MIDTERM, PUBLIC ECONOMICS (4044) NAME: _____

Fill in the blanks. Use the space provided to show your work, and to give mini-essay responses.

1. Public good – non-rival and non-excludable. Suppose that, in a certain town with only three people, fireworks are a non-rival and non-excludable good. The utility functions for the three citizens are

$$U_1 = x_1 + 3\ln y \qquad U_2 = x_2 + 5\ln y \qquad U_3 = x_3 + 12\ln y$$

where y is the quantity of fireworks purchased by the town, and x_i is the amount of money that person i has left over for private consumption. Assume that one unit of fireworks costs \$1.

1-1. What is the Pareto efficient quantity of fireworks, y^o? _____ Explain briefly how, if $y < y^o$, a Pareto improvement must be possible.

1-2. If the citizens of this town are absolutely incapable of coordination and bargaining, what is the Nash equilibrium quantity of fireworks? _____

1-3. If the citizens of the town agree to divide the cost of the fireworks evenly among them, and then decide how many fireworks to purchase using a process of iterative majority rule voting, what value of y will be an equilibrium in this voting process? _____

1-4. An amazing psychic visits the town, and makes the citizens' utility functions known to each other. Armed with this knowledge, they decide to implement a Lindahl tax scheme. Thus, they decide that the fractional fireworks cost shares for persons 1, 2, and 3 will be _____, _____, and _____, respectively.

2. Common resource – rival but not excludable. Suppose that there is a pasture somewhere that can be used for goat grazing. In the nearby village, any amount of goats can be purchased, for \$10 each. If the number of goats that people buy and keep in the pasture is x, the revenue that can be derived from the goats living in the pasture (e.g. from their milk, or whatever) is $R(x) = 90x - x^2$. (This function is concave and eventually decreasing in x due to the fact that the goats will be less healthy if they have less grass to eat.)

2-1. If a profit-maximizing monopolist controls the pasture, they will choose to keep _____ goats there. In this case, the monopolist's goat-related profit is _____.

2-2. If the pasture is a non-excludable common resource, and the world is teeming with entrepreneurs seeking to profit from goat husbandry, then the equilibrium number of goats on the pasture is _____. (Assume that each goat on the pasture yields the same revenue.) In this case, the total profit gained from the pasture is _____.

2-3. Suppose that the pasture is still a non-excludable common resource, but that the government wishes to introduce a per-goat tax on the use of the pasture, in order to cause the field to be used efficiently (in the sense of maximizing revenue net of costs). To do this, they should levy a tax of _____ per goat. If they do so, the goat entrepreneurs' profit will be _____, and the government's revenue will be _____.

3. Excludable public good / natural monopoly – non-rival but excludable. Suppose that some non-rival but excludable good can be produced for a fixed cost of 32. For example, the good may be a song that can be downloaded without cost, but not without permission, due to cutting-edge anti-piracy software. The fixed cost is all-inclusive, that is, it includes the opportunity cost of the musicians' time, etc. When n people download the song, the marginal benefit of an additional person downloading the song is given by $MB(n) = 10 - \frac{1}{2}n$.

3-1. If the band acts as a profit-maximizing monopolist, what price will they charge for the song? _____ At this price, _____ people will download the song, the band's economic profit will be _____, and their profit plus the consumer surplus will be _____.

3-2. If the government forces the band to distribute the song for free, but gives them a compensation of 32, then consumer surplus will be _____, and consumer surplus net of government expenditure will be _____.

3-3. If the government forces the band to charge a price equal to average cost ($32/n$), so that it makes zero economic profit, the (Pareto-superior) equilibrium quantity will be _____, the corresponding price will be _____, and consumer surplus will be _____.

3-4. Using your calculations above, rank the three pricing schemes in order of efficiency (i.e. total economic surplus).

4. Clarke tax. There are five individuals who wish to use a Clarke voting mechanism to chose among three options: A, B, and C. Sincere utilities (in dollar amounts) for the different options are given in the first table below. Assuming that everyone votes these sincere utilities, which option will be chosen? _____ Use the table in the middle as an intermediate step toward filling in the tax table on the right.

	A	B	C
1	5	2	0
2	3	1	0
3	0	4	3
4	0	3	2
5	3	0	4

A	B	C

	tax
1	
2	
3	
4	
5	

Explain how voters 3 and 4 can game the system, if the remaining voters express their sincere preferences.

5. Positive externality. Suppose that there is some good that creates a positive externality valued at \$2 per unit; thus, $MEB(q) = 2$. Demand for the good is given by the private marginal benefit function $MB(q) = 10 - q$ and supply of the good is given by the private marginal cost function $MC(q) = 2 + q$. If nothing is done to internalize the externality to buyers' and sellers' decisions, then the equilibrium quantity of the good is _____, and the total economic surplus is _____. If the government offers a \$2 per unit subsidy to buyers of the public good, then the equilibrium quantity is _____, and the total economic surplus is _____. Keep in mind that total economic surplus includes consumer surplus, producers surplus, and external benefit, net of government expenditures.

6. Game Theory. Let the 'rock-paper-scissors' game be defined by this payoff matrix:

	rock		paper		scissors	
rock	0	0	−1	+1	+1	−1
paper	+1	−1	0	0	−1	+1
scissors	−1	+1	+1	−1	0	0

Is there a (mixed strategy or pure strategy) Nash equilibrium in this game? If so, describe it. If not, explain why not.

7. Game Theory and Anarchy. The tables below represent interactions between people who are deciding whether or not to spend some of their time stealing each other's stuff. 'S' stands for 'steal', and 'D' stands for 'don't steal'. Each person starts off with 10 units of stuff, and they have the option of stealing 5 units of the other guy's stuff, at the expense of forgoing 3 units worth of stuff-producing. 'Good' people get a bonus of 4 utils whenever they don't steal; 'evil' people do not. Underline best responses, and circle all of the pure strategy Nash equilibria.

		evil			
		D		S	
evil	D	10	10	5	13
	S	13	5	8	8

		good			
		D		S	
good	D	14	14	9	13
	S	13	9	8	8

		evil			
		D		S	
good	D	14	10	9	13
	S	13	5	8	8

8. Define rent-seeking as used in the context of public economics. Why might we want to minimize people's incentives to engage in rent-seeking behavior?

9. Tiebout sorting. What are the main assumptions of the Tiebout model, and what are the main results?

Keeping in mind the results and limitations of the Tiebout model, name two goods, argue the advantages of handling one at a local / small-scale level, and argue the disadvantages of handling the other at a local / small-scale level.

10. Principal-agent problem. Explain how the relationship between voters and representatives can be viewed as a principle-agent problem. Give a specific example in which this problem might come into play. Name one possible method of ameliorating this problem, and make an argument for why your method would help.