FINAL EXAM, PUBLIC ECONOMICS (4044) NAME: _____

Fill in the blanks, and/or answer in the space provided. You must show correct work for credit. Put boxes around your answers for algebraic and numerical problems.

1. Public good – non-rival and non-excludable. Suppose that, in a certain town with only five people, the park is a non-rival and non-excludable good. The utility functions for each citizen i can be represented as $U_i = x_i + \alpha_i \ln y$, where y is the amount of money that the town spends to build its park, and x_i is the amount of money that person i has left over for private consumption. The α_i values are as follows: $\alpha_1 = 1$, $\alpha_2 = 3$, $\alpha_3 = 7$, $\alpha_4 = 13$, and $\alpha_5 = 21$.

1-1. What is the Pareto efficient expenditure on the park, y^o? _____

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

1-3. If the citizens of the town agree to divide the cost of the park evenly among them, and then decide how much to spend on the park 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 park cost shares will be $s_1 =$_____, $s_2 =$_____, $s_3 =$_____, $s_4 =$_____, and $s_5 =$_____. Given these tax shares, the majority voting equilibrium will be $y =$ _____.

2. Election algorithms. Suppose that there are three candidates in an election, named A, B, and C. There are 100 voters in total, who have sincere preferences as follows:

$40: A \succ B \succ C$ $\quad$ $7: B \succ A \succ C$ $\quad$ $15: B \succ C \succ A$ $\quad$ $38: C \succ B \succ A$

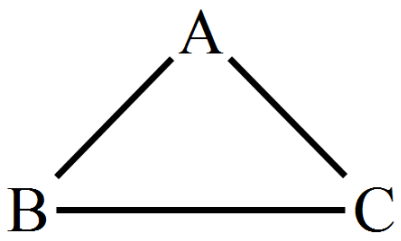
2-1. Plurality. If votes are cast sincerely, the plurality winner is _____? Show your work, including scores for each candidate.

2-2. Instant runoff voting (IRV). If votes are cast sincerely, the IRV winner is _____. Use the table below to show the vote tallies in each round.

	A	B	C
round 1			
round 2			

2-3. Minimax. If votes are cast sincerely, the minimax winner is _____. Construct the pairwise matrix below-left to find the candidates' scores, and construct a tournament diagram below-right, by drawing arrows from winning candidates to defeated candidates.

	A	B	C
A			
B			
C			



2-4. Borda count. If votes are cast sincerely, the Borda winner is _____. Show your work, including scores for each candidate.

2-5. Single transferable vote. If votes are cast sincerely, and the single transferable vote method (with a Droop quota) is used to elect two of the three candidates, then candidates _____ and _____ will be elected. Show your work.

2-6. Condorcet winner, majority rule cycle. What is the definition of a Condorcet winner? Is there a Condorcet winner in this election? If so, who is it? What is the definition of a majority rule cycle? Is there a majority rule cycle in this election?

2-7. Strategy in plurality? Given a plurality election with these preferences (as in 2-1), is there a group of voters who could have achieved a result that they all preferred to the sincere winner, by voting differently? If so, describe what they could have done.

2-8. Strategy in IRV or minimax? Is IRV vulnerable to strategy in the same way, in this example? How about minimax? If you find an opportunity for manipulation in either system, describe it.

3. Game theory. Let the 'chicken' game be defined by this payoff matrix:

		Biff			
		swerve		straight	
Alex	swerve	6	6	5	8
	straight	8	5	0	0

Are there any pure strategy Nash equilibrium? Be as specific as possible. Underline best responses in the matrix above.

4. Natural monopoly – decreasing average cost. Suppose that there is a pharmaceutical company that has produced invented a new drug as a result of $\$2{,}000$ in research and development costs (fixed costs). Now that the formula has been found, however, producing one pill costs only \$1; thus, the marginal cost of production is $MC(q) = 1$, and the total cost of producing q units is $TC(q) = 2000 + q$, where q is the number of pills. Demand for the drug can be represented by the marginal benefit function $MB(q) = 13 - \frac{1}{100}q$.

