Final Exam, JDEP 384H, Spring 2007

Due Date for Exam: Thursday, May 3, 1:00 p.m.

Instructions: For full credit, show your work and give reasons for your answers. Write out your solutions neatly and completely. There is to be absolutely no consultation of any kind with anyone else other than me about the exam. If you have questions, email me. Do not post any questions or discussion on Blackboard. If there are points of clarification or corrections, I will post them on our discussion section in Blackboard. ALL materials used in your work that have not been provided by me for this course must be explicitly credited in your write-up. Point values are indicated. You may send an email document (only one file: preferably a pdf file, but Word documents will be accepted) or hand in hardcopy at my office. Be sure identify yourself as the owner of any document you turn in to me, electronic or hard copy. Point values of problems are indicated for a total of 140 points.

(27 pts) **1.** Consider the system of equations

$$\begin{aligned} 2x_1 + 11x_2 + 110x_3 &= 10 \\ 11x_1 + 101x_2 + 1010x_3 &= 110 \\ 11x_1 + 1010x_2 + 10101x_3 &= 1100. \end{aligned}$$

(a) Solve this system with Matlab

(b) How many digits of accuracy do you think could be lost in this answer. Explain.

(c) Describe an iterative method for solving this system that converges. Don't actually apply it, but explain why you know that it converges.

(27 pts) **2.** Consider a European put with strike price 55, 7 months to expiry, and risk-free interest rate 0.06. The present price of the stock is 44.

(a) Find the implied volatility of the stock when the price of the option is 10, 11, 13, 14, and 15.

(b) Use the volatility at these points to make a plot of implied volatility as a function of option price on the interval $[10, 15]$ by running a spline through these values and plotting the spline.

(c) Find the error of the spline value at price 12 as an approximation to the implied volatility at that point.

(25 pts) **3.** Consider a truncated European call option with 5 months to expiry, current stock price 50, strike price 52, barrier 75, volatility 0.4, drift $\mu = 0.1$, and risk-free interest rate 0.08. This option works the same way as vanilla European call, *except* that the payoff is zero if the price of the stock exceeds a barrier value $S_b$at expiry. Use Monte Carlo methods with the random number generator reset as in class notes and 1000 samples to approximate the current price of this option. Compare this value to the corresponding vanilla European call. Do they differ significantly, and if so, why should they?

(25 pts) **4.** Consider the following payoff table for a zero-sum two-person game:

Strategy		Player 2		
		1	2	3
Player 1	1	4	2	1
	2	0	1	3

(a) Are there any dominated strategies to be eliminated?

(b) What moves and payoffs would minimax/maximin dictate for each player?

(c) Find the solution to this game and explain what your answer means.

(36 pts) **5.** The NG energy company owns a tract of land that may contain oil. Their geologists estimate that the probability of this happening is about 28%. NG could sell the land to another energy firm for $110,000 or drill themselves at a cost of $150,000. If they strike oil, they will realize a net profit of $650,000. They could also experiment by paying $50,000 for a seismic survey, which is known to give a favorable reading in 45%of the cases in which there is actually oil on the land and an unfavorable reading in 80% of the cases in which there is no oil on the land.

(a) Write a decision analysis form for this problem by identifying the states of nature, alternatives, prior probabilities, payoff table and conditional probability table of the seismic survey.

(b) Find the EVPI for this problem.

(c) Use Matlab to calculate the unconditional and posterior probabilities.

(d) Find the decisions for NG that yield the optimal return.