AALBORG UNIVERSITY
Department of Mathematical Sciences
Fredrik Bajers Vej 7 G ▪ DK 9220 Aalborg East ▪ DENMARK

AAU, 16^{th} August 2013

DESIGN AND ANALYSIS OF EXPERIMENTS

Dear PhD Student,

Welcome to the joint PhD course "Design and Analysis of Experiments." I hope you will enjoy it and find it useful for your further studies.

Is this the right course for me?

It is important that the course meet your expectations. It must be emphasised that this is not a course on laboratory techniques and, due to the number of participants, there will not be time to work out detailed plans for the individual participant's experiments. On the other hand, several participants from previous runs have contacted me after the conclusion of the course and I have had fruitful discussions about their experiments.

Although the mathematical level is moderate (calculus is rarely used), there will be a certain mathematical flavour. You should know that the title refers to a branch of statistics. Unfortunately, there won't be time to cover subjects like time series, survival analysis and questionnaires. Some of these could no doubt be useful for some of you. However, mastering the general principles will certainly have a rub-off effect.

Textbook

Douglas C. Montgomery
Design and Analysis of Experiments, 8^{th} ed.
Wiley, 2012

This book seems to be a widely used text-book around the world. The mathematical level should be easy for an engineer. The book should be available at the University Bookshop. We shall cover as much as time permits.

Computing

Today it is unthinkable doing statistics without a computer for doing all the calculations. In this course, we will use the statistics package **R**, where we will be using the user interface **RStudio**. It is free software and works equally well

on Linux/Unix, Windows and Macintosh. **R** and **RStudio** can be downloaded from

http://cran.r-project.org and http://www.rstudio.com

Please, come with a laptop (extension cords welcome) with R and RStudio installed (remember to check that it works).

If you prefer just to use **R** without **RStudio** or you have another favorite user interface for **R**, feel free to use this; all the examples in the course should work equally well on this.

In my view **R** is state of the art in statistical computing. It has a professional standard, better than most—in my opinion all—proprietary statistics packages. It is easy to make small programmes in **R** and to modify existing routines. Furthermore, there is a large number of additional packages that can be downloaded (also for free) adding nearly any statistical method you can think of to the program. I hope that you will find **R** useful in your later career, too. For those new to **R**, it would be a good idea to find the manual "*An Introduction to **R***" (you can just google it).

Must I learn a new language?

Maybe you are familiar with other computer packages, a spreadsheet like Microsoft Excel or perhaps Matlab. A spreadsheet is completely inadequate for serious statistics. It is probably possible to do all the exercises for this course in Matlab, but I definitely won't recommend that you do this in order to avoid spending time on learning **R**; you may well end up wasting more time than you save trying to figure out how to do the exercises in Matlab, since I won't be able to help you with Matlab, and you won't be able to copy-paste anything from my examples.

Having said that I must emphasise that statistical computing is not the main topic in the course. Only a small subset of the many available commands in **R** is needed. *The important matter is the statistical concepts.*

Jakob G. Rasmussen
Fredrik Bajers Vej 7G, G1-125
Phone: 9940 8878
e-mail: jgr@math.aau.dk