



Decision Analysis of Engineering Schools in Virginia

Group 0

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Objective

Finding a university with an engineering program that fits certain specifications is a difficult task, especially due to the large amount of public universities in Virginia. The majority of prospective students look at academic life, ranking, cost, and unemployment rates when selecting a school. Three well known universities, University of Virginia (UVA), Polytechnic University of Virginia (VT), and George Mason University (GMU), were compared and analyzed within those four different categories to help determine which school is the most ideal to a future engineer.

Data Collection Method for Values

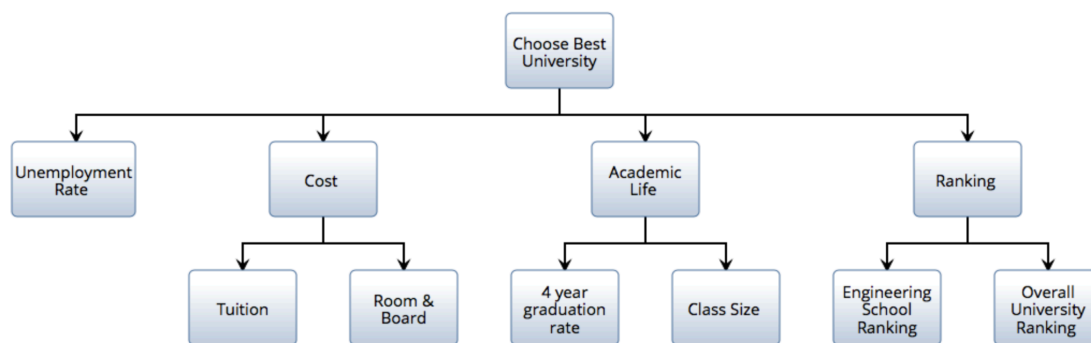


Figure 1. Affinity Diagram

The four categories that were compared and analyzed were Academic Life, Ranking, Cost, and Unemployment Rate, as seen in **Figure 1**.

Academic life was broken up into two subcategories: class size and graduation rate. Class size was defined as the percentage of classes in which the number of students in a particular class ranges between 20 to 49 students; a high percentage of classes between 20 to 49 students was considered the preferred option. Graduation rate was specified as the amount of students that have graduated college within four years or less. A higher graduation rate within an institution was favorable.

Ranking takes into account the university's overall national ranking as well as its engineering school ranking. A lower numerical ranking was preferred, meaning that the school and/or the program has a higher ranking.

Cost was also divided into two subcategories: tuition and room & board. A lower number for cost was preferred in both subcategories.

Unemployment rate is the percentage of students from each university who are not employed after graduation. A lower percentage in this category was preferred.

	Academic Life		Cost		Ranking		Unemployment Rate
Schools	Class Size (20-49)	Students Graduating in 4 Years	Room & Board	Tuition	Overall	Engineering	
UVA	29.2%	88%	\$11,220	\$16,146	25	24	14%
GMU	55.8%	46%	\$11,090	\$11,924	140	110	24%
Virginia Tech	49.8%	61%	\$8,424	\$12,852	69	14	24%

Table 1. Academic Life, Cost, Ranking, Unemployment Data (www.usnews.com)

The software, *Logical Decisions*, was used to assign weights to the different universities. The Analytical Hierarchy Process (AHP) was the decision methodology used to analyze the three universities. The matrix constructed from this method is seen in **Table 2**. where a one-to-one comparison of each of the categories was done. Different weights were assigned to the one-to-one comparisons based on the team members' personal preference. Doing this allowed the weights to increase or decrease based on the categories that were considered more or less important to the selection of the optimal decision.

The team considered that Ranking and Unemployment Rates were twice as important than Academic life, mostly because these two factors are crucial to finding a job in today's industry. Unemployment rates were also twice as important compared to Cost and Ranking, demonstrating the team's preference to a university that will maximize the chances of getting a job after graduation.

The Consistency Index (C.I) of the matrix was also calculated to be 0.062. Due to its small value, it was concluded that the matrix is very consistent and that no major discrepancies exist that could affect the results.

