

## Service Processes and Systems Homework #4

Assigned: Feb. 21, 2006

Due: Feb. 27, 2006

1. A student is faced with three options about which university/college to attend.

	Acad. Quality	Cost	Size	Geography	Intangibles
Mom's Alma Mater	**	\$	15	very good	Wow
Univ. of Right Here	****	\$\$	10	OK	ok
Prestige Private College	****	\$\$	5	Blah	yuk

The following information is available for the various attributes (the mapping between the data above and utility points or "utils"):

- Academic Quality: 10 utils per star
- Cost: \$ = 30 utils, \$\$ = 20 utils
- Size:  $u(x) = 35 - x$
- Geography: very good = 30 utils, OK = 25 utils, blah = 20 utils
- Intangibles: wow = 35 utils, ok = 25 utils, yuk = 10 utils

Through a variety of scaling exercises, the analyst determines that the least important attribute is "intangibles". The next least important attribute is "geography," but that's still three times more important than intangibles. The most important attributes is "academic quality," which is three times more important than geography. The second most important attribute is "cost," which is five times more important than intangibles. Finally, the middle attribute, "size," is weighted exactly in between the 2nd and 4th most important attributes.

What is the weighting of the attributes?

Use Multi-Attribute Utility Theory (MAUT) to rank order the three choices, from best to worst? Show your work. What is the maximum utility that the student can achieve?

2. PuroMexicano Inc. is trying to decide whether to build a large, medium, or small facility to manufacture "sombros". The market for sombros could be poor, moderate, or good, with probabilities of 0.2, 0.5, and 0.3 respectively. If a large plant is built and business is good, the Net Present Value (NPV) of the plant's future earnings is expected to be \$1.75 million. In a moderate business climate, the large plant will earn \$1.00 million NPV and in a poor climate will lose \$0.50 million.

If a medium sized plant is built, the projected NPV for good, moderate, and poor climates are \$1.2 million, \$1.1 million, and \$0.2 million respectively. If a small plant is built, it will earn \$0.6, \$0.6 or \$0.15 million if business conditions are good, moderate, or poor respectively.

What size plant should be built? (Include a tree diagram to illustrate the situation).

3. Information is a key element of every service process. Choose a service process you are familiar with, and develop a flow chart that illustrates how information flows in, out, and is acted on by the process.

4. A new hospital is being planned. An analysis is being made to determine the optimum quantity of doctors and nurses needed for the hospital.

- The hospital budget can accommodate a maximum of \$10 Million (\$10,000 k) in salary for doctors and nurses. A doctor's salary is \$200k and a nurse's is \$50k.
- Another factor to consider is parking. The parking lot has 80 spots for doctor and nurse employees. It is expected that the nurses will carpool in groups of two.
- Also, there is a regulation that requires at least one nurse for every doctor.
- Finally, regional employment statistics indicate that there are only 150 qualified nurses in the region.

It is desired to maximize the hospital revenue, and for each doctor and nurse, the expected revenues are \$300k and \$100k respectively. Based on all these considerations, establish a linear programming model that describes this situation. Use the graphical technique described in class to solve the linear programming problem and identify the optimal number of doctors and nurses.

5. It is desired to select a design concept for a light source that can be used to navigate in homes during the middle of the night and not disturb others. We will use QFD to select the concept. The "customer wants" have been identified and prioritized; several product concepts have been brainstormed. Each concept has been evaluated in terms of the customer wants (3 – best to 0 worst).

Customer Wants	Priority	Design Concepts				
		Jar of Fireflies	Flashlight	Candle	Clapper on Room Lamp	Glow Stick
Light	6	0	2	2	3	1
Localized	4	3	3	3	0	3
Easy to Use	3	1	3	0	3	3
Inexpensive	5	3	2	2	2	0
Long Lasting	1	0	2	1	3	1
Environment	2	3	2	1	2	0

Use the data in the table to prioritize the design concepts.

**For Graduate Credit:**

Identify a technical paper that presents an application of mathematical programming in the design of a service process.

Prepare a critical review of the paper. What are the positive contributions of the paper? What are the technical deficiencies of the paper? Be sure to include a copy of the paper with your submission.