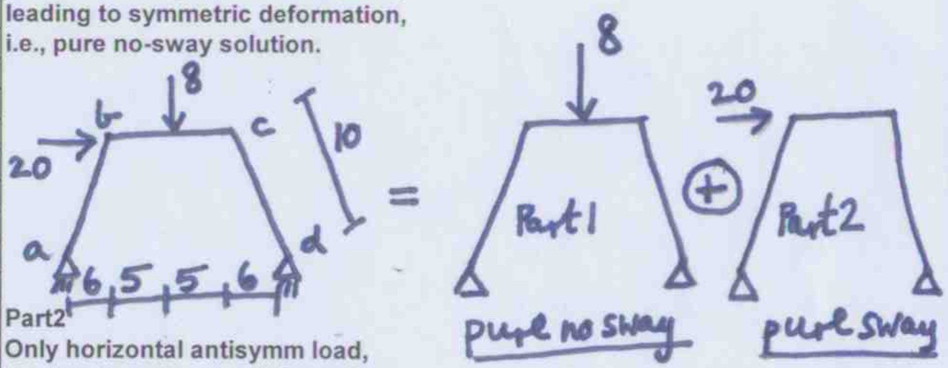
Method-1 looks identical.

BM=Bmprime+(-r)/rprime*Bmdash

T2/9

added Autumn 2012							
Ex5							
jt	a	b	b	c	c	d	
mem end	ab	ba	bc	cb	cd	dc	
stiff	1	1	1	1	1	1	
mod stiff		0.75	0.5				
df		0.6	0.4				
fem		0	-10				
dist,co		6	4				
BM1	0	6	-6	6	-6	0	
jt	a	b	b	c	c	d	
mem end	ab	ba	bc	cb	cd	dc	
stiff	1	1	1	1	1	1	
mod stiff		0.75	1.5				
df		0.333333	0.666667				
fem		-100	240				
dist,co		-46.6667	-93.3333				
BM2	0	-146.667	146.6667	146.6667	-146.667	0	
Va	14.66667						
Vd	14.66667						
Fx	80.66667						
sf	0.247934						
BM	0	-30.3636	30.36364	42.36364	-42.3636	0	
jt	a	b	b	c	c	d	
mem end	ab	ba	bc	cb	cd	dc	
stiff	1	1	1	1	1	1	
mod stiff		0.75	1	1	0.75		
df		0.428571	0.571429	0.571429	0.428571		
fem		-100	240	240	-100		
dist		-60	-80	-80	-60		
co			-40	-40			
dist		17.14286	22.85714	22.85714	17.14286		
co			11.42857	11.42857			
dist		-4.89796	-6.53061	-6.53061	-4.89796		
co			-3.26531	-3.26531			
dist		1.399417	1.865889	1.865889	1.399417		
co			0.932945	0.932945			
dist		-0.39983	-0.53311	-0.53311	-0.39983		

Part1
Only vertical symmetric load acts,
leading to symmetric deformation,
i.e., pure no-sway solution.

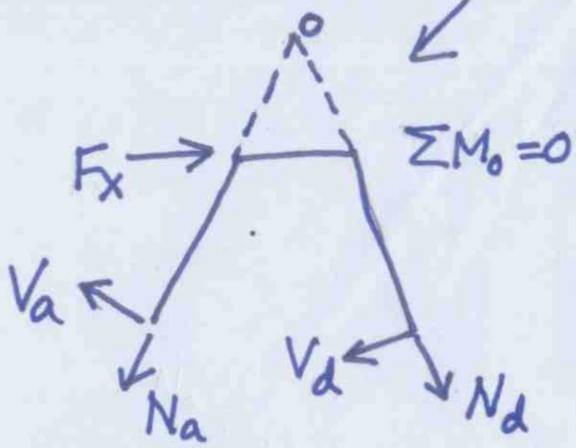


Part2
Only horizontal antisymm load,
leading to antisymm deformation.
No no-sway soln, only pure sway soln.

Fem_ba=3EI*Delta/Lab^2=100; Fem_bc=6EI*Delta1/Lbc^2;
Delta1=2*Delta*sin_alpha; sin_alpha=3/5;
Fem_bc=2*2*3/5*Fem_ba;
Va=-(Mab+Mba)/Lab; Vd=-(Mdc+Mcd)/Lcd;
Fx*5*cot_alpha=(Va+Vd)*(10+5/sin_alpha);

sf=scaling factor=20/Fx
BM=BM1+20/Fx*BM2

This is only to check that antisymm concept above works.
Here it is done without stiffness reduction due to antisymm.



