Reason to use:

· Due to ethical reason, we may not be able to recieve enough experiment unit to make a RCB. We need a way to make this type of experiment.

How do we design it:

· We can make the experiment into table form.

A row represents the treatment effect.

A column represents the blocking effect.

Restriction:

a := represents the number of treatments.

b := represents the number of level for the blocking.

k := represents ~~the size of block~~ the number of unit in a block.

r := represents ~~the number of unit in a row~~ each of the a treatments occurs if balance.

λ := represents ~~the number of replication of pair~~ pair of treatments occurs the same number of times if balance ~~of treatment~~.

This is not experiment unit. Because the people may change.

↳ These three is the key to say a balance design.

Then, we have a BIBD - Balanced Incomplete Block Design.

↳ $k \leq a$ means incomplete.

· However, sometimes, we cannot make BIBD.

To be a valid BIBD,

① $b \geq a$. ② $\lambda = \frac{r(k-1)}{a-1}$ is an integer

③ $ar = bk = N$

Need some clarification.

Analysis:

· The conclusion will be the same as RCB.

ANOVA.

	df	ss	MS
Treatment	a-1	SSA	MSA
Block	b-1	SSB	MSB
Error	N-a-b+1	SSE	MSE
Total	N-1	SST	

But, BIBD will not have independent property.

This means we cannot use regular formula to obtain SST = SSA+SSB+SSE.

New formula:

$$SSA = \frac{k\sum_{i=1}^{a} Q_i^2}{\lambda a} \qquad SSB = \left[\sum_{j=1}^{b} k(\bar{y}_B)^2\right] - N(\bar{y}_T)^2 \qquad SST = \sum_{i=1}^{a}\sum_{j=1}^{b} \bar{y}_{ij}^2 - N(\bar{y}_T)^2$$

$$Q_i = T_i - \frac{B_j}{k} \qquad T_i = r\bar{y}_{A_i} \qquad B_i = \sum_{j=1}^{b} k\bar{y}_{B_j} \; I(\text{treament } i \text{ is in block } j)$$