SCM 517 Lego DOE Project

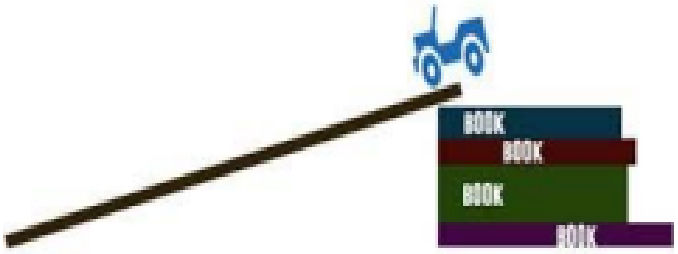
As part of your class project for SCM 517, you will be required to design a Race Car made out of Lego blocks. You will be provided with a kit (Lego) to build the car and a Bill of Materials (BOM) with an associated cost for each component. On Race Day, your design will be put to the test as you compete in the "Desert Classic Phoenix Grand Prix". You are encouraged to dress up in team colors and cheer on!

Your grade on the final project will be based on the **Designed Experiment and the supporting analysis** that will be required to select your final design. If you win the Grand Prix, you get bragging rights!

How to run the DOE Experiment?

Your ultimate goal is to maximize the distance your car will travel down a pre-constructed ramp. The distance traveled by the car will be your response variable (*y*). You will be required to construct a make shift ramp as shown in the pictorial below. You could use books and some cardboard paper to construct a make shift ramp or any other material that you see fit.

Please ensure that you use the same ramp (height/length/angle) for all your experiments (please make sure that the angle is consistent throughout your experiment). Once you select a design configuration, you will release the car from the top of the ramp and then measure the horizontal distance (*y*) it travels from the end of the ramp. The order in which you run your various designs will need to be randomized. (This will make more sense as we cover the material in class.)



Distance Travelled (y)

Choice of Factors:

The Lego set comes with several different blocks, wheels and axles. A few factors that you could consider (you are not restricted to use these, they are merely for illustration purposes) could be the wheel base, size of wheels etc.

I encourage you to have fun and be creative with you factors. You must decide on these factors as a team. Please do not google factors that impact car speed. This isn't meant to be a class on physics but a demonstration of designed experiments.

Constraints

1. You must only use the Lego pieces provided to you.
2. The car must have a windshield, steering wheel and a driver.
3. Your DOE must have at least 4 factors.

Running the experiment

You could perform a screening experiment to identify which factors truly contribute to distance. Remember, a screening experiment must also be a factorial design. You can then do a full factorial or fractional factorial with replicates on the selected variables to optimize the settings. You can use any design concepts that are discussed in class. Please use Minitab to run the DOE and run your experiments in the random order that Minitab provides (once you set up the experiment).

Deliverables

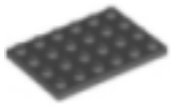
You must submit a detailed PowerPoint presentation describing you experiment and the results. The slides should include

1. Project objectives and goals
3. Description of your experimental setup, including how you conducted the experiment, where etc.
4. Factors chosen and a description of each factor. The thought process behind the selection of the factor.
5. Response variable and how you measured it.
6. Choice of experimental design and experimental approach in general. How did you perform the experiment? How did you block any noise parameters etc.?
7. Data Analysis and model adequacy checks, including residual analysis to ensure model assumptions are not violated.
8. Graph demonstrating the results from the experiments and any insight that you may have acquired.
9. A Financial Analysis based on the design of the car and its performance. Are there any trade-offs. Are there any alternatives you would recommend to be more cost effective?
10. Final conclusion and recommendations.

Note:

The cost associated with each component is provided in the Bill of Material. Based on the cost of various designs, is there a recommendation that maximizes the distance the car traveled while being cost effective? What are your recommendations? Finally, be creative! Take the experiment seriously and use this time to learn how to conduct a DOE. Most importantly, have fun!

Bill of Material

	Parts of Car	Count	Price Per Unit
1		5	500
2		3	2000
3		2	1500
4		4	500
5		10	200
6		6	1000
7		2	1000
8		3	1200
9		8	100 each

10		1	100

11		1	500
12	Small wheels	6	1000
13	Big wheels	6	2200
14	8*4 plate 	1	500
15	4*2 plate 	6	1000
16	2*1 plate 	5	500

Intro Video from batch of 2018
https://www.youtube.com/watch?v=RlL69NUelyM