

Data, Models, and Decisions I
Department of Public Administration and Policy
University at Albany
Midterm Quiz—Spring, 2001

(Your name)

Exam Instructions. Work the problems below in the spaces provided. Continue your work on the back of the exam sheet, if necessary. Show all of your work and reasoning—partial credit will be awarded on all questions. Save arithmetic computations, if necessary, for last. I am interested more in your ability to set up problems than in arithmetic. Work quickly and try not to leave any questions unanswered. Good Luck

1. (30 points) **Keeping Track of State Aid to Libraries.** The Division of Library Development for the State Education Department is managing a new program of state aid to municipal libraries. The aid formula is simple, but designed to be equalizing. Libraries that spend less than \$10 per capita on library services will be reimbursed 15% of all authorized expenditures by the state. Libraries that spend more than \$10, but less than \$20 per capita will be reimbursed 5% of all authorized expenditures. Libraries that spend more than \$20 per capita will receive no state aid. There are 510 municipalities eligible for state aid. A spreadsheet for managing state aid is given below:

	A	B	C	D	E	F	G
1	Municipality	Authorized Expenditures	Population	Expenditures Per Capita	Computed Aid Ratio	Computed Aid	
2	Small Town	\$102,576	6411	\$16.00	5%	\$5,129	
3	Gotham City	\$98,265,600	5,459,200	\$18.00	5%	\$4,913,280	
4	Suburb Central	\$510,440	18,230	\$28.00	0%	\$0	
511	Upstate Burgh	\$536750	56,500	\$9.50	15%	\$80,512	
512	Summary Stats						
513							
514							

A. Write out the correct cell formulas for the following cells
 B512=Total Authorized Expenditures in all municipalities=

D512= Average Expenditure Per Capita across all municipalities=

D2=

E2=

F2=

2. (35 points) **Forecasting Demand for Online References Services in the Upstate Burgh**

Municipal Library. The Municipal Library in Upstate Burgh is about to implement an innovative online reference service. To use this service, users can ask reference questions either from an online computer located in the library, from an online computer located in one of the Burgh's schools, or from an online computer that a resident has at home. Past experiences with similar systems in other towns, indicates that user demand will grow substantially and the Director of Reference Services wants to forecast how great demand might be in the first several years of implementation. Although Upstate Burgh has a population of 56,000 the current base of library users is estimated to be on 20,000 citizens. Experience shows that after one month, 60% of the persons who use the system as first time users become repeat users. The other 40% of the first time users revert to "traditional" (that is non-online services). Experience at other sites also indicates that each month, approximately 8% of the repeat user population seem to "drop out" and revert back to being traditional users. However, repeat users also act to "recruit" first time users from a word of mouth effect. In fact, a recent survey in an online libraries journal asserted that a stock of 10 repeat users would recruit a flow of one additional first time users per month (a stock of 70 repeat users would recruit a flow of seven additional first time users per month, and so on).

A. Draw a stock and flow diagram that could be used to create a model to simulate the growth in demand for on-line services in Upstate Burgh. Specify what additional information, if any, you might need to answer this question.

B. Write out a set of difference equations that could be used to simulate the model that you have sketched in Part A above. Specify what additional information, if any, you might need to answer this question.

C. Madeleine Christiansen, the Director of Libraries believes that the demand for reference services could be set up as a Markov Process. Is she correct? Please show your work and justify your reasoning. Specify what additional information, if any, you might need to answer this question.

3. (35 points) **Deciding on Airline Connections to Kick-A-Boo Texas.** Madeleine Christiansen, Director of the Upstate Burgh Municipal Library, is traveling to the annual meeting of the American Library Association (ALA) being held in Kick-A-Boo Texas in mid January. She is chairing a committee that is having a critical dinner meeting at 6 PM the day before the conference's main program begins. She is considering two flight options, both of which arrive at 5 PM, in time for the critical dinner. The first flight takes 6 hours with one connection through Chicago. The alternative flight takes 9 hours with two connections in Atlanta and Dallas. The flight connecting through Chicago would be the obvious choice except winter storms and delays are quite common this time of year. In fact, the probability that the airline system will be backed up on her planned travel day is 40%. In the case that the airline system is clogged, the connection through Chicago will take 12 hours, not the planned 6 hours. The double connections through Atlanta and Dallas will take 10 hours instead of 9 hours if the air route system is clogged (southern routes are less severely impacted by weather). It is close to her departure date and Madeleine has access to a long-range forecast that claims to give good information on whether or not the air routes will be clogged on her travel day.

A. Draw a decision tree that could be used to support Madeleine's decision making process.

B. If a forecast of weather and air route system clogging was not available, which option should Madeleine choose using the EV criteria? Show your reasoning.

C. Assuming that the weather forecasting system could give Madeleine perfect information and that she valued her time at \$50 per hour, what is the most that Madeleine should be prepared to pay for the services of the forecasting service? Explain your reasoning. Specify what additional information, if any, you might need to answer this question.

D. Is Expected Travel Time a good criteria for Madeleine to use in making this Decision? If you think it is, explain why. If you think that it is not a good criterion, explain why and suggest better criteria. Specify what additional information, if any, you might need to answer this question.