T2 (10)

co			-0.26656	-0.26656			
	0	-146.756	146.489	146.489	-146.756	0	

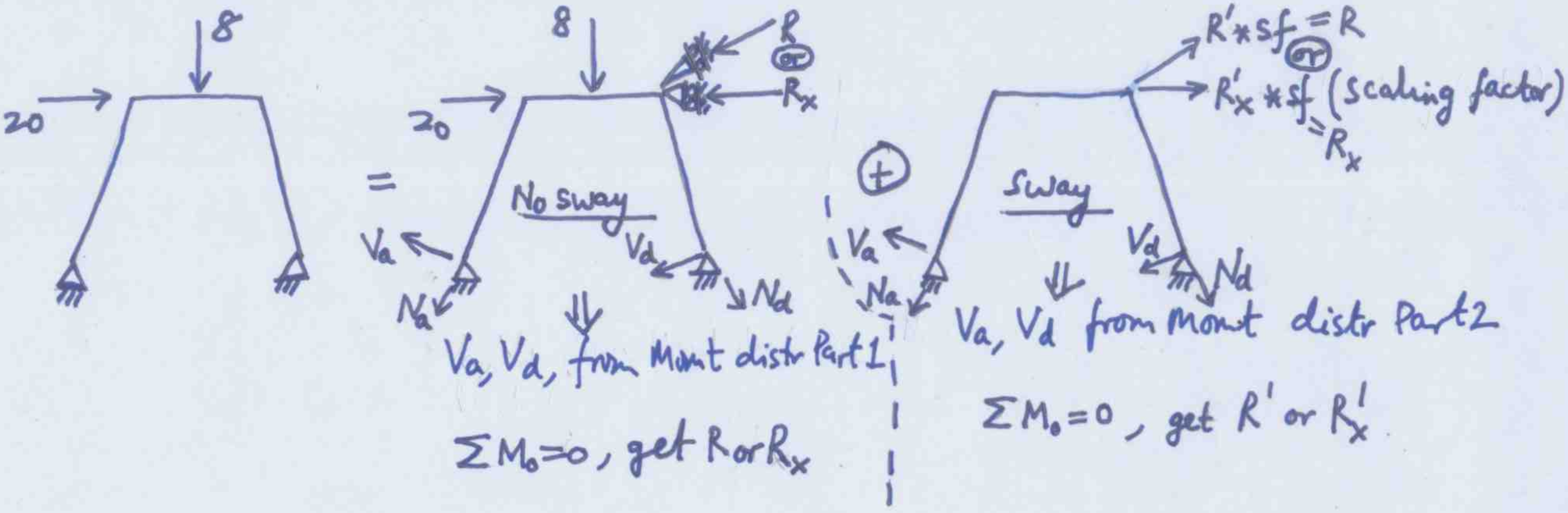
Checks out!

Va	-0.6						
Vd	0.6						
Rx	20						
R	16						
Rxprime	80.66667						
Rprime	64.53333						
sf=Rx/Rxprime		0.247934					
sf=R/Rprime		0.247934					
	0	-30.3636	30.36364	42.36364	-42.3636	0	

Done by letting all loads act. So sway and no-sway part superposed. For no-sway part, momt distribution as in Part 1 above.
Va=-(Mab+Mba)/Lab; Vd=-(Mdc+Mcd)/Lcd;
(Rx-20)*5*cot_alpha+(Va+Vd)*(10+5/sin_alpha)=0;
R*5/sin_alpha-20*5*cot_alpha+(Va+Vd)*(10+5/sin_alpha)=0;
Rx if vertical roller at C to prevent sway
R if inclined roller at C, in direction of CD, to prevent sway.

For sway part, momt distribution and Va, Vd, as in Part 2 above.
Rxprime*5*cot_alpha=(Va+Vd)*(10+5/sin_alpha);
Rprime*5/sin_alpha=(Va+Vd)*(10+5/sin_alpha);
Rxprime if vertical roller at C to prevent sway;
Rprime if inclined roller at C, in direction of CD, to prevent sway;

so you can choose roller in any direction, except perpendicular to member for which sway is prevented, an you get same scaling factor (sf).
BM=BM1+sf*BM2, i.e., same as from above Part1 plus Part2 soln, where symm (pur no_sway) and antisymm (pure sway) problems were solved separately.