I-max = 4.186 C.I. = 0.062 C.R. = 0.0965	Academic Life	Cost	Ranking	Unemployment
Academic Life	0.168	1.000	0.500	0.500
Cost	1.000	0.242	2.000	0.500
Ranking	2.000	0.500	0.204	0.500
Unemployment	2.000	2.000	2.000	0.346

Table 2. AHP Matrix

Results

After running the program, the following results were captured in **Figure 2.** where University of Virginia was the most preferable with a weight utility of 0.653, followed by Virginia Tech with a weight utility of 0.638, and lastly George Mason University with a weight utility of 0.453.

As seen by the bar graphs, most of the weight was put on Unemployment Rate (red), followed by Cost (green), Ranking (blue) and Academic Life (yellow). It is important to mention that there is a small difference in terms of Unemployment Rate between the three universities and that Ranking and Academic Life made the difference in terms of selecting the best university.

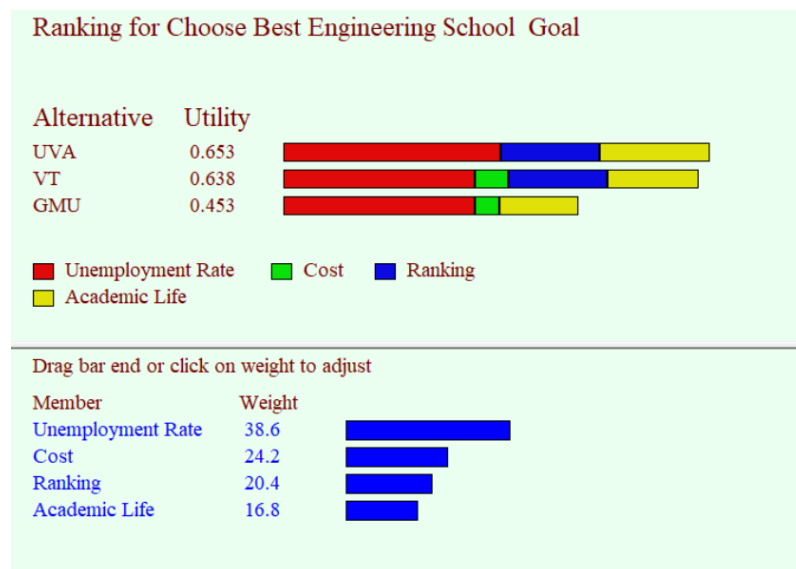


Figure 2. Results

Sensitivity Analysis

Academic Life

In terms of Academic Life, UVA is the most preferred university followed by VT and GMU. If the weight of Academic Life is increased, UVA remains to be the preferred alternative. However, if the weight is decreased to ~8%, VT becomes the preferred university. GMU is never the most preferred university at any point.

