Rockefeller College of Public Affairs and Policy
PUB/PAD 504 Final Exam
Spring, 2006
(Andersen)

_____

(your name)

Instructions: Show all you work on the pages provided. I will give partial credit and need to know you thought process. Leave calculations to last, grading stresses problem set up skills. Good Luck!

1. **Take Home Question: A Normalized Database for the Clarksville School Nurse (25 points).** You received this question on May 10 and you have already done it ☺.

2. Emergency Flood Evacuation in the Boxwood School District (25 points). The Boxwood School District is a small rural district located on a flood plain in the Contucket River Valley. A recent study released by the State has revealed that a major upstream dam on the Contucket River may have a construction flaw. If the dam were to burst, three schools in the Boxwood School district would be under water in less than one hour and experts estimate that a flood rush could hit the schools within 40 minutes. The three schools at risk are the Clarksville and Hayland elementary schools plus the Boxwood Middle School.

You are engaged in a project to plan for emergency evacuation from the three schools at risk to two safe schools—the Glenfield elementary school and the Boxwood High School.—both of which are on safe and high ground. The estimated time to bus students from each of the schools at risk to the safe schools is given in the table below:

Clarksville School needs to evacuate 225 students; Hayland 150 students, and the Middle School 300 students. The High School is set to receive 750 students and Glenfield elementary school can receive 225 students in case of an emergency.

Safe Schools	Clarksville Elementary.	Hayland Elementary	Middle School
Glenfield Elementary	7	11	17
Boxwood High School	30	9	45

Table 1: Time (in minutes) to bus children between schools at risk and safe schools

A. You have been asked to set up an emergency busing schedule that creates the optimal evacuation plan. What would be an appropriate set of activity variables to use to set this problem up as a linear program?

B. Discuss what should be the best objective of the optimization model that you plan to formulate. If you have competing objectives, explain what are the advantages and disadvantages of each. Write out the formal objective function for the general objective that you choose to model.

C. In the space below, set up the Boxwood evacuation model as a formal linear program. Describe and include all appropriate constraints as well as the objective function that you have selected in part B above.

3. A Database to Support Emergency Evacuation (20 points). As part of the emergency flood evacuation plan to bus children from schools at risk to safe schools in case of a break in the upstream dam on the Contucket River, managers at the Boxwood School District have created a database to support the evacuation. This database provides teachers, administrators, and school bus drivers with critical information needed to evacuate all students. Being good information managers, the Boxwood emergency evacuation database is fully normalized (and has been implemented in Access). A query from the database merging information from several separate data tables is given below:

Last Name	First Name	Home Phone Number	Home Room Class Teacher	Assigned Bus	Evacuation Site
Andersen	William	475-8892	Wang	12	Glenfield
Andersen	Elizabeth	475-8892	Gonzales	14	High School
Bartholmew	Jennifer	438-1194	Wang	12	Glenfield
Carley	Edna	445-6794	Wang	12	Glenfield
Corinth	David	789-2245	Gonzales	14	High School
Corinth	Susan	789-2245	Jones	11	Glenfield
Danning	Karl	475-5927	Jones	11	Glenfield
Ewing	Melissa	438-2267	Smith	15	High School
ETC	ETC	ETC	ETC	ETC	ETC

A. Using the presumption that "Students" and "Homerooms" are two of the entities in the Boxwood database, describe in details below how you would go about creating a relationship in Access between these two entities.

B. In the space below, list other entities that in your opinion would probably appear in the Boxwood emergency evacuation database. Remember that this database is fully normalized. . Note what additional information, if any, you would like to know in order to answer this question.

C. In the space below, use the entity-attribute-relationship mapping tools discussed in class to sketch the key entities (refer to your answer in part B above) and relationships that in your opinion probably appear in the Boxwood emergency evacuation database. For each entity note on your diagram what might be the primary key as well as several attributes. Note what additional information, if any, you would like to know in order to answer this question.

4. Selecting a Third "Safe Site" for Boxwood School Evacuation Plan (25 points). The Boxwood School District is interested in creating a third "safe site" for evacuating school children in case of a dam burst on the Contucket River. The selected site is being chosen to be closer to both the Clarksville Elementary and the Middle School in order to minimize possible evacuation delays. The school board is considering several sites, each of which can be evaluated using multiple criteria as shown in Table 2 below:

	A	B	C	D	E	F	G	H
1	Site	Bus Time to Clarksville (minutes)	Bus Time to Middle School (minutes)	Cost (dollars)	Normalized Time to Clarksville	Normalized Time to Middle School	Normalized Cost	Summary Rank
2	Town Hall	11	8	$120,000				
3	Library	4	35	$12,000				
4	Police Station	33	15	$35,000				
5	Fire Station	28	7	$9,000				
6	Rank	2	1	3				
7	Raw Weight							
8	Normalized Weight							

Table 2: Data being used to evaluate four "safe sites" by Boxwood School District

A. Assume for the moment that Boxwood wants to set up this selection as a standard MAU model. What would be the following cell formulas for an Excel-based MAU model? The best answer would have fully general cell formulas.

E2=

H2=

B7=

B8=

B. Pause and Reflect. Is a standard MAU model the best tool to solve this problem? Describe the strengths and limitations of setting up this decision as a multi-criteria decision problem.