



NTNU  
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## **TMA4267 Linear Statistical Models V2014**

**Part 6: Design of experiments quiz**  
**Quiz hosted by [clicker.math.ntnu.no](http://clicker.math.ntnu.no)**

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To be lectured: March 17, 2014  
[wiki.math.ntnu.no/emner/tma4267/2014v/start/](http://wiki.math.ntnu.no/emner/tma4267/2014v/start/)

# 1. DOE design matrix

Which of the following is NOT correct for the DOE  $2^k$  full factorial design matrix  $\mathbf{X}$ ?

- A  $\mathbf{X}$  only contains the numbers -1 and 1.
- B The sum of each column equals 1.
- C The columns of  $\mathbf{X}$  are orthogonal.
- D  $\mathbf{X}^T \mathbf{X}$  is a diagonal matrix.

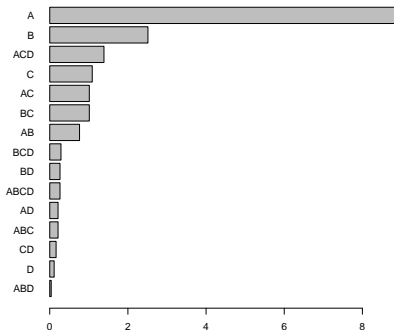
## 2. Variance

In  $2^k$  DOE we assume a general MLR model with  $\mathbf{Y} = \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon}$ , with  $\boldsymbol{\varepsilon} \sim N_n(0, \sigma^2 \mathbf{I})$ . We estimate effect  $j$  by  $\widehat{Effect}_j = 2 \cdot \frac{1}{n} \sum_{i=1}^n x_{ij} Y_i$ . Which of the four entries below gives the effect variance  $\text{Var}(\widehat{Effect}_j)$ ?

- A  $\sigma^2$
- B  $\frac{1}{n}\sigma^2$
- C  $\frac{2}{n}\sigma^2$
- D  $\frac{4}{n}\sigma^2$

## 3. Plot

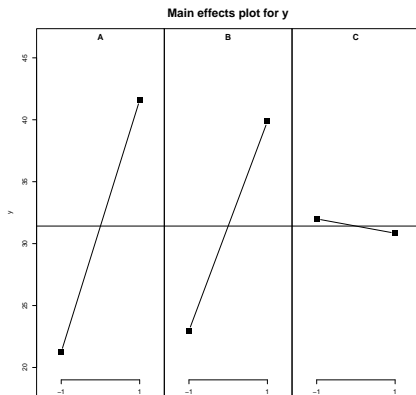
What is this plot called?



- A Main effects plot
- B Interaction effects plot
- C Pareto plot
- D Normal plot

## 4. Main effect

What is the estimated main effect of A?



A 0

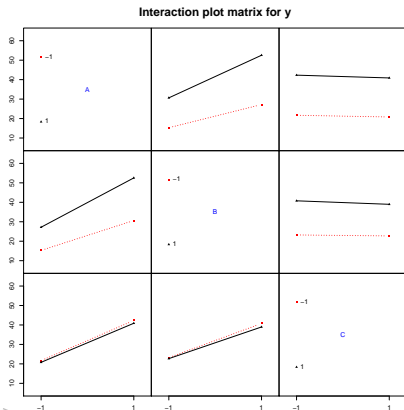
B 10

C 20

D 30

## 5. Interaction effect

Which of the estimated interaction effects AB, AC, BC is the largest?



A AB

B AC

C BC

## 6. Fractional factorial designs

Set up a full factorial design in the three variables A, B, C. Then, use the generators: D=AB, E=AC, F=BC, G=ABC. What do you get?

A  $2_{III}^{7-4}$

B  $2_{IV}^{7-3}$

C  $2_{IV}^{7-4}$

D  $2_{III}^{7-3}$

## 7. Fractional factorial

What does it mean that a design is of resolution III?

- A Main effects are confounded with each other.
- B Main effects are confounded with 2-way interactions.
- C Main effects are confounded with 3-way interactions.
- D Main effects are confounded with 4-way interactions.



# Correct?

Are you sure you want to read the correct answers? Maybe try first?

# Answers

Correct: BDCCAAB