

PAD 504 Data, Models, and Decisions
Spring, 1999
Final Exam

(your name)

Instructions: You will have two hours to work on this quiz (5:45 to 7:45 PM). I am more interested in set up and reasoning than in computation and “right answers”. Show all of your work since partial credit is given.

1. Susan Tomlin’s Campaign Strategy. (25 points) Susan Tomlin is running for the local school board and is working with a limited budget of \$2000 for her campaign. In addition, she has ten volunteers who have each volunteered to work for her for 10 hours per week for the last two weeks of the campaign (for a total of 200 volunteer hours). Tomlin has two objectives for her campaign. First she wishes to achieve high name recognition. She has been told that she can do this by placing 50 signs around her rural town one month in advance of the election. Each sign will cost her \$10 and she can place them all herself. Her second objective is to maximize the number of citizens that her volunteers contact either in person or over the phone during the last two weeks of the campaign (for now ignore citizen contact before the last two weeks of the campaign). She estimates that a volunteer can make four person-to-person contacts per hour by knocking on doors. The probability that someone will be contacted during one of these home visits is 60%. She will have to pay on average 50 cents per home visit to cover mileage on the volunteer’s car.

On the other hand, a volunteer can make on average ten contacts per hour working over the phones. However, the cost of the phone bank averages out to one dollar per call. In addition, the probability of successfully contacting a citizen over the phone is only 40% for each call made because citizens tend not talk that much over the phone. Finally, polling research has shown that a face-to-face house call is twice as effective as a phone contact when contact can actually be made.

A. If you were to set up Tomlin’s strategy problem as linear program, what would you choose as the activity variables?

B. Formulate at least two different objective functions that Tomlin might use for the citizen contact portion of her campaign (last two weeks) and explain what is the logic of each. One of the two should be the objective function that you think would be best. Explain why you think your objective function is the best one possible.

C. In the space below, write out the constraints that exist in this linear program.

2. Tomlin's Election Night Banquet. (25 points) Whether she wins or loses the election for school board, Susan Tomlin is certain that she wants to host a dinner for all of her volunteers and supporters on election night. She wants the dinner to be nice as well as close to election headquarters. But she is also very concerned about price, since most of her supporters will be paying for their own dinner. Below are data for four restaurants that Tomlin is considering to host her banquet?

Restaurant	Price per Plate	Distance from Headquarters (miles)	Menu Rating from local paper (1=poor and 5=excellent)
Guy's Steak House	\$12	3 miles	3 stars
Luigi's Italian	\$11	6 miles	2 stars
Oriental Buffet	\$13	1 mile	5 stars
Home Style Cookin	\$11	4 miles	1 star
Raw Weights	40	10	30

In the space below, set up a spreadsheet that Tomlin could use to select the best restaurant. Make sure that all normalized weights and scales are computed with formulas (as opposed to being hand computed and entered) so that any piece of data in the above table could be altered and the new overall score would be calculated automatically.

3. Data Model for the Region-Wide Girl Scout Encampment (25 points).

Among Susan Tomlin's many volunteer activities, she is active in the Girl Scouts. This year she is organizing an encampment for 150 scouts at the Great Brook Scouting Center. These girls come from 10 different troops all located in her region. Each troop will come with between 6 to 18 girls and between 2 to 4 adult parent volunteers. There will be a total of 28 volunteers in all. The Great Brook Scouting Center is organized around four camping sites each of which has between 6 to 12 tents. In total, there are thirty tents each of which can sleep 8 to 10 persons (adults plus scouts). Tomlin wants to create a multi-table relational data base to handle assignments of troops, adult leaders, and girl scouts to tents located within the various sites. Each troop would like to be located together in a single site, if possible. Each tent should have at least one adult assigned to supervise it.

A. In the space below, list what are the entities that Tomlin needs to map in her data model for the girl scout encampment. For each entity, propose what might be a good key field (or key fields).

B. In the space below, create the beginning of a data model for Tomlin's encampment data base. Your model should show the entities and the relationships between them. Model the relationships as one-to-one, one-to-many, or many-to-many. Do not show all of the possible attributes for each entity.

4. Value-Based Parameters and Sensitivity Analysis (25 points)

A. Sometimes models use parameter values that reflect the values of the decision maker. Are there any parameters used in the models that you sketched for question 1 (campaign strategy) or question 2 (election night dinner) that are based on the decision makers' values. Explain why or why not.

B. Sensitivity analysis can help if the decision maker or decision making team has unclear or conflicting values. If Tomlin or her decision making team were unclear about some of the values parameters that you discussed in part A above, discuss how sensitivity analysis could help them to evaluate the usefulness of their formal model. In answering this question, make sure that you clearly explain what sensitivity analysis is in formal models and clearly describe how you would do sensitivity analysis in this example.