Problem Set 5
Group Assignment (4 group members maximum)
Due Friday November 9, 2007 by 4pm (10% per day late penalty)

Question 1 (10 pts): Re-consider the Hurricane Katrina question from project 1 (which I will not repeat here) where there are construction costs, and benefits from avoided hurricane damages. Considering our recent lectures and discussions on simulation, utility, and extreme events, consider a model of the decision to build the levees.

A – 3 pts) If we build the levee and then treat the 1/50 possibility of a hurricane every year as a random event, what would a simulated NPV look like? Would you recommend building?

B – 3 pts) If we randomly select a year from 1 to 50 that the hurricane might hit, and simulate the NPV of the result, how would this model be different and would we recommend building?

C – 4 pts) Create a model that better represents the "extreme event" nature of the hurricane, as well as the risk tolerance of the government. Discuss the conditions under which you would build the levee (or not build).

Question 2 (25 pts): Few Americans used trains (i.e., Amtrak) until recent events made people less comfortable flying. Amtrak introduced a new high-speed train called 'Acela Express' that uses fast trains and business-class type cabins between Washington, D.C., New York, and Boston, Mass.

In this problem you will make a model to compare the improved Acela service, the regular Amtrak train service, driving by car, and also airplane trips between downtown Washington and downtown New York. The following table shows details of the three options:

	Washington to New York	
Service Option	**Time required**	**Price**
Current Amtrak	3:30	$84
Acela Express	2:40	$152
Airplane (USAirways)	1:05	$203 last-minute $64 in advance
Personal Car	3:50	$10 toll

Notes:

- Time in (hours:minutes), e.g. 2:40 is 160 minutes and is 'point to point' scheduled times
- Ticket prices for airlines are given for both 'walk-up/last minute' fares and 'advance purchase' travel. Assume all costs above are <u>one-way</u>.
- Assume that 50% of passengers are business travelers earning $60,000 per year and 50% are leisure travelers earning $30,000 per year. Also assume that all business passengers buy last-minute tickets and all leisure travelers buy tickets in advance.
- Assume the Amtrak and Acela stations are downtown, while the USAirways shuttle flights are at airports, <u>which are 30 minute cab rides from downtown</u>.

- Assume driving speed averages 60 miles per hour for your own car or taxis.
- Assume that a cab ride would be needed between the airport and downtown, and that the fare is 50 cents per minute to travel between airport and downtown.
- Driving your own car costs $10 in tolls along the way. Also don't forget the per-mile cost for driving (a total of 40.5 cents a mile – which includes gas, depreciation, insurance, etc.). If you are unfamiliar with this, see http://www.irs.gov/newsroom/article/0,,id=131232,00.html).

A – 5 pts) Consider two classes of passengers: (1) only business travelers, (2) only leisure travelers. Find the total cost (using only the information above) for each class of passengers using the transit options for passengers looking to travel from downtown Washington to downtown New York. Rank the alternatives in order of cheapest to highest cost for each passenger type. Which option is recommended for each passenger class?

[Hint: You should compare 'equivalent' trips where passengers go from downtown Washington to downtown New York City. Cab rides might be necessary. Assume that the downtown train stations are your final destinations. Drawing a picture may help (but you do not need to submit it).]

B – 5 pts.) Perform sensitivity analysis on all parameters (including those for which I have assumed values for you) and determine the assumptions required for more business passengers to choose Acela. Given your overall findings, what would you tell the head of Amtrak are the primary reasons that more people are not choosing Acela? What kind of marketing might change this? Do not forget that marketing is about identifying and convincing certain groups of people to buy your product.

C – 5 pts) An item ignored above is that the travel times assumed scheduled times. But in reality the times vary a lot and induce delays. I posted "actual flight time" data for USAirways flights Washington - NYC (http://www.ce.cmu.edu/~hsm/bca2007/hw/USAirways_May_05.xls.zip). Using this data, find a distribution function that fits the data well. Once you make this distribution for flights, use the same "distribution family", e.g. Exponential, as a basis for time distributions for 2 types of trains and cars (state your assumptions and note different parameters).

D- 5 pts) Above we also ignored "time waiting", for example being at the airport or train station ahead of schedule. Use the range of waiting times given below with triangular distributions.

	Waiting Time (mins)		
Mode	Min	Mean	Max
Train (business)	15	30	45
Train (leisure)	15	45	90
Airplane (business)	30	45	60
Airplane (leisure)	60	90	120
Car	0	0	0

Now, using all of the new functions from parts C and D, find the distribution of Acela's cost compared to the cheapest option over at least 1000 trials. **NOTE YOU ONLY NEED TO**

SUBMIT YOUR @RISK RESULTS (mean, stdev, histogram, cdf), NOT the results of your trials.

E – 5 pts) Given your analysis, discuss your results and what the optimal decisions might be for each type of passenger. Don't just discuss which is best, describe what @RISK tells you – for example how often you expect one to be cheaper than another, what is the range of costs for each option that you expect to be relevant 90% of the time? Can you see stochastic dominance?

Question 3 (10 pts)

Following is data on 6 different ways of planting soybeans in Argentina using tilling and no-tilling methods, such as data on triangular distributions of yields (tons/hectare) from each farming method, and costs ($/hectare). The estimated distribution of soybean price is triangular with a minimum value of $120, modal value of $160, and maximum value of $220 (all prices are per ton). Gross revenues ($/hectare) can be found by multiplying yield (tons/hectare) and price ($/ton). Gross margins are gross revenues minus costs.

Alternative	Min Yield	Mode Yield	Max Yield	Costs
1	2	3.5	5.5	230.43
2	2	3.5	5	241.11
3	1.7	3.5	5.5	260.12
4	1.7	3.5	5	256.22
5	1.5	2	2.7	165.12
6	1.2	2	2.7	157.21

Which method(s) would you recommend and why?