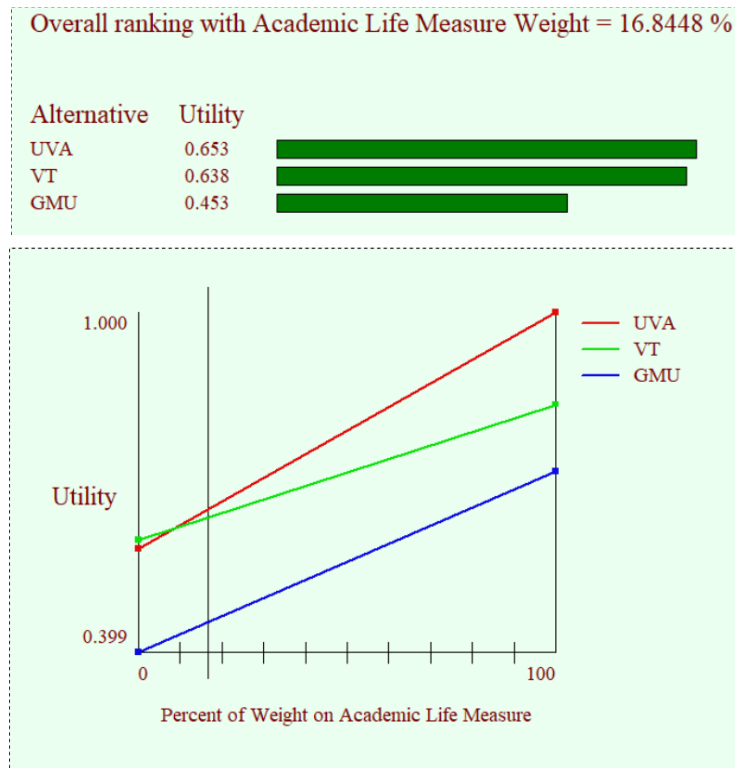


Figure 3. Academic Life Utility

A increasing linear function , as shown in **Figure 4.**, was used to model the utility of Academic Life. The higher the percent of classes having a class between 20-49, the more desirable it becomes.

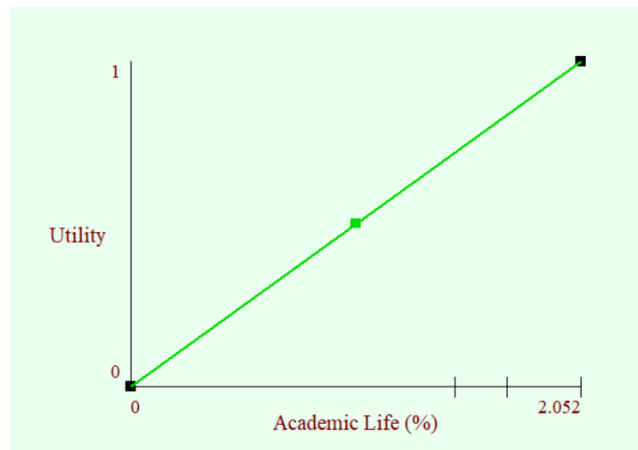


Figure 4. Academic Life Utility Graph

Cost

For Cost, UVA is the most preferred school with a weight of 24.1638%, as shown in **Figure 5.**, closely followed by VT. UVA remains the most preferred at any weight. However, if the weight is increased to ~30% or more, VT becomes the most preferred--UVA becomes the least preferred when the weight is at ~65% or greater. GMU is never the most preferred university at any weight.

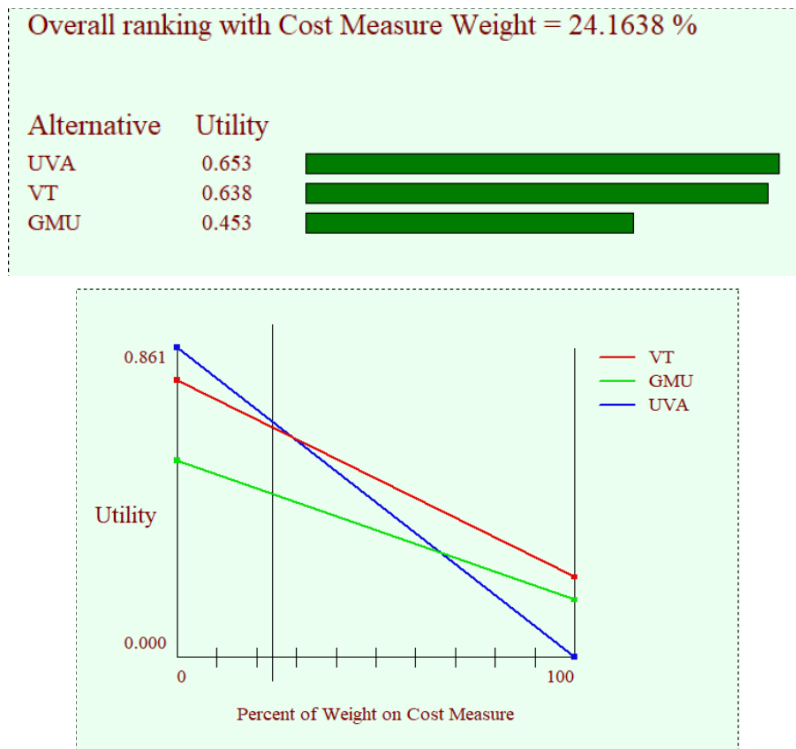


Figure 5. Cost Utility

A decreasing linear function was used to model the utility of Cost. The higher the cost, the less desirable it comes. The utility functions ranges up to \$27,366, which is the highest cost among the three universities and that corresponds to UVA.



