

12-706 / 19-702 / 73-359 Problem Set 5
Due November 7, 2005 at start of class (10% per day late penalty)

You may work in groups of 3 on this problem set (and turn in one joint answer).

Question 1 (8 pts, from last year's final exam):

On the next page are sample outputs from a Monte Carlo simulation done using the Excel treeplan add-in RiskSim with 100 samples (trials). The model was set up to find the Net Present Value (NPV) of a highway expansion project with parameters for construction costs and travel time savings (and of course a discount rate).

Please answer the following questions using the sample outputs provided, and explain your answers. **Be specific** (including quantitative answers, avoiding yes/no answers). This is not a hard question, so I expect answers to be perfect.

- [3 pts] How likely is it that the project will be worthwhile? Give a quantitative estimate.
- [3 pts] What is your estimate of the NPV? Would you recommend the project?
- [2 pts] Will additional trials give you the correct NPV?

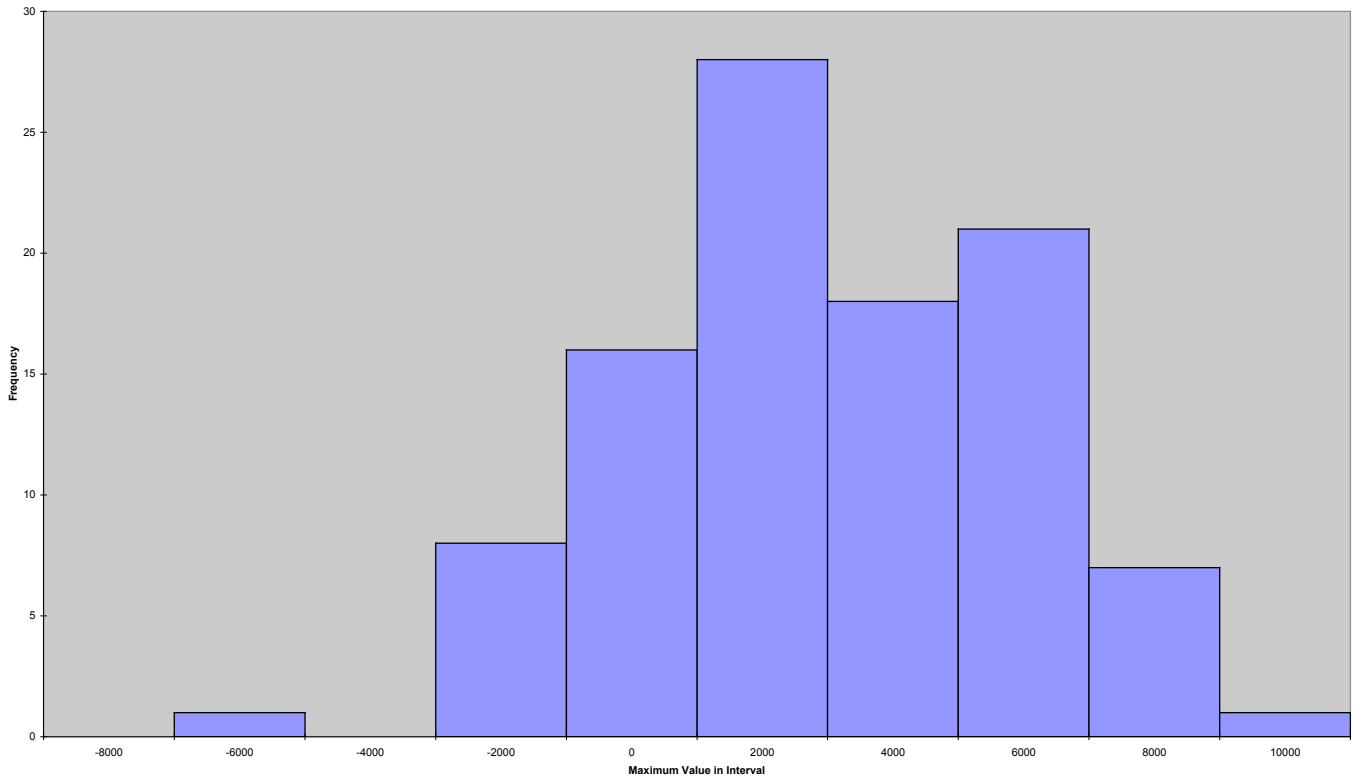
Question 2 (12 pts)

Scott and Deanna are preparing to take a vacation over winter break. They only care about 3 things: getting as far away from campus as possible, cost, and finding somewhere warmer than Pittsburgh. They have narrowed down their options as follows:

