Stat/Econ 473 Game Theory
Problem Set 1

Due: Tuesday January 22

1) A city has an annual budget of \$20,000,000. City code restricts spending on parks to no more that 5% of the budget. The mayor wants to choose the parks budget to maximize the benefit to the community. If the park spending is \$$c$ then the benefit is
$$v(c) = \sqrt{400c} - \frac{c}{80}.$$
  a) What is the optimal choice of spending?
  b) Suppose public opinion shifts and the new benefit function is
$$v(c) = \sqrt{1600c} - \frac{c}{80}.$$
What is the new optimal spending choice?

2) At the dog races you have to decide whether or not to bet. If you decide to bet you must decide whether to bet \$1 on Snoopy or Lassie. A winning bet on Snoopy pays \$2 (for a net winnings of \$1)and a winning bet on Lassie pays \$11 (for a net winnings of \$10). You believe the probability of Snoopy winning is 0.7 and the probability of Lassie winning is 0.1–there is a probability of 0.2 that some other dog wins.
  a) Draw the decision tree for this problem.
  b) What is your optimal strategy?

3) Alice is training for a race and falls injuring her leg. There is a 0.2 probability that the leg is broken. Alice does not know if her leg is broken but has to decide now whether to enter an upcoming race. If she enters the race there is a 0.1 probability that she will win (this does not depend on whether the leg is broken). But if the leg is broken she runs the risk of serious injury. Her payoffs are as follows:
  +100 if she wins and the leg is not broken
  +50 if she wins and the leg is broken
  0 if she loses and the leg is not broken
  -50 if she loses and the leg is broken
  -10 if she doesn't run and the leg is broken
  0 if she doesn't run and the leg is not broken

  Draw the decision tree for this problem and determine what Alice should do.

4) The manager of a pizza parlor needs to decide how many pizzas to prepare for lunch on Saturday. Each pizza sells for \$10 and costs \$4.25 to prepare. Any unsold pizza can be sold to a a youth group of \$1.25. Every disappointed customer cost \$0.25 in good will. There is a probability of .2 that you will sell 20 pizzas, a .3 probability you will sell 40 pizzas and a .5 probability of selling 50 pizzas. How many pizzas should be prepared?