Figure 6. Cost Utility Graph

Ranking

For Ranking, UVA is the most preferred school with a weight of 20.4224% as shown in **Figure 7**. It remains the most preferred school in any weight. Virginia Tech is the next preferred university, followed by GMU. From the sensitivity analysis, UVA is overall the best decision in regards to ranking across the entire range. Moreover, GMU displays a decreasing behavior when the percent weight on Ranking measure begins to increase.

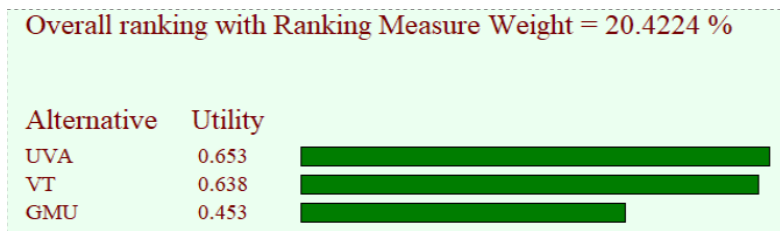




Figure 7. Ranking Utility

The decreasing linear function in **Figure 8.** was used to model the utility of Ranking since the lower it is, the more desirable it becomes. The utility function ranges from 3, which is the lowest ranking it can have as seen in the affinity diagram in **Figure 1.**, and it increases to 360.



Figure 8. Ranking Utility Graph

Unemployment

With the weight of Unemployment Rate at 39.569% as shown in **Figure 9**, UVA is the most preferred university. However, VT becomes the most preferred school if the weight of unemployment is decreased to ~28%. As the weight of Unemployment Rate increases to 100, GMU and VT have equivalent utilities.

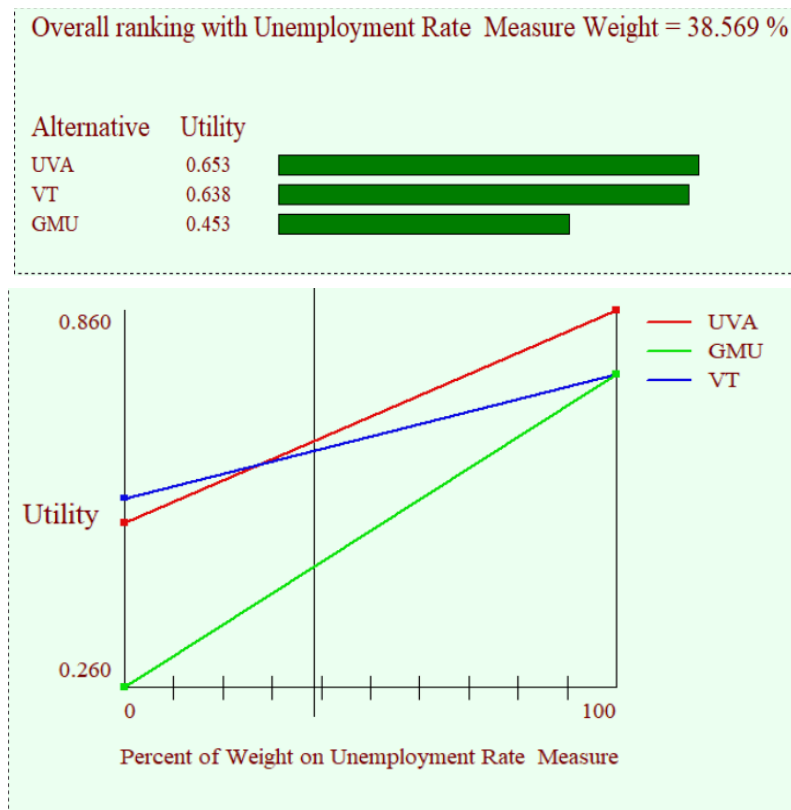


Figure 9. Unemployment Rate Utility

A decreasing utility function in **Figure 10**. was used to model the utility of Unemployment rate since the lower the rate, the more desirable it becomes .The utility ranges from 0% to 100%.