T2/11

Ex5a

Fy	-107.556						
Fx	80.66667						
BM	0	11.36364	-11.3636	-11.3636	11.36364	0	

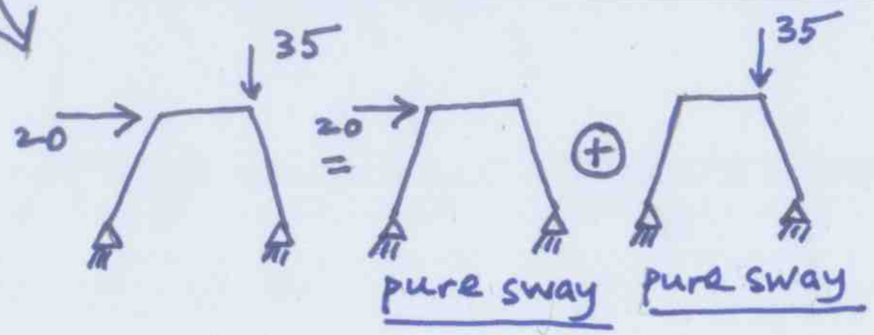
Loads are rightward 20kN at B, downward 35kN at C

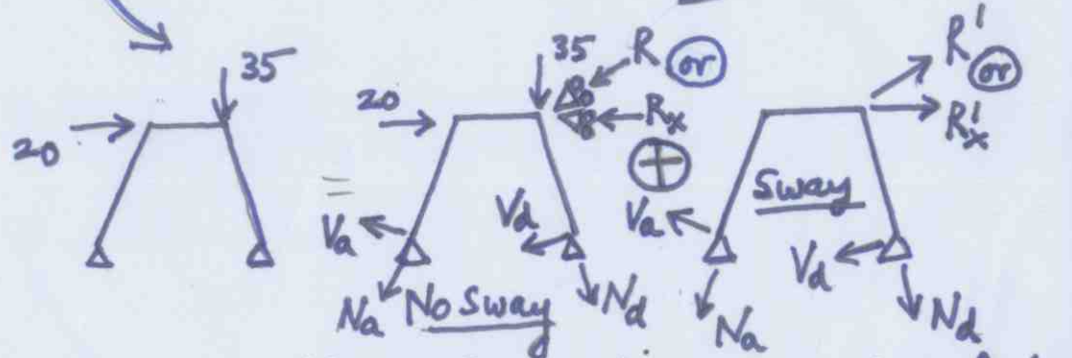
Done by pure sway solution, i.e., no no-sway part,
by superposing solution due to each load.
Momt distr as in Part2 above.
Fy*5+(Va+Vd)*(10+5/sin_alpha)=0;
Fx*5*cot_alpha=(Va+Vd)*(10+5/sin_alpha);
BM=(20/Fx+35/Fy)*BM2

Rx	-6.25						
R	-5						
Rxprime	80.66667						
Rprime	64.53333						
sf	-0.07748	-0.07748					
BM	0	11.36364	-11.3636	-11.3636	11.36364	0	

Done by letting all loads act. So sway and no-sway part superposed. For no-sway part, momt distribution is zero.
So Va=0, Vd=0;
(Rx-20)*5*cot_alpha+35*5=0;
R*5/sin_alpha-20*5*cot_alpha+35*5=0;
Rx if vertical roller at C to prevent sway
R if inclined roller at C, in direction of CD, to prevent sway.

For sway part, momt distribution and
Va, Vd, as in Part 2 above.
Hence, Rxprime and Rprime as above;
Rxprime if vertical roller at C to prevent sway;
Rprime if inclined roller at C, in direction of CD, to prevent sway; Use either vertical or inclined roller, or any other dir.
So again sf=Rx/Rxprime=R/Rprime;
BM=BM2*sf;
Same result as obtained above by superporsition of pure sway solutions due to each load.





