M7 Decision Analysis Project Group 1 – Deliverable 4

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Deliverable 4

A local Virginia high school senior from a middle class family wants to attend college to study data science, but has also been considering a math degree. He applied to and received admissions from Rochester Institute of Technology, University of Michigan – Ann Arbor, Georgia Tech, and Virginia Tech. He needs assistance on deciding which college will give him the best education, student experience, and preparation for his career. He is unsure about where to start in the decision making process.

Our first step in working with the decision maker was to conduct a brainstorming session to consider all aspects of interest regarding the schools and sort them into affinity groups. The next step was to create an affinity diagram, to determine the specific objectives the student wanted to achieve with his decision to attend a particular school. Here we had to check for independence and a clear statement of the objective to be able to specify measures that would capture the range of options for each objective. We proceeded to gather data and compile a spreadsheet of the relevant measure values for each of the four schools. We will use the software package Logical Decisions for Windows (LDW) to model the affinity diagram, calculate the utility functions, and capture the weights to be able to rank the alternatives.

After we build the affinity diagram and collect the data, we will prepare a set of slides to show the decision maker each school's measures and use that to elicit weights using the rank sum and trade off methods. After obtaining the two sets of weights, we will check with the decision maker to see which seems to better fit with his understanding of the situation. After this meeting, we will complete the final version of our model and calculate the weighted scores to rank the alternatives.

We will be able to make our final recommendation at this point, and use the subscores from LDW to explain and support our recommendation. We will have what is objectively the best school for the decision maker to attend, based on his considerations. Along with the best school, we will also include the other schools in order based on their utility to the decision maker and ultimately leave the decision up to him.

We came up with a lot of alternatives and measures, but after talking with the decision maker we used his feedback to narrow it down to the best options. After brainstorming, we decided to eliminate sports as an objective since the student would be happy to travel or watch games on TV. We also eliminated internships as an objective since the student was more interested in research opportunities on campus. We removed personal and mental health as an objective as we considered every school has the infrastructure in place that supports the students so it would not matter as much to the decision maker in choosing a school. For similar reasons, we decided to eliminate clubs and extracurricular activities as an objective since every school has plenty of opportunities. Also, it depends on the student, not the school, to take advantage of the opportunity. Finally, we took out prestige as an objective, which was ultimately not as important as job placement rate and grad rate. This was considered important at first, but the student realized that what he was looking for was the opportunities the school provides, not the prestige in and of itself. This process was important in decreasing choice overload, a potential cognitive impairment for the decision maker during this process.

Next, we were able to establish the single value utility functions and elicit weights. While the measures associated with research budget and research space used a linear model, the other measures required an exponential function, according to the way the decision maker viewed the increasing or decreasing change in utility with higher values. The weights were

elicited first using the rank sum method, since it was the simplest to set up. However, the decision maker did not think the weights produced through this method accurately captured his preferences. So, we tried another approach with the tradeoff method, and had the decision maker state which pair of preferences led him to be indifferent. This method took more time than rank-sum, but produced better results, which the decision maker confirmed were a better reflection of his preferences.

We also used Logical Decisions' dynamic sensitivity analysis. With this sensitivity analysis, we can adjust the weights on the fly if the decision maker's circumstances change without going through the whole weight elicitation process again. Of course if needed, the whole process could be restarted if the decision maker's circumstances changes significantly. The only significant change that affected the model was total cost. If the decision makers' weight on total cost increases, we can adjust it on the fly and get a new ranking for the decision maker. Which is perfect since this is the primary area of uncertainty, since funding is not guaranteed and his familys' financial situation might change.

With the SDVFs and weights fully developed, we were able to finalize our model and produce a utility ranking for the four school alternatives, using the Logical Decisions for Windows software package. The final recommendation was for the decision maker to attend University of Michigan - Ann Arbor, which, even though has a higher tuition cost, adds value and maximizes utility through its low faculty-student ratio, optimal size, student support, and opportunities for research. The analysis lets us rule out Rochester Inst. of Technology, which had far lower utility than the other choices. After presenting the result to the decision maker, he indicated that the model and final results confirmed what he had been leaning toward throughout

the process, but this let him feel his decision was well founded in the choice that would maximize his utility and give him the best college experience.