

## Assignment 5

### Problem 1

Explain what is the purpose of two-level factorial designs.

### Problem 2

In an experiment for the determination of Titanium(Ti) in glass ceramics, we look at the influence of elements Mg, Na and Si on the Ti signal. Sensible low and high levels in  $\mu\text{gmL}^{-1}$  are proposed for each of these elements. Duplicate Ti measurements are obtained for each combination of factors.

Run	Combination	Mg (a)	Na(b)	Si(c)	Response
1	(1)	(-)	(-)	(-)	7,9
2	a	(+)	(-)	(-)	8,10
3	b	(-)	(+)	(-)	32,36
4	ab	(+)	(+)	(-)	50,54
5	c	(-)	(-)	(+)	14,18
6	ac	(+)	(-)	(+)	20,24
7	bc	(-)	(+)	(+)	43,47
8	abc	(+)	(+)	(+)	53,59

Use R to test for significance the main effects, the first and second order interactions.

What are your conclusions for the next step of the experiment?

### Problem 3

In the previous experiment, imagine we were planning to use as a fourth factor: the influence of Aluminum (Al) on the Ti level. Explain the total number of possible combinations for the four factors and the necessary notations.