Name ___________________________

Phil 321
Final Examination

December 13, 1999

(10) **1.** Jack Spratt likes to eat fatty foods, but the following (fictitious) statistics give him pause for thought (since Jack Spratt is a fictional character, he is worried by fictitious statistics):

H ≡ develop heart disease before age 65
F ≡ high-fat diet
L ≡ low-fat diet

P(H / F) = 40%
P(H / L) = 30%

a) Suppose that Jack's utilities for the different possible outcomes have the following form:

	H	~H
High-fat diet (F)	20+k	50+k
Low-fat diet (L)	20	50

What is the minimum value of k such that Jack can justify continuing to follow a high-fat diet?

b) Jack Spratt's wife points out that the statistical data are correct, but that the correlation between high-fat diets and heart disease arises only because diet and heart disease are independent results of a common cause: a bad genetic makeup. If you have the bad gene, you are more likely to eat lots of fat and to get early heart disease; if you don't, you are more likely neither to eat lots of fat nor to get early heart disease; but diet does not itself have any causal influence on whether you get early heart disease. If Jack agrees, then what should he do?

(10) **2.** Consider a simplified version of the St. Petersburg game: a fair coin is to be tossed up to N times, with the bettor (you) receiving \$2 if heads first appears on toss 1 (H_1), \$4 if heads first appears on toss 2 (H_2), and in general $\$2^k$ if heads first appears on toss k (H_k). If no heads appears in any of the N tosses, you must give up $\$2^N$ dollars. Assuming you make your decisions based on EMV, what constitutes a fair price to play this game (i.e., what is the EMV of the game)?

(10) **3.** Suppose Fred is waiting at the bus stop with exactly \$1.50, and needs (or strongly desires) to ride the next bus. We saw that it can sometimes be rational for him to refuse to purchase bets whose EMV exceeds \$1.50. Suppose that Fred's preferences satisfy all of the assumptions of utility theory and that $u(\$0) < u(\$1.50) < u(\$3)$, where u is Fred's utility function. Can Fred consistently refuse every bet that costs \$1.50, and pays \$3.00 with probability p and \$0 with probability 1-p, where $p < 1$?

(10) **4.** Find all equilibrium strategies for the following games, using pure or mixed strategies.

(5) **a)**

5	-1
3	2

(5) **b)**

(10, 20)	(8, 15)
(12, 6)	(7, 7)

(10) **5.** Consider the following game. Col chooses one of two coins: B, biased to come up heads 75% of the time, and F, a fair coin. Row chooses R_H (bet heads) or R_T (bet tails). These choices are independent: neither player knows the other's choice. The coin is tossed, and depending on the result (H ≡ heads, T ≡ tails), the payoffs (in dollars) are as follows, where the first number is the payoff to Row and the second is the payoff to Col:

Row's bet		H	T
	R_H	(32, 0)	(0, 32)
	R_T	(0, 20)	(40, 4)

a) Construct the game table.

b) Find an equilibrium pair of strategies (pure or mixed).

6. Consider the following version of the Prisoner's Dilemma (PD):

		Col	
		Cooperate	Cheat
Row	Cooperate	(3, 3)	(1, 4)
	Cheat	(4, 1)	(2, 2)

(5) **a)** Suppose the above PD is to be played by Row and Col for **three rounds**, and each player may choose exactly one of the following three strategies: CO (always co-operate), CH (always cheat), TT (tit-for-tat). Draw up the game table (showing payoffs for **both** Row and Col).

(5) **b)** Indicate all equilibria for this game.

(10) **c)** Suppose now that the above three-round PD is played by many people at the same time, pairing off at random. You are given the opportunity to play, adopting any strategy you please. You are told two things: (1) all the other players use only CO, CH or TT, and (2) the group using TT outnumbers the group using CO. Find a strategy with which your expected payoff exceeds that for anybody using CO, TT or CH (use back of page or facing page, if needed).

(30) **7.** Do **one** of the following three questions:

(a) The paradoxes of utility theory (St. Petersburg, Allais and Ellsberg) purport to show that subjective probability and utility theory recommend decisions that many people would reject, and rule out decisions that many people would make. Choose one of these paradoxes, and explain how the problem arises. How can a decision theorist respond to the criticism? Is the response successful, in your opinion?

(b) Briefly explain Newcomb's problem. What are the main reasons for thinking that the rational decision in Newcomb's problem is to take both boxes? Explain why you do or do not find these reasons compelling.

(c) Suppose A issues a threat of retaliation to deter B from some action that would harm A (e.g., the USA threatens to retaliate with nuclear weapons if the USSR invades Western Europe). Is it ever rational for A to carry out that threat if (i) A would prefer not to retaliate once B has performed the harmful action, and (ii) the situation will never be repeated (so that there is no possibility of deterring future aggression)? If so, why is it rational? If not, how can threats in this type of situation ever be effective?