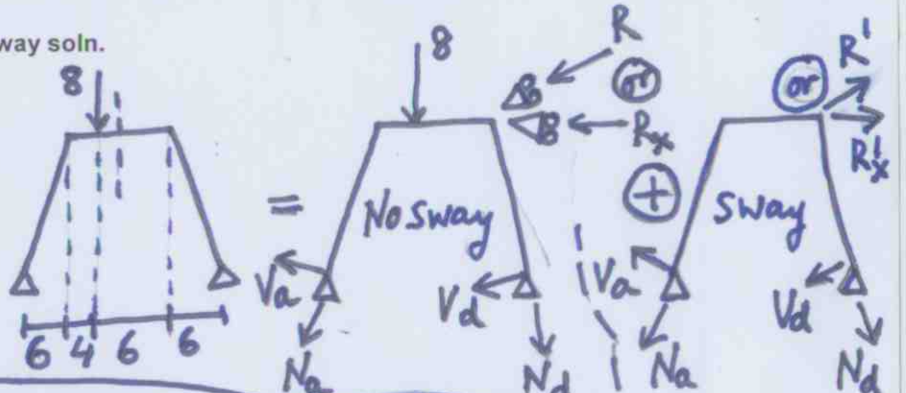
$V_a = V_d = 0$
($\because$ No Fem's to distribute)
($N_a \neq 0$, $N_d \neq 0$)

V_a, V_d from Part2

Ex5b							
jt	a	b	b	c	c	d	
mem end	ab	ba	bc	cb	cd	dc	
mod stiff		0.75	1	1	0.75		
df		0.428571	0.571429	0.571429	0.428571		
fem		0	-11.52	7.68	0		
dist,co		4.937143	6.582857	3.291429			
dist,co			-3.13469	-6.26939	-4.70204		
dist,co		1.34344	1.791254	0.895627			
dist,co			-0.25589	-0.51179	-0.38384		
dist,co		0.109669	0.146225	0.073112			
dist,co			-0.02089	-0.04178	-0.03133		
dist,co		0.008953	0.011937	0.005968			
dist,co				-0.00341	-0.00256		
BM1	0	6.399204	-6.3992	5.119773	-5.11977	0	
Va	-0.63992						
Vb	0.511977						
Rx	1.551844						
Rprime	1.241475						
Rxprime	80.66667						
Rprime	64.53333						
sf	0.019238	0.019238					
BM	0	3.57767	-3.57767	7.941307	-7.94131	0	

Eccentric downward 8kN load 4m to right of jt. B on member BC.

No-sway soln.



Va=-(Mab+Mba)/Lab;
Vd=-(Mdc+Mcd)/Lcd;
Rx*5*cot_alpha=-(Va+Vd)*(10+5/sin_alpha)+8*1;
R*5/sin_alpha=-(Va+Vd)*(10+5/sin_alpha)+8*1;
Rx if vertical roller at C to prevent sway
R if inclined roller at C, in direction of CD, to prevent sway.
Use roller in vertical or inclined or any other direction, except in direction perpendicular to member whose sway is to be restrained.

Va, Vd from this momt distr

Va, Vd from Part2

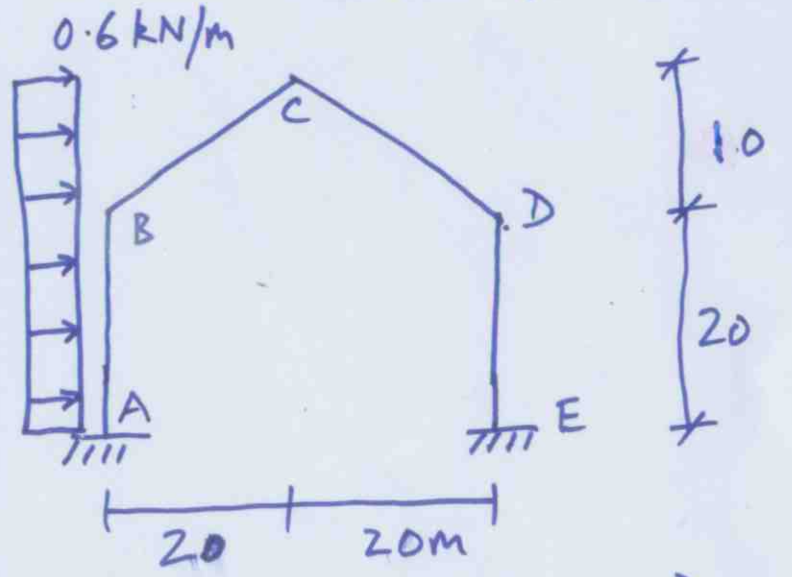
Sway soln.
For sway part, momt distribution and Va, Vd, as in Part 2 above.
Rxprime*5*cot_alpha=(Va+Vd)*(10+5/sin_alpha);
Rprime*5/sin_alpha=(Va+Vd)*(10+5/sin_alpha);
Rxprime if vertical roller at C to prevent sway;
Rprime if inclined roller at C, in direction of CD, to prevent sway;
So again sf=Rx/Rxprime=R/Rprime;
BM=BM1+sf*BM2, use BM1 as obtained immediately above, and BM2 from Part2 above.

