

## Final Project

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### Bubble Wrap Experiment Description

Company XX is a manufacturer of several types of protective packaging, including bubble wrap sold in both retail and bulk. The objective of this project is to determine the best operating conditions for the bubble wrap lines to increase production capacity.

Variables such as extrusion rate, temperature, line speed, and percent loading of additives were key factors that were considered in the study. After preliminary experiments, the engineers decided that **line speed**, and **percent loading of additives** were the most significant factors and thus a complete randomized (also called factorial) design was implemented with these two factors:

Factor	Levels		
Line Speed (m/mm)	36	37	38
Loading of Additives (%)	0	2	4

The response variable was the **production rate** measured in lbs/hr. The experiment was replicated 3 times and the randomization order for each replication was also recorded.

Our goal is to find the **optimal combination** of **line speed** and **percent load of additives** that results in the **highest production rate**.

The data can be found in the `bubblewrap.csv` data set on Moodle.

### Deadline

One report per group should be submitted by **Monday, December 13 @ 11.59pm**.

### Instructions

The final project can be completed either individually or in groups of 2-3 students. If you decide to work in a group, you must complete both parts of the problem.

## Part I

In this project, you should use models and methods *we discussed in class* to analyze the data from this experiment. Your goal is to answer the question in the model description (i.e. find the **optimal combination** of **line speed** and **percent load of additives** that results in the **highest production rate**) , so make sure that you use appropriate hypothesis tests to reach a conclusion. Finally, you should make sure to check the model assumptions by performing appropriate diagnostic tests and taking remedial measures, if needed.

## Part II - to be completed by groups

During the experiment, the team observed that the quality of the bubble wrap was not acceptable for *Replication 2, runs 2,3, and 5*, which resulted in discarding the produced bubble wrap. Re-do the analysis in *Part I* with the appropriate modifications.

## Deliverables

The case study should be submitted on Gradescope as a group (only once case study per group) or individually (if you worked on your own). You should submit:

- (1) a **PDF** file containing a 2-3 executive summary of the analysis. You need to make sure that your report is professionally and clearly written, addressed to someone who *knows statistics*. You should also include a concluding paragraph where you should state your conclusions in layman's terms. Any necessary plots or **R** output should be attached in an *appendix*. You should include no **R** code in the summary.
- (2) an **R Markdown** and corresponding **HTML** file with comments with all the R code that you built to analyze the data set.

A rubric on which the grading of the case study will be based is posted on Moodle for your reference.