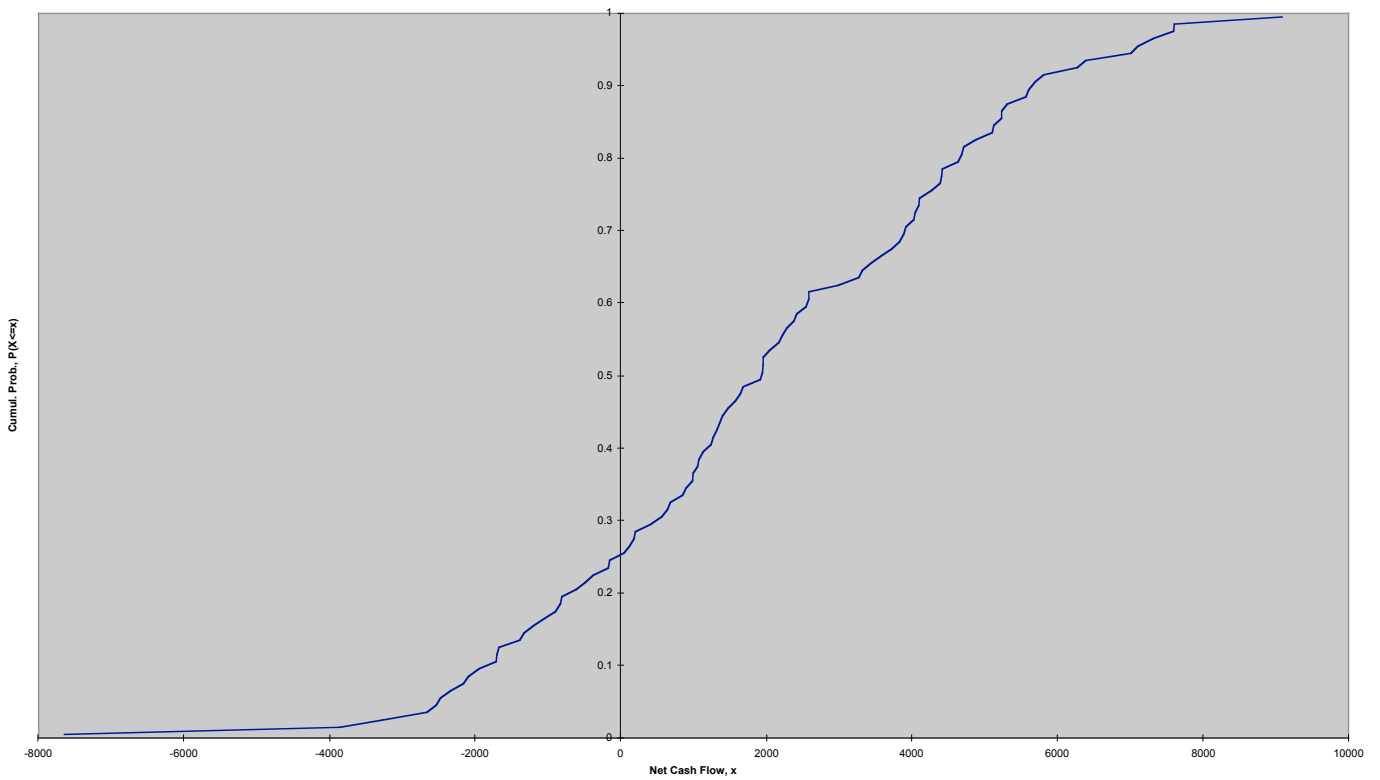
Travel Option	Distance	Cost	Δ Pittsburgh Temperature
Los Angeles, CA	2,300	\$203	25
Orlando, FL	750	\$153	30
Baltimore, MD	250	\$358	5
New Orleans, LA	1,000	\$227	15

- [3 pts] Which of the options are non-dominated or dominated? What does this tell us about their optimal decision?
- [3 pts] For all pairs of non-dominated options, find the tradeoffs for selecting between them. Does this tradeoff analysis tell you the final selection?
- [4 pts] What if we tell you that we think temperature and distance are both equally important to us, and both are twice as important as cost? What should our decision be using additive utility?
- [2 pts] Does our answer change if we value all 3 criteria equally?

Risk Simulation Histogram
Number of Iterations = 100 Random Number Seed = 0.5



Risk Simulation Cumulative Distribution
Number of Iterations = 100 Random Number Seed = 0.5



Question 3 (20 pts):

[Feel free to use any of the decision add-ins on this problem.]

According to the National Highway Safety Administration, the probability that a teen-aged driver in the U.S. will have an accident in any six-month period is 30%. Assume a US teenager is considering purchasing collision insurance for his 1998 Chevrolet Cavalier, which has a value of \$6,600. He has learned that the six-month premium amount for collision insurance with a \$500 deductible is \$1,250. He is not sure that he can afford that much, so he decides to investigate the cost of collision insurance with a \$1000 deductible. The six-month premium for collision insurance with a \$1000 deductible is \$1050. He is also considering the possibility of not carrying any collision insurance.

Further assume that if he does have an accident, the table below shows the probabilities of 4 damage categories. Also, assume midpoint damage ranges for each category (as shown in the “Assumed damage” column) except the worst-case damage category, which is “total” damage, equal to the full value of the car.

Probability	Damage Range	Assumed Damage
0.45	Less than or equal to \$500	\$250
0.15	\$500 to \$1000	\$750
0.25	\$1000 to Half Value	\$2150
0.15	Half Value to Total Value	\$6600

- [6 pts] What are the expected costs of each insurance option (including no insurance)? Which option should he choose?
- [6 pts] How does the decision of which option to choose change as the probability of having an accident vary (from 0 to 100%)? Find a clear and useful way of displaying this result.
- [5 pts] What is the expected value of perfect information (EVPI)?
- [3 pts] Reconsider part (a) but with new values of cars and insurance costs as shown in the table below. Now what are the expected costs of each of the options and which one should be chosen? **Hint:** Don’t forget to adjust the assumed damage midpoints above!

Car Value	Premiums	
	\$500 Deductible	\$1000 Deductible
\$3,000	\$660	\$543
\$15,000	\$2,627	\$2,301
\$30,000	\$5,086	\$4,499