4-1. If the pharmaceutical company acts as a profit-maximizing monopolist, what price will they charge per pill? _____ At this price, _____ pills will be consumed, the company's profit will be _____, and their profit plus the consumer surplus will be _____.

4-2. If the government forces the company to sell their pills for \$1 each, but gives them a lump sum transfer of $\$2{,}000$ to compensate them for their research and development costs, consumer surplus will be _____, and consumer surplus net of government expenditure will be _____.

4-3. If the government forces the company to charge a price equal to average cost ($TC \div q$), so that it makes zero economic profit, the (Pareto-superior) equilibrium quantity will be _____, the corresponding price will be _____, and consumer surplus will be _____.

4-4. Using your calculations above, rank the three pricing schemes in order of efficiency (i.e. total economic surplus). How does your ranking change if every dollar of government revenue used to finance the lump sum transfer in 3-2 causes fifty cents of deadweight loss when it's raised? Show your work.

5. Rawlsian insurance. In the future, Ariel will either be 'poor' or 'rich', depending entirely on luck (as opposed to effort). She will be poor, and thus receive an income of w_p, with probability π_p; likewise, she will be rich, and thus receive an income of w_r, with probability $\pi_r = 1 - \pi_p$. Ariel can buy shares of insurance that cost $\beta \in (0, 1)$ and pay \$1 if she turns out to be poor. Thus, her consumption if poor is given by $c_p = w_p + (1 - \beta)x$, and her consumption if rich is given by $c_r = w_r - \beta x$, where x is the number of insurance shares she buys. Ariel's goal is to maximize her expected utility, which – given her Von Neumann-Morgenstern utility function $U(c)$ – can be represented as $E[U] = \pi_p U(c_p) + (1 - \pi_p)U(c_r)$.

5-1. General budget constraint and first order condition. Find Ariel's budget constraint: a single equation in terms of β, c_p, c_r, w_p, and w_r. Use this to find her first order condition for expected utility maximization in terms of β, π_p, c_p, c_r, w_p, w_r, and the $U(\cdot)$ function. Box your answer.

5-2. Solution in terms of w_p and w_r. Suppose that $U(c) = \ln c$, $\pi_p = 1/4$, and $\beta = 1/2$. Find expressions for c_p^* and c_r^* (Ariel's consumption if poor and rich, given her optimal level of insurance) in terms of only w_p and w_r.

5-3. Numerical solution. Suppose that $w_p = 1{,}000$ and $w_r = 11{,}000$. Find the numerical values of c_p^*, c_r^*, and x^*.

6. Leaky bucket redistribution. Suppose that there is a society with an equal number of poor people and rich people. At present, each poor person has an income of $w_p = 15{,}000$, and each rich person has an income of $w_r = 140{,}000$. For every dollar that the government takes from each rich person, each poor person only receives $\delta \in (0, 1)$ dollars. Thus, poor and rich consumption can be represented respectively as $c_p = w_p + \delta\tau$ and $c_r = w_r - \tau$, where τ is the number of dollars that the government chooses to take from each rich person. Suppose that $\delta = 3/4$, and the government wants to maximize its perceived social welfare function of $W = \ln c_p + \ln c_r$. Find the values τ^*, c_p^*, and c_r^* that solve this maximization problem.

7. Limits to redistribution. Explain four reasons why redistribution of wealth or income from the rich isn't more extensive than it is currently in the US. Try to use points that were covered in the class discussion.

8. Proportional representation.

8-1. What is the difference between a single-winner voting system and a proportional representation voting system?

8-2. Explain two advantages and/or disadvantages of proportional representation relative to single-winner systems.

8-3. Name two distinct types of proportional representation systems (more distinct than the same basic system with two different quotas), and explain clearly how each of them works.