ASQ CRE Prep course

Lesson III. A. 7. j.

Design of Experiments

Various Designs

Objective

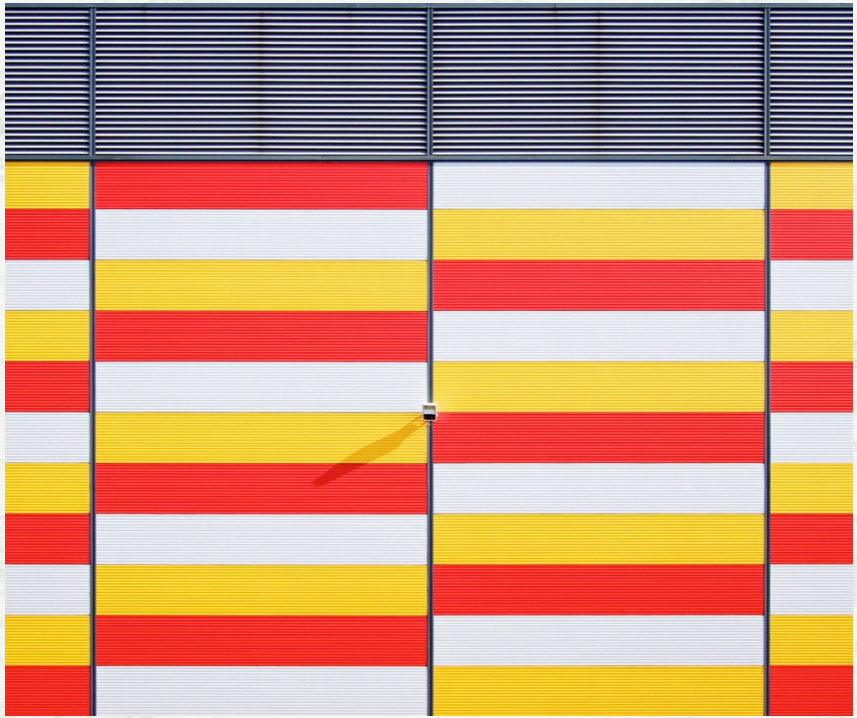
Comparative

Screening

Response surface

Optimizing

Optimal fitting (regression)



Latin Square

Single factor

2 blocking factors

All factors have the same number of levels

4 Hub Designs - Power Transfer

	Sprocket Type			
Rider	I	II	III	IV
1	A	B	D	C
2	D	C	A	B
3	B	D	C	A
4	C	A	B	D

Graeco-Latin Square

Single factor

3 blocking factors

All factors have the same number of levels

4 Hub Designs - Power Transfer

	Sprocket Type			
Rider	I	II	III	IV
1	A α	B β	D γ	C δ
2	D β	C α	A δ	B γ
3	B γ	D δ	C α	A β
4	C δ	A γ	B β	D α

Test fixtures: α, β, γ, and δ

Hyper-Graeco-Latin Square

Single factor

4 blocking factors

All factors have the same number of levels

4 Hub Designs - Power Transfer

	Sprocket Type			
Rider	I	II	III	IV
1	A α a	B β b	D γ c	C δ d
2	C δ b	D γ a	A β d	B α c
3	D β c	C α d	B δ a	A γ b
4	B γ d	A δ c	D α b	C β a

Test fixtures: α, β, γ, and δ
Temperature: a, b, c, and d

Full Factorial

- **All possibilities**

Number of Factors	Number of Runs
2	4
3	8
4	16
5	32
6	64
7	128

Run	Hub	Sprocket	Frame
1	–	–	–
2	+	–	–
3	–	+	–
4	+	+	–
5	–	–	+
6	+	–	+
7	–	+	+
8	+	+	+

Fractional Factorial

- **Select a process (hypothesis)**
- **Identify the output factors**
- **Establish the input factors and levels**
- **Select a design**
- **Conduct the experiment**
- **Collect the data**
- **Analyze the data and form conclusions**

Plackett-Burman

Very efficient Screen

Only main effects

#runs multiple of 4

Not power of 2

11 factors with 2 levels

12 runs

19 factors with 2 levels

20 runs

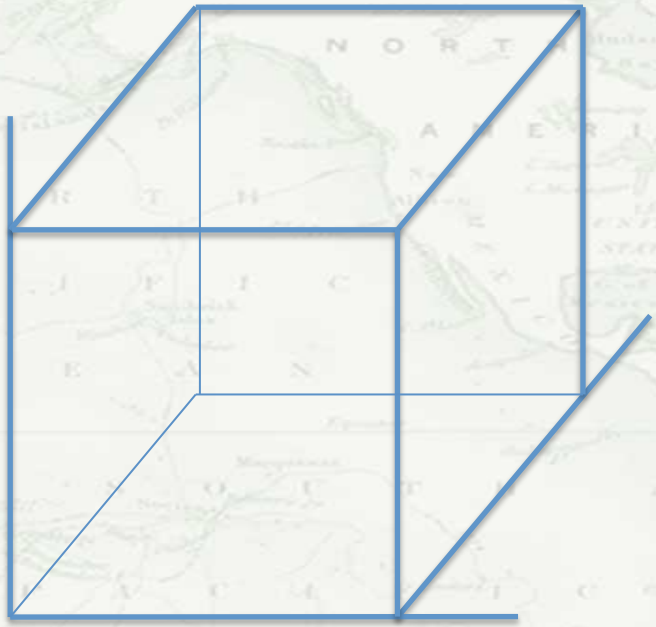
3 factor & 3 levels

Non linearity

Interactions difficult

Not as efficient

Often not necessary



Do you have a good DOE book?

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Lesson III. A. 7. k.

Design of Experiments

A Simple Taguchi Example