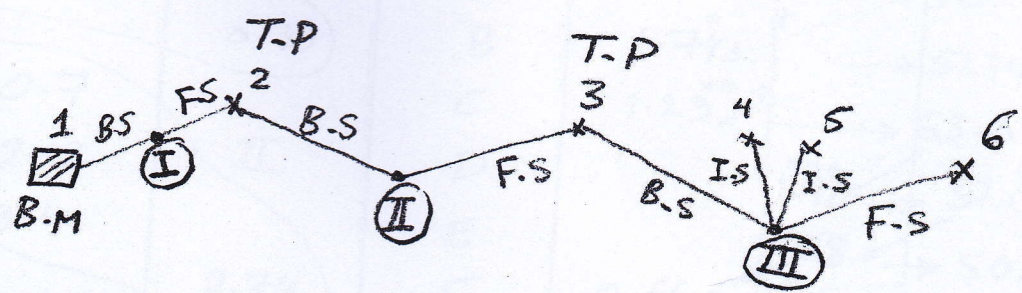
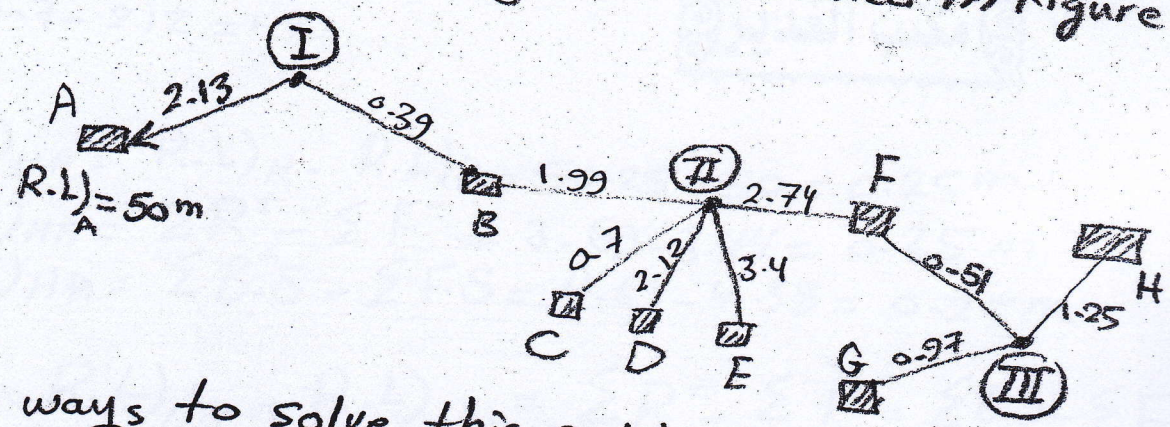


# Differential leveling

This method of leveling is used to determine the difference in elevation of two points either too far apart or by an intervening ground.



Example/ Transferring the leveling device three times to find the difference elevation between A as a B.M and point H, where the elevation at A was 50m, all the readings was illustrated in figure below



- Two ways to solve this problem as follows
- ① Rise and fall method
  - ② Height of instrument.

1) Solve by using Rise and fall method

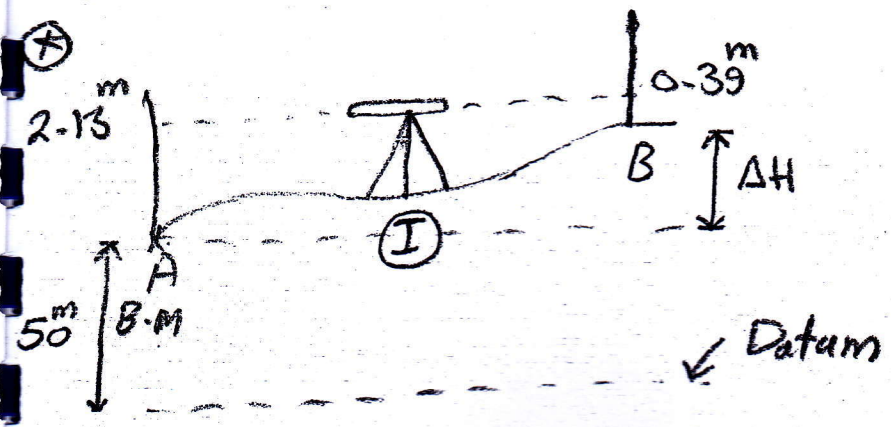
Staff reading			Staff station	R(+)	F(-)	R.L	note
B.S.	I.S.	F.S.					
2.13		I	A			50	B.M
1.99		0.39	B	1.74*		51.74	T.P
	0.7		C		1.29**	53.03	
	2.12	II	D		1.42***	51.61	
	3.4		E		1.28	50.33	
0.51		2.74	F	0.66		50.99	T.P
	0.97		G		0.46	50.53	
		1.25	H		0.28	50.25	
$\Sigma = 4.63$				$\Sigma = 3.69$	$\Sigma = 3.44$		

$\Sigma = 4.63$                        $\Sigma = 4.38$   
 \*  $2.13 - 0.39 = 1.74$   
 \*\*  $1.99 - 0.7 = 1.29$   
 \*\*\*  $0.7 - 2.12 = -1.42$

