

$$Y_i = \alpha + \beta_1 X_i + \beta_2 Z_i + e_i$$

$$\beta_1 = \frac{\sum((Y_i - \bar{Y}) * (X_i - \bar{X}))}{\sum(X_i - \bar{X})^2} - \beta_2 \frac{\sum((X_i - \bar{X}) * (Z_i - \bar{Z}))}{\sum(X_i - \bar{X})^2}$$

$$\beta_2 = \frac{\sum((Y_i - \bar{Y}) * (Z_i - \bar{Z}))}{\sum(Z_i - \bar{Z})^2} - \beta_1 \frac{\sum((X_i - \bar{X}) * (Z_i - \bar{Z}))}{\sum(Z_i - \bar{Z})^2}$$

$$\alpha = \bar{Y} - \beta_1 \bar{X} - \beta_2 \bar{Z}$$

Calculating the required terms:

Y	X	Yi- $\bar{Y}$	Xi- $\bar{X}$	(Yi- $\bar{Y}$ )*(Xi- $\bar{X}$ )
3	4	-2.5	-0.5	1.25
4	6	-1.5	1.5	-2.25
7	8	1.5	3.5	5.25
5	4	-0.5	-0.5	0.25
6	3	0.5	-1.5	-0.75
8	2	2.5	-2.5	-6.25
$\sum Y_i$	$\sum X_i$			$\sum ((Y_i - \bar{Y}) * (X_i - \bar{X}))$
33	27			-2.5
$\bar{Y}$	$\bar{X}$			
5.5	4.5			

Y	Z	Yi- $\bar{Y}$	Zi- $\bar{Z}$	(Yi- $\bar{Y}$ )*(Zi- $\bar{Z}$ )
3	3	-2.5	0	0
4	4	-1.5	1	-1.5
7	5	1.5	2	3
5	2	-0.5	-1	0.5
6	3	0.5	0	0
8	1	2.5	-2	-5
$\sum Y_i$	$\sum Z_i$			$\sum ((Y_i - \bar{Y}) * (Z_i - \bar{Z}))$
33	18			-3
$\bar{Y}$	$\bar{Z}$			
5.5	3			

$X$	$Z$	$x_i - \bar{x}$	$z_i - \bar{z}$	$(x_i - \bar{x}) * (z_i - \bar{z})$
4	3	-0.5	0	0
6	4	1.5	1	1.5
8	5	3.5	2	7
4	2	-0.5	-1	0.5
3	3	-1.5	0	0
2	1	-2.5	-2	5
$\sum x_i$	$\sum z_i$			$\sum ((x_i - \bar{x}) * (z_i - \bar{z}))$
27	18			14
$\bar{x}$	$\bar{z}$			
4.5	3			

$(x_i - \bar{x})^2$
0.25
2.25
12.25
0.25
2.25
6.25
$\sum (x_i - \bar{x})^2$
23.5

$(z_i - \bar{z})^2$
0
1
4
1
0
4
$\sum (z_i - \bar{z})^2$
10

Substitute the values, take up to 3 digits and round off to two.

$$\beta_1 = -0.11 - \beta_2 0.6 \quad \text{--- 1}$$

$$\beta_2 = -0.3 - \beta_1 1.4 \quad \text{--- 2}$$

Multiply equation 2 with -0.6 and rearrange

$$-0.6 \beta_2 = 0.18 + \beta_1 0.84 \quad \text{--- 3}$$

$$-\beta_1 0.84 = 0.18 + 0.6 \beta_2 \quad \text{--- 4}$$

Add 4 and 1

$$0.16 \beta_1 = 0.07$$

$$\beta_1 = 0.44 \quad \text{--- 5}$$

Substitute 5 in equation 1

$$\beta_1 = -0.11 - \beta_2 0.6$$

$$0.44 + 0.11 = -\beta_2 0.6$$

$$\beta_2 = -0.92 \quad \text{--- 6}$$

For  $\alpha$

$$\alpha = \bar{Y} - \beta_1 \bar{X} - \beta_2 \bar{Z}$$

$$\begin{aligned} \alpha &= 5.5 - (0.44)(4.5) + (0.92)(3) \\ &= 6.28 \end{aligned}$$