Ex6

jt	a	b	b	c	c	d	d	e	
mem end	ab	ba	bc	cb	cd	dc	de	ed	
stiff	1	1	1.788854	1.788854	1.788854	1.788854	1	1	
df		0.35857	0.64143	0.5	0.5	0.64143	0.35857		
fem	-20	20	-5	5	0	0	0	0	
dist		-5.37855	-9.62145	-2.5	-2.5	0	0		
co	-2.68928		-1.25	-4.81072	0	-1.25		0	
dist		0.448213	0.801787	2.405362	2.405362	0.801787	0.448213		
co	0.224106		1.202681	0.400894	0.400894	1.202681		0.224106	
dist		-0.43125	-0.77144	-0.40089	-0.40089	-0.77144	-0.43125		
co	-0.21562		-0.20045	-0.38572	-0.38572	-0.20045		-0.21562	
dist		0.071874	0.128573	0.385718	0.385718	0.128573	0.071874		
co	0.035937		0.192859	0.064286	0.064286	0.192859		0.035937	
dist		-0.06915	-0.12371	-0.06429	-0.06429	-0.12371	-0.06915		
co	-0.03458		-0.03214	-0.06185	-0.06185	-0.03214		-0.03458	
dist		0.011526	0.020618	0.061853	0.061853	0.020618	0.011526		
co	0.005763		0.030926	0.010309	0.010309	0.030926		0.005763	
dist		-0.01109	-0.01984	-0.01031	-0.01031	-0.01984	-0.01109		
co	-0.00554		-0.00515	-0.00992	-0.00992	-0.00515		-0.00554	
dist		0.001848	0.003306	0.009919	0.009919	0.003306	0.001848		
co	0.000924		0.004959	0.001653	0.001653	0.004959		0.000924	
dist		-0.00178	-0.00318	-0.00165	-0.00165	-0.00318	-0.00178		
co	-0.00089		-0.00083	-0.00159	-0.00159	-0.00083		-0.00089	
dist		0.000296	0.00053	0.001591	0.001591	0.00053	0.000296		
co	0.000148		0.000795	0.000265	0.000265	0.000795		0.000148	
dist		-0.00029	-0.00051	-0.00027	-0.00027	-0.00051	-0.00029		
co	-0.00014		-0.00013	-0.00026	-0.00026	-0.00013		-0.00014	
dist		4.75E-05	8.5E-05	0.000255	0.000255	8.5E-05	4.75E-05		
co	2.38E-05		0.000128	4.25E-05	4.25E-05	0.000128		2.38E-05	
BM1	-22.6792	14.6417	-14.6417	0.094638	-0.09464	-0.02025	0.020253	0.010103	summed up to line before last co
Va	6.401874								Va=-(Mab+Mba-.6*20^2/2)/Lab; Ve=-(Mde+Med)/Lde;
Ve	-0.00152								Bx+Dx+Va+Ve-0.6*30=0;
Na	0.383451								Va*30+Bx*10-Na*20-0.6*30^2/2+Mab+Mcb=0;
Bx	10.81973								Mab+Med-Na*40-(Bx+Dx)*20+0.6*30^2/2=0;
Dx	0.779909								

No sway soln.

2-degree of sway problem



(done previously by SDM).

