Example: Solve by Relaxation method (SOR method):

$$9x - 2y + z = 50$$

$$x + 5y - 3z = 18$$

$$-2x + 2y + 7z = 19$$

Solⁿ: The residuals are given by

$$\left.\begin{aligned} R_x &= 50 - 9x + 2y - z \\ R_y &= 18 - x - 5y + 3z \\ R_z &= 19 + 2x - 2y - 7z \end{aligned}\right\} \rightarrow (1)$$

We now compute the following table:

Residuals → / ↓ Increments	δR_x	δR_y	δR_z
$\delta x = 1$	-9	1	2
$\delta y = 1$	2	-5	-2
$\delta z = 1$	-1	3	-7

Co-efficients of x, y, z of R.H.S. of 1st eqn. of (1).

co-efficients of x, y, z of R.H.S. of 2nd eqn. of (1).

Co-efficients of x, y, z of R.H.S. of 3rd eqn. of (1).

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Now, we compute the following [Relaxation Table]:

SL NO.	Variables	R_x	R_y	R_z
1	$x=y=z=0$	50	18	19
2	$\delta x = 50/9 \cong 5$	5	13	29
3	$\delta z = 29/7 = 4$	1	25	1
4	$\delta y = 25/5 = 5$	11	0	-9
5	$\delta x = 11/9 \cong 1$	2	-1	-7
6	$\delta z = -7/7 = -1$	3	-4	0
7	$\delta y = -4/5 = -0.8$	1.4	0	1.6
8	$\delta z = 1.6/7 = 0.23$	1.17	0.69	-0.09
9	$\delta x = 1.17/9 = 0.13$	0	0.56	0.17
10	$\delta y = 0.56/5 = 0.112$	0.224	0	-0.054

x	y	z
0	0	0
5	0	0
5	0	4
5	5	4
6	5	4
6	5	3
6	4.2	3
6	4.2	3.23
6.13	4.2	3.23
6.13	4.31	3.23

- Thus, $\Sigma \delta x = 6.13$, $\Sigma \delta y = 4.13$, $\Sigma \delta z = 3.23$.

∴ Hence the required solⁿ. is $x = 6.13,\ y = 4.13,\ z = 3.23$ //

[• In above table, it is obvious that in the row (1) the largest residual is 50. So to reduce it, we give an increment $\delta x = \left(\dfrac{50}{\text{numerically largest co-efficient in 1st eqn}}\right)$

$$= \frac{50}{9} \cong 5.$$

So the residuals in the row (2). Here $R_z = 29$ is the largest residuals and we give an increment $\delta z = 29/7 \cong 4$ to get the residuals in the row (3). In the row (6), $R_y = -4$ is numerically largest and we have an increment $\delta y = -(4/5) = -0.8$ so as to give the residuals in (7). Similarly other steps have been carried out.]

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