# lsm 23

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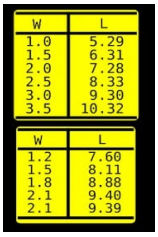
## 1 Data Layout

we have the data from lab 1 and lab 2.

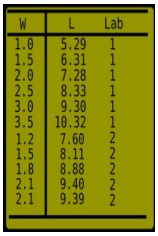


| W | L |
|---|---|
| 1.0 | 5.29 |
| 1.5 | 6.31 |
| 2.0 | 7.28 |
| 2.5 | 8.33 |
| 3.0 | 9.30 |
| 3.5 | 10.32 |

| W | L |
|---|---|
| 1.2 | 7.60 |
| 1.5 | 8.11 |
| 1.8 | 8.88 |
| 2.1 | 9.40 |
| 2.1 | 9.39 |

The technique to merge them is to put one below the other. However ,we still need to specify the difference between the collected data from either lab, i.e. we need to specify the lab in which the relevant trial has been conducted.

This can be done by adding an additional column indicating the lab the data is obtained from.



| W | L | Lab |
|---|---|---|
| 1.0 | 5.29 | 1 |
| 1.5 | 6.31 | 1 |
| 2.0 | 7.28 | 1 |
| 2.5 | 8.33 | 1 |
| 3.0 | 9.30 | 1 |
| 3.5 | 10.32 | 1 |
| 1.2 | 7.60 | 2 |
| 1.5 | 8.11 | 2 |
| 1.8 | 8.88 | 2 |
| 2.1 | 9.40 | 2 |
| 2.1 | 9.39 | 2 |

Note that, the number of arrows in the black box representation (other than the one associated with the random error) are 3 .


Once we have this factor input(lab) ; a more useful way of denoting this linear model is by changing the notations to : $l_{ij}$ ; $w_{ij}$ ; $\epsilon_{ij}$

When ever there is a factor input , one subscript must be dedicated to that factor alone and one subscript can be allotted for the random error.

So, how to decide on the linear model ?
Suppose all the springs are of same pitch/radius/elasticity. And we are trying to study springs of that property set.
Note : Initial length is not of much importance.But $\alpha_i$ can be dependent on initial length.
The linear model can be represented as :

$$l_{ij} = \alpha_i + \beta w_{ij} + \varepsilon_{ij} \tag{1}$$

$\alpha_i$ is dependent on the initial length, thus only dependent on i.
$\beta$ depends on elasticity/radius/pitch, thus independent of both i and j.