ECON 107
Final Exam

Be sure to show your work for all answers, even if the work is simple.
This exam will last 100 minutes.

1. *(18 points)* **Honor Statement:** Please read and sign the following statement:

   I promise that my answers to this test are based on my own work without reference to any notes, books, or the assistance of any other person. I will also neither help others nor use a calculator or other electronic aid for calculation.

   Name and Surname: _
   Student ID: _
   Signature:

   _

2. *(10 points)* Compare and contrast a long run perfectly competitive equilibrium and a long run monopolistic competitive equilibrium. What do the two models have in common? What is the critical difference? In reality, how do the welfare properties of the two equilibria compare?

   Remark 1 *It may assist you to remember that in monopolistic competition firm i's marginal revenue can be written as* $MR_i = P_i\left(1 - \frac{1}{\varepsilon_i}\right)$*, where* ε_i *is the absolute value of the firm's elasticity of demand.*

   Solution 2 *In both we have free entry and exit, so this will result in zero economic profit or:*

   $$0 = \Pi = Pq - c(q) = q * (P - AC)$$

   thus price will equal average cost.

   The key difference is that in perfect competition $MR = P$ *thus we have:*

   $$MR = P = MC$$

   while in monopolistic competition $MR_i = P_i\left(1 - \frac{1}{\varepsilon_i}\right)$

   $$MR_i = P_i\left(1 - \frac{1}{\varepsilon_i}\right) = MC$$

   this means that a perfect competitor will be at the minimum of LRAC, while the monopolistic competition model will be only near *that point. To be precise we will have:*

   $$MC = \left(1 - \frac{1}{\varepsilon_i}\right) AC$$

However the difference between the two depends on ε_i, which will probably be extremely large. The reason for this is that firms will be seeking out markets with low ε_i because this will mean high profits, and the existence of close substitutes will increase ε_i—thus the equilibrium of the entry and exit game will result in ε_i being very large and probably fairly homogeneous across all industries.

In the end they are just different ways of describing the same market. Monopolistic competition probably wins in terms of realism, but perfect competition is a simpler and elegant model. I can easily give you a simple model of perfect competition, but one that handles a long run equilibrium in monopolistic competition is very hard. Thus one should expect that the welfare properties of the two are essentially equal.

3. *(12 points)* Your mom is kind of a hard nose about money. You told her you need a new pair of pants, so she went to the Decathlon website, found out how much a new pair of pants would cost, and gave you 2500TL in cash. You know how she is, so you know if you buy anything else she just won't give you any money for several months—and most certainly won't buy you those pants. However now you are out shopping with your friends, and several other options have come up. Your friends want to go to a fancy restaurant for lunch, you found a shirt that is absolutely to die for, and an earring that would be sure to attract the attention of that special someone. Being a good economics student, you have constructed the following table:

Good	Marginal Utility	Cost
Pants	W	2400TL
Restaurant	X	1500TL
Shirt	Y	2100TL
Earring	Z	1800TL

Good	Marginal Utility	Cost	BfB	Choice
Pants	4800	2400TL	$\frac{4800}{2400} = 2.0$	Pants
Restaurant	2000	1500TL	$\frac{2000}{1500} = 1.333\,3$	
Shirt	3000	2100TL	$\frac{3000}{2100} = 1.428\,6$	
Earring	3500	1800TL	$\frac{3500}{1800} = 1.944\,4$	

Good	Marginal Utility	Cost	BfB	Choice
Pants	4800	2400TL	$\frac{4800}{2400} = 2.0$	
Restaurant	4500	1500TL	$\frac{4500}{1500} = 3$	Restaurant
Shirt	3000	2100TL	$\frac{3000}{2100} = 1.428\,6$	
Earring	4000	1800TL	$\frac{4000}{1800} = \frac{20}{9} = 2.222\,2$	

Good	Marginal Utility	Cost	BfB	Choice
Pants	4800	2400TL	$\frac{4800}{2400} = 2.0$	
Restaurant	2000	1500TL	$\frac{2000}{1500} = 1.333\,3$	
Shirt	4400	2100TL	$\frac{4400}{2100} = 2.095\,2$	Shirt
Earring	3600	1800TL	$\frac{3600}{1800} = 2.0$	

Good	Marginal Utility	Cost	BfB	Choice
Pants	4800	2400TL	$\frac{4800}{2400} = 2.0$	
Restaurant	2000	1500TL	$\frac{2000}{1500} = 1.333\,3$	
Shirt	4500	2100TL	$\frac{4500}{2100} = \frac{15}{7} = 2.142\,9$	
Earring	4500	1800TL	$\frac{4500}{1800} = \frac{5}{2} = 2.5$	Earring

which should you buy and why? As always most of the points will be for the explanation.

Solution 3 *What matters is the "bang for the buck" or*

$$\frac{MU_x}{p_x}$$

thus one should choose the maximum of:

$$\max\left(\frac{W}{2400}, \frac{X}{1500}, \frac{Y}{2100}, \frac{Z}{1800}\right)$$

and for each variation of the midterm the answer was different.