Kinematics: $\psi_{ba} = \frac{\Delta_b}{20}$, $\psi_{de} = \frac{\Delta_d}{20}$

$\psi_{bc} = -\frac{\sqrt{5}}{2}(\Delta_b - \Delta_d)\cdot\frac{1}{\sqrt{500}} - \psi_{cd}$

fem	-100	-100	178.8854	178.8854	-178.885	-178.885	0	0	Sway at B only
dist		-28.286	-50.5995	0	0	114.7425	64.14298		stiff and df remain same as in no sway case.
co	-14.143		0	-25.2997	57.37123	0		32.07149	
dist		0	0	-16.0357	-16.0357	0	0		
co	0		-8.01787	0	0	-8.01787		0	
dist		2.87497	5.142903	0	0	5.142903	2.87497		
co	1.437485		0	2.571451	2.571451	0		1.437485	
dist		0	0	-2.57145	-2.57145	0	0		

co	0		-1.28573	0	0	-1.28573		0	
dist		0.461023	0.824703	0	0	0.824703	0.461023		
co	0.230511		0	0.412351	0.412351	0		0.230511	
dist		0	0	-0.41235	-0.41235	0	0		
co	0		-0.20618	0	0	-0.20618		0	
dist		0.073928	0.132247	0	0	0.132247	0.073928		
co	0.036964		0	0.066124	0.066124	0		0.036964	
dist		0	0	-0.06612	-0.06612	0	0		
co	0		-0.03306	0	0	-0.03306		0	
dist		0.011855	0.021207	0	0	0.021207	0.011855		
co	0.005927		0	0.010603	0.010603	0		0.005927	
dist		0	0	-0.0106	-0.0106	0	0		
co	0		-0.0053	0	0	-0.0053		0	
BM2	-112.432	-124.864	124.8642	137.55	-137.55	-67.5648	67.56476	33.78238	summed up to line before last co
Va1	11.86481								Va1=-(Mab+Mba)/Lab; Ve1=-(Mde+Med)/Lde;
Ve1	-5.06736								Bx1+Dx1+Va1+Ve1=0;
Na1	1.432486								Va1*30+Bx1*10-Na1*20+Mab+Mcb=0;
Bx1	-35.2413								Mab+Med-Na1*40-(Bx1+Dx1)*20=0;
Dx1	28.4438								

fem	0	0	-178.885	-178.885	178.8854	178.8854	-100	-100	Sway at C only
dist		64.14298	114.7425	0	0	-50.5995	-28.286		stiff and df remain same as in no sway case.
co	32.07149		0	57.37123	-25.2997	0		-14.143	
dist		0	0	-16.0357	-16.0357	0	0		
co	0		-8.01787	0	0	-8.01787		0	
dist		2.87497	5.142903	0	0	5.142903	2.87497		
co	1.437485		0	2.571451	2.571451	0		1.437485	
dist		0	0	-2.57145	-2.57145	0	0		
co	0		-1.28573	0	0	-1.28573		0	
dist		0.461023	0.824703	0	0	0.824703	0.461023		
co	0.230511		0	0.412351	0.412351	0		0.230511	
dist		0	0	-0.41235	-0.41235	0	0		
co	0		-0.20618	0	0	-0.20618		0	
dist		0.073928	0.132247	0	0	0.132247	0.073928		
co	0.036964		0	0.066124	0.066124	0		0.036964	
dist		0	0	-0.06612	-0.06612	0	0		
co	0		-0.03306	0	0	-0.03306		0	
dist		0.011855	0.021207	0	0	0.021207	0.011855		
co	0.005927		0	0.010603	0.010603	0		0.005927	
dist		0	0	-0.0106	-0.0106	0	0		
co	0		-0.0053	0	0	-0.0053		0	
BM3	33.78238	67.56476	-67.5648	-137.55	137.55	124.8642	-124.864	-112.432	summed up to line before last co
Va2	-5.06736								Va2=-(Mab+Mba)/Lab; Ve2=-(Mde+Med)/Lde;
Ve2	11.86481								Bx2+Dx2+Va2+Ve2=0;
Na2	1.432486								Va2*30+Bx2*10-Na2*20+Mab+Mcb=0;

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Bx2	28.4438								Mab+Med-Na2*40-(Bx2+Dx2)*20=0;
Dx2	-35.2413								
sf1	0.9321								(-35.2413)*sf1+28.4438*sf2+10.8197=0
sf2	0.7744								28.4438*sf1-35.2413*sf2+0.7799=0
BM	-101.316	-49.4221	49.42206	21.78627	-21.7863	33.69746	-33.6975	-55.5688	BM=BM1+sf1*BM2+sf2*BM3