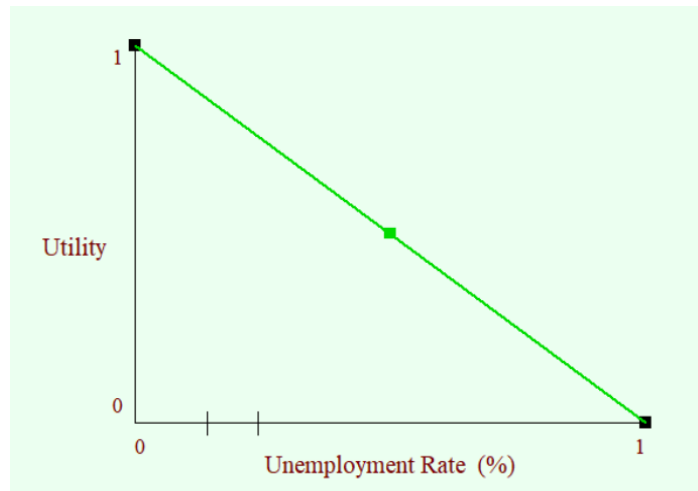


Figure 10. Unemployment Rate Utility Graph

Conclusion

The results show that the University of Virginia the most preferred university in every criteria except cost, followed by Virginia Tech and George Mason University. It is worth noting that the criterias are based on subjective level of importance.

Although the University of Virginia is numerically more preferable than Virginia Tech there is virtually no difference among the two universities as seen in **Figure 11**. This means that future work, such as the addition of quality of living between Blacksburg, Va and Charlottesville, Va, needs to be done in order to make the best decision between the two universities.

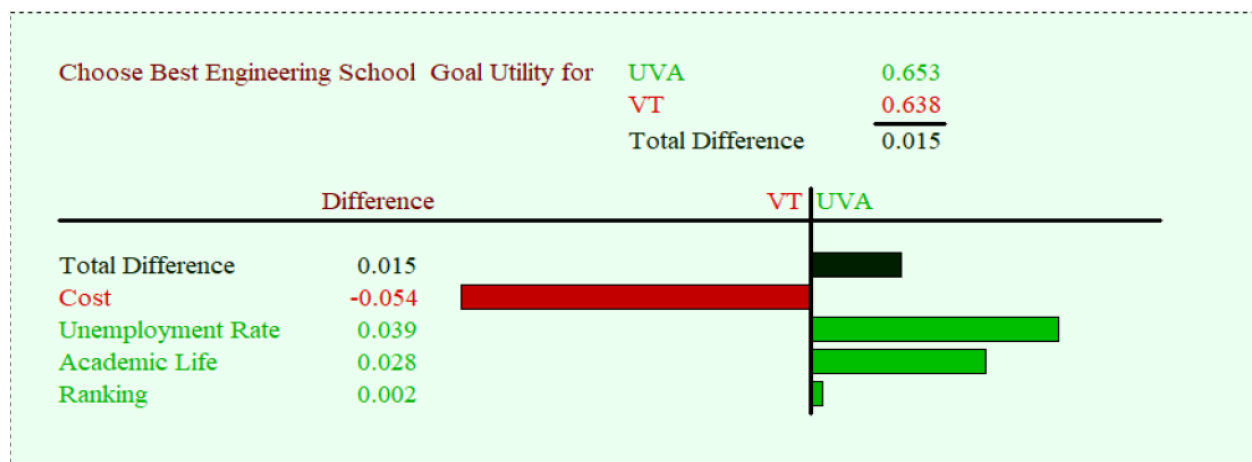


Figure 11. Utility Comparison - UVA vs. Virginia Tech