4. *(15 points total)* Consider the abstract game below. Player 1 chooses between (U, M, D) and player 2 chooses between (L, C, R) and in each box the first payoff is the one player 1 receives and the second is the one player two receives. **NOTE:** *Write all answers in terms of strategies, i.e. either (U, M, D) or (L, C, R) or one of both.*

	L	C	R
U	$-6; 9$	$3; 13^2$	$11; 11$
M	$6; 2^{12}$	$0; 0$	$15; -3^1$
D	$0; 4$	$9; 6^{12}$	$2; 2$

	L	C	R
U	$0; 0$	$20; -6^1$	$7; 5^{12}$
M	$13; 7^{12}$	$5; 5$	$0; 2$
D	$6; 23^2$	$18; 18$	$-7; 13$

	L	C	R
U	$15; -5^1$	$1; 6^{12}$	$0; 0$
M	$12; 12$	$-1; 6$	$5; 18^2$
D	$6; 6$	$0; 3$	$6; 9^{12}$

	L	C	R
U	$1;1$	$7;8^{12}$	$0;7$
M	$8;8$	$2;9^{1}$	$-5;7$
D	$15;-2^{2}$	$0;0$	$5;1^{12}$

(a) *(8 points)* Write the best responses below, for the best response of player 2 to M explain your reasoning in detail.

Solution 4 *For simplicity I have marked them in the tables above. I wrote a 1 in the upper right hand corner if it was a best response for 1, and a 2 for 2. However I asked you to write them down, and as clearly indicated in the quiz answers for that I wanted something written, not just the table above re-copied with some marks on it. The one student who explained what they were doing got partial credit, otherwise you got none. So let me give the correct answers for the game:*

	L	C	R
U	$15;-5^{1}$	$1;6^{12}$	$0;0$
M	$12;12$	$-1;6$	$5;18^{2}$
D	$6;6$	$0;3$	$6;9^{12}$

$BR_1(L) = U$, $BR_1(C) = U$, $BR_1(R) = D$. $BR_2(U) = C$, $BR_2(M) = R$, $BR_2(D) = R$.

For the best response to M, $U_2(L, M) = 12$, $U_2(C, M) = 6$, and $U_2(R, M) = 18$. Of these three possibilities, R gives the highest payoff thus $BR_2(M) = R$.

(b) *(7 points)* Find the Nash equilibria, and for each one explain why it is an equilibrium.

Solution 5 *For all of them there are two pure strategy Nash Equilibria, the reason they are Nash equilibria is always the same—they are the two pairs of strategies where each is a best response to the other. Equivalently, for only these two pairs of strategies* knowing *what the other is going to do will not change your plans. For example in the game:*

	L	C	R
U	$0;0$	$20;-6^{1}$	$7;5^{12}$
M	$13;7^{12}$	$5;5$	$0;2$
D	$6;23^{2}$	$18;18$	$-7;13$

these are (M, L) and (U, R). Notice that both these payoffs are Pareto dominated by (D, C), as I said during the exam I included a common trap. With you guys I noticed another trap, if $U_1 = U_2$ it must be a Nash equilibrium. So for example (U, L) and (M, C) must be equilibria. This is particularly amusing because the numbers I wrote down are arbitrary. I could have changed all of a player's payoffs by

any finite number and the game would be the same. For example the game:

	L	C	R
U	$-20;0$	$0;-6$	$-13;5$
M	$-7;7$	$-15;5$	$-20;2$
D	$-14;23$	$-2;18$	$-27;13$

has the same best responses and Nash equilibria as the original. I did an example in class where the equilibrium was not symmetric.

5. *(25 points total)* About *Pareto Efficiency.*

   (a) *(5 points)* Define Pareto Efficiency.

   Solution 6 *A* Pareto efficient *outcome is one where there is no way to make anyone better off without hurting others.*

   Equivalently, it is an outcome that is not Pareto dominated. Where an allocation Pareto dominates another if everyone likes it better and some like it strictly better.

   (b) *(6 points)* Consider the classic problem of *dividing a cookie*. Two people have one cookie, they both want to eat as much of it as they can. In this environment what are the Pareto Efficient allocations? Explain.

   If useful, a precise mathematical model is: An allocation is an (s_1, s_2) where $s_1 \geq 0$ and $s_2 \geq 0$ (you can't get a negative share of the cookie) and the allocation is feasible if $s_1 + s_2 \leq 1$ (you can't eat more than one cookie).