$\Delta H)_{HA} = (R.L)_H - (R.L)_A = 50.25 - 50 = 0.25 \text{ m}$   
 $\Delta H)_{HA} = \Sigma R^+ - \Sigma F^- = 3.69 - 3.44 = 0.25 \text{ m}$   
 $\Delta H)_{HA} = \Sigma B.S - \Sigma F.S = 4.63 - 4.38 = 0.25 \text{ m}$

$\therefore (R.L)_{\text{Last}} - (R.L)_{\text{first}} = \Sigma R^+ - \Sigma F^- = \Sigma B.S - \Sigma F.S$

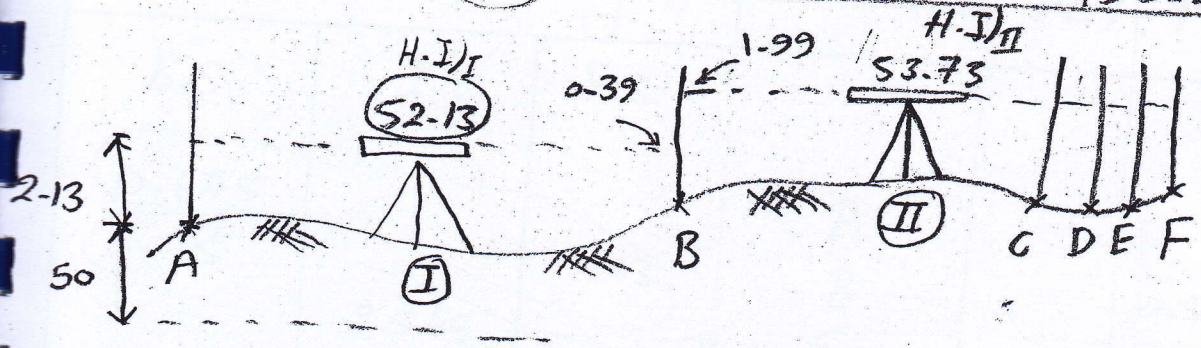
note: no. of B.S = no. of F.S. = no. of level station



$\Delta H)_{AB} = 2.13 - 0.39 = 1.74$   
 $(R.L)_B = 50 + 1.74 = 51.74 \text{ m}$   
 OR  
 $50 + 2.13 - 0.39 = 51.74 \text{ m}$   
 $(R.L)_A + (\text{Reading})_A - (\text{Reading})_B$

2) Solve by using height of instrument

Staff reading			Staff station	H.I	R.L.	note
B.S.	I.S.	F.S.				
2.13			A	52.13*	50	B.M.
1.99		0.39	B	53.73**	51.74***	T.P.
	0.7		C	"	53.03	
	2.12		D	"	51.61	
	3.4	2.74	E	"	50.33	
0.51			F	51.5	50.99	T.P.
	0.97		G	"	50.53	
		1.25	H	"	50.25	



\*  $H.I)_I = R.L)_A + \text{Staff reading)}_A = 50 + 2.13 = 52.13 \text{ m}$

\*\*  $H.I)_II = H.I)_I + [B.S)_I - F.S)_I]$   
 $= 52.13 + [1.99 - 0.39] = 53.73 \text{ m}$

\*\*\*  $R.L)_B = H.I)_I - F.S)_I = 52.13 - 0.39 = 51.74 \text{ m}$   
 (OR)  $R.L)_B = H.I)_II - B.S)_II = 53.73 - 1.99 = 51.74 \text{ m}$

check

$\Sigma B.S. - \Sigma F.S. = R.L)_{\text{last point}} - R.L)_{\text{first point}}$

⑥

Example 2/ The following staff reading observed by level, the instrument having been moved after the second, fifth and eighth reading, all readings were as follows

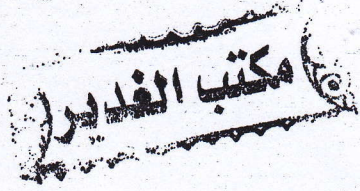
0.675, 1.230, 0.750, 2.565, 2.225, 1.935, 1.835, 3.220, 3.115 and 2.875

The first staff reading was taken with the staff held on B.M. = 100.00 m. Enter the reading in Level List and find R.L. of all point and check the result

sol. ① By Rise and fall method

staff reading			staff station	R(+)	FC(-)	R.L.	note
B.S.	I.S.	F.S.					
0.675			A			100	B.M.
0.75		1.23	B		0.555	99.445	T.P.
	2.565		C		1.815	97.63	
1.935		2.225	D	0.34		97.97	T.P.
	1.835		E	0.1		98.07	
3.115		3.220	F		1.385	96.685	T.P.
		2.875	G	0.240		96.925	
$\Sigma 6.475$		$\Sigma 9.55$		$\Sigma 0.68$		$\Sigma 3.755$	

H.W) Check the results by u



② By using height of instrument  
staff reading

⑦

Staff reading			staff station	H.I.	R.L.	note
B.S.	I.S.	F.S.				
0.675		I	A	100.675	100	
0.75		1.23	B	100.195	99.445	
	2.565	II	C	"	97.63	
1.935		2.225	D	99.905	97.97	
	1.835	III	E	"	98.07	
3.115		3.22	F	99.8	96.685	
		2.875 IV	G	"	96.925	

H.W) check the results by height of instruments

H.W) Complete the following table and apply arithmetical checking

Staff reading			H.I	R.L.	note
B.S.	I.S	F.S			
( )			279.08	277.65	
	2.01			( )	
	( )			278.07	
3.37		0.40	( )	278.68	
	2.98			( )	
	1.41			280.64	
		0.68		281.37	