Quantitative Methods in Systems Engineering: Project Supplement

General Guidance

This document is intended to supplement the instructions included in the Excel files for the Week 2-4 project.

1. Ensure that you have downloaded both the template file and the example solution. You may refer to the sample solution at any time for an example of formatting and worksheet structure.
2. The example problem you choose has a large impact on the difficulty of the problem. Make sure that your problem is small enough and familiar enough to you personally so that you know where to look for design variable and attribute values, and can fill in any gaps using your experience and engineering judgment. The purpose of the project is to exercise the methods discussed in the course content rather than to design a high-fidelity engineering system – no need to spend undue hours researching your system. **You may need to simplify your problem as you move farther into the project – it is OK to do so.**
3. By default, the project template workbook is locked. This prevents unintentional modifications to the background calculations performed by the workbook. However, if you need to change formatting or cell contents in a non-yellow cell you may unlock a specific sheet or the entire workbook using the **Tools->Protection** menu (Excel for Mac) or using the **Review** tab on the menu ribbon (Excel 2016 for PC). You can also right-click specific worksheet tabs and choose to unprotect them. Similar options exist in earlier versions of Excel.

Week 2, Step 3

Defining SAU Curves:

- The SAU curves translate raw attribute levels to perceived system value – this relationship is not always linear. For example, a system attribute level may be useful below a threshold score, but beyond that score the system may lose functionality and therefore usefulness (such as a system shutdown that occurs beyond a specific temperature). The SAU curve defines this perceived sensitivity in usefulness. The SAU curve must be monotonic – an increasing attribute level must always correspond to an increasing (or equal) utility value. For attributes where higher levels have lower utility (smaller is better), the SAU curve must be always decreasing (or equal). **SAU definition is subjective, ideally elicited by the decision maker who cares about that attribute, but can also (as a proxy) be based on engineering judgment, experience, and system requirements.**

Defining MAU weights:

- The MAU weights assign the relative contribution to the overall utility of each attribute. Like the SAU curve definition, MAU weighting is subjective and based on perceived stakeholder expectations. For this project, the weighting of the attributes must sum to 1. In lieu of elicitation from decision makers, the weighting applied to each attribute can be based on judgment and key system requirements.

Week 2, Step 4

The purpose of Step 4 is to validate the SAU curves and MAU weightings assigned in Step 3. Attribute scores within the acceptable range should result in an SAU score between 0 and 1. The MAU score should also fall between 0 and 1 based on the weighting scheme developed in Step 3. Row 65-73 are meant for general testing, while rows 75-89 should be filled with extreme values for each attribute in all possible permutations (maximum or minimum for each attribute).

As always, we encourage you to discuss this project with your group and in the discussion forum.