   Solution 7 *Any way of dividing the cookie is Pareto efficient as long as all of the cookie is consumed. If some of the cookie is not consumed we can obviously split it between both parties and make both strictly happier, the only way we can't do this is if all of the cookie is consumed.*

   Mathematically, this means any (s_1, s_2) *where* $s_1 \geq 0$ *and* $s_2 \geq 0$ *and* $s_1 + s_2 = 1$. *If* $s_1 + s_2 = 1 - \rho$ *for* $\rho > 0$ *we can give* $\alpha\rho$ *to person 1 and* $(1-\alpha)\rho$ *to person 2 for any* $\alpha \in [0,1]$ *(*$0 \leq \alpha \leq 1$*) and at least one person will be strictly happier without the other being worse off.*

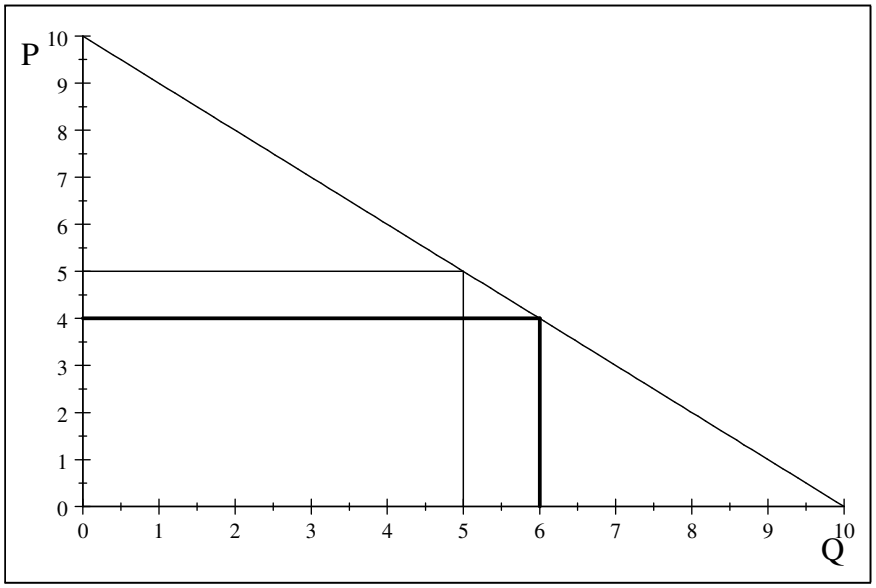
   (c) *(2 points)* Let us assume person 2 bought the cookie in the previous analysis, does it change the set of Pareto efficient allocations? Explain

   Solution 8 *No, ownership or work for a good does not impact the set of Pareto efficient outcomes. One can think of either of these things as "sunk costs," i.e. money was expended but that is something that happened in the past.*

(d) *(6 points)* Is an allocation Pareto efficient if it is *fair*? Do you "get what you deserve" in a Pareto efficient allocation? Explain

Solution 9 *In the original problem $s_1 = 1$, $s_2 = 0$ is Pareto efficient, but clearly not fair. In the variation where player 2 bought the cookie (and thus indirectly worked for the cookie) this has no impact on the set of Pareto efficient allocations at all.*

6. *(8 points)* In the graph below illustrate the benefit and cost of increasing your output for a monopolist. Quantify each area, though you can ignore the small triangle.



Solution 10 *In this graph the downward sloping curve is the demand curve $(10 - P)$, and the light vertical and horizontal line indicate the revenue when $Q_o = 5$, the dark when $Q_n = 6$.*

If I could I would add the following areas to the graph:

$$\begin{aligned} Gain &= P_n (Q_n - Q_o) = 4 (6 - 5) = 4 \\ Loss &= (P_n - P_o) Q_o = (4 - 5) 5 = -5 \end{aligned}$$

*The **gain** is the lower right hand rectangle, the **loss** is the upper left hand rectangle. These are the cost and benefit of increasing output for the monopolist.*

7. *(12 points)* Explain the *water/diamond paradox*, in particular what it tells us about prices.

Solution 11 *Adam Smith noticed that water was infinitely valuable, but had a price that was essentially zero, while diamonds (with all due respect) are basically valueless but have a very high price.*

The resolution to this paradox is realizing that the marginal cost of an additional glass of water was basically zero (especially back then when they didn't realize germs existed) but the marginal cost of a unit of diamonds was very high. Thus price is set by the margin, it does not reflect the value of a good but rather how much the marginal unit either benefits the consumer or costs to the supplier.

It is not, as many of you put forth, due to scarcity. Platinum is very rare and valuable in the modern world, and indeed back when Europeans invaded the Americas it was essentially non-existent in Europe. It was extremely scarce but the Spanish government dumped a fortune's worth of it into the Atlantic. (It was being used as a substitute for silver in coins, thus debasing the currency.) Scarcity does not determine price in the long run, it is the marginal cost of production.

Most goods you think of as having a price determined by scarcity are essentially forms of money. Gold is not valuable because it is scarce, it is only valuable because people think it is valuable–like any currency. Again some original Americans thought it was only good as decoration during religious ceremonies. This resulted in one lake in Central America having a fortune's worth of gold sitting at its bottom and many Europeans making a mockery of themselves trying to recover it. (You ***do*** *remember that the Spanish were obsessed with finding gold in the Americas, don't you? El Dorado? The local's favorite way of getting the Europeans to leave town?)*