Solution from slope deflection method (see deflections on page 19, topic 1 (i.e., SDM))

	theta_b	theta_c	theta_d	delta_b	delta_d	psi_ab	psi_bc	psi_cd	psi_de	theta_a	theta_e
	119	-91.4	218.7	6214	5163	310.7	-52.55	52.55	258.15	0	0
	-101.31	-49.41	49.42589	21.7884	-21.7793	33.69307	-33.705	-55.575			

Ex7

jt	a	b	b	c
mem end	ab	ba	bc	cb
mod stiff	0.75			0.75
df	0	1	1	0
fem/BM1	-187.5	0	0	125
stiff	1			1
df	0	1	1	0
fem	-125	125	-83.3333	83.33333
dist,co	-62.5	-125	83.33333	41.66667
BM	-187.5	0	0	125
Rl	31.25			
Rr	37.5			
fem/BM2	-100	0	0	100
Rlprime	10			
Rrprime	10			
sf	3.4375			
BM	-531.25	0	0	468.75

NO SWAY. Restrain each roller using Rl, Rr.

Deal with each part (i.e., AB, BC) separately. Don't combine at joint B during MD
Mod stiff and Fem's used
No MD required, i.e., Fem's are converged BM1.

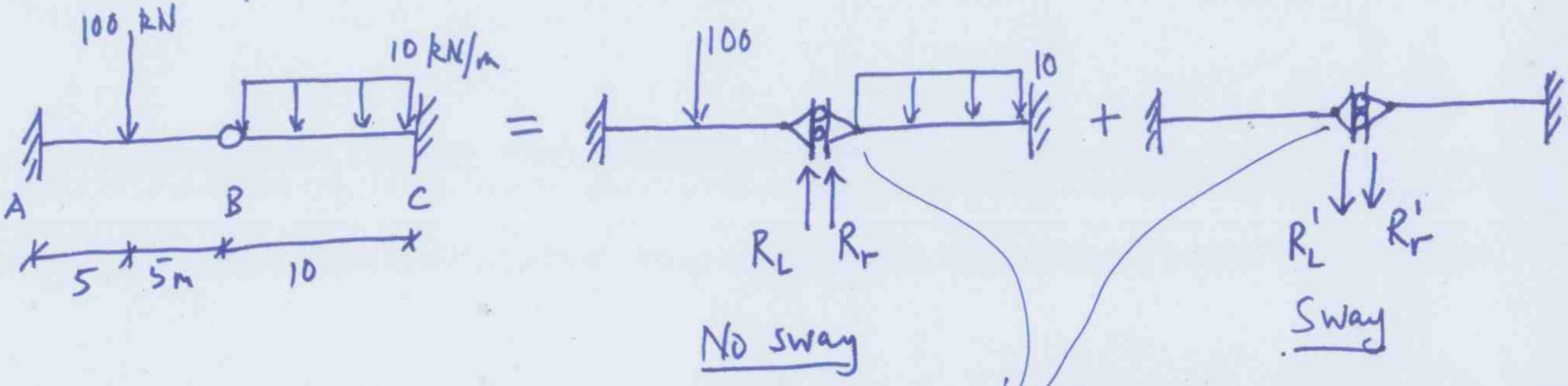
Med stiff not used. Single step MD.

Same result as when using mod. Stiff.!
Rl=(Mab+100*5)/Lab; Rr=(-Mcb+10*10^2/2)/Lcb

SWAY. Apply equal downward sway at B by means of Rlprime and Rrprime
Mod stiff and Fem used. No MD required, i.e., Fem's are convereged BM2.
Rlprime=-Mab/Lab; Rr=Mcb/Lcb;

sf=(Rl+Rr)/(Rlprime+Rrprime)
BM=BM1+sf*BM2
Note that scaling each reaction individually (i.e., Rl/Rlprime or Rr/Rrprime)) gives incorrect sf, since that is like solving two independent problems without combining at joint B. So the fem entry as well as the way sf is computed, both taken together, implies that the two sub-problems are combined into one problem where joint B is an internal hinge.

Problem with internal hinge.



pinned rollers to allow for slope discontinuity at pin B.