Last Name (Please PRINT): .....

First Name (PRINT): .....

Your I.D. Number: .....

INSTRUCTIONS (please read!)

1. Please make sure that you have 9 pages, including this page. Complaints about missing pages will not be accepted.
2. Please answer all the questions. You are not allowed to use any course material. Calculators are permitted.
3. Time Allowed: 09:00–12:00
4. Your grade depends on the arguments you develop for supporting your answers. Each answer must be justified by using a logical argument consisting of a model/graph. An answer with no justification will not be given any credit.
5. You must provide all the derivations leading you to a numerical solution. Please do *not* use any "formulas" developed in class. You need to drive them by yourself.
6. When you draw a graph, make sure that you label the axes with the appropriate notation.
7. Maximum Score: 100 Points
8. Budget your time. If you cannot answer a certain question, skip it and go to the next one.
9. Please always bear in mind that "somebody" has to read and understand your handwriting. Please make sure that your ink is 'visible' and that your sentences are properly organized and fit into the designated blank space. If you think that your handwriting is poor, please print each word!
10. Good Luck !

(1) Consider the duopoly computer industry with consumer preferences exhibiting network externalities. Suppose that the computer brands are initially *incompatible* and that there are 100 A-oriented consumers and 200 B-oriented consumers, with utility functions (of each consumer type) given by

$$U_A \stackrel{\text{def}}{=} \begin{cases} q_A - p_A & \text{buy } A \\ q_B - p_B - \delta & \text{buy } B, \end{cases} \quad U_B \stackrel{\text{def}}{=} \begin{cases} q_A - p_A - \delta & \text{buy } A \\ q_B - p_B & \text{buy } B, \end{cases}$$

where δ is the differentiation (switching cost) parameter.

(1a) [10 pts.] Assume that $\delta > 300$. Calculate the UPE prices and profit levels assuming that in equilibrium both brands are sold in the market and the that brands are *incompatible*.

(1b) [5 pts.] Conclude which firm charges a higher price under incompatibility and which firm earns a higher profit. Explain in words the intuition behind your result!

(1c) [10 pts.] Calculate the UPE prices and profit levels assuming that in equilibrium both brands are sold in the market and the that brands are *compatible*.

(1d) [5 pts.] Conclude whether firms are better off when the computers are incompatible than when there are compatible.

(2) [10 pts.] You are given the following information about a market with two hardware brands labeled A and B: (a) There are 100 A-oriented consumers, and 100 B-oriented consumers. (b) Each consumer type has a utility function given in question (1). (c) In an undercut-proof equilibrium, brands' prices are $p_A = p_B = 50$. (d) The computer systems are incompatible.

Calculate the differentiation (switching-cost) parameter δ.

(3) Consider a technology-adoption game played by two users (or firms) displayed in following table.

		User *B*	
		New Technology	Old Technology
User *A*	New	3 3	1 0
	Old	0 1	2 2

(3a) [5 pts.] Which technology will be adopted by each user in Nash equilibrium. That is, find the Nash equilibrium(ia) for this game (if they exist). Prove your answer!

(3b) [5 pts.] Which outcome(s) in the above game constitutes a case of *excess momentum*? Explain!

(4) Consider a market for a popular software DOORS™. There are 100 support-oriented (type-O) consumers, and 200 support-independent (type-I) consumers, with utility functions given by

$$U^O \stackrel{\text{def}}{=} \begin{cases} 3q-p & \text{buys the software} \\ q & \text{pirates (steals) the software} \\ 0 & \text{does not use this software,} \end{cases} \quad \text{and } U^I \stackrel{\text{def}}{=} \begin{cases} q-p & \text{buys the software} \\ q & \text{pirates (steals) the software} \\ 0 & \text{does not use this software,} \end{cases}$$

where q denotes the number of users of this software (which includes the number of buyers and the number of pirates, if piracy takes place). Suppose that the software is costless to produce and costless to protect. Also, assume that DOORS™ provides support only to those consumers who buy the software.

(4a) [10 pts.] Suppose that DOORS™ is *not* protected, so piracy is an option for every consumer. Calculate the software seller's profit-maximizing price. Prove your answer.

(4b) [5 pts.] Suppose that DOORS™ is protected, so piracy is impossible. Calculate the software seller's profit-maximizing price. Prove your answer.

(4c) [5 pts.] Suppose that the producer of DOORS™ has the option to protect or not to protect the software. Which option yields a higher profit. Prove your answer!

(5) [10 pts.] Consider an economy with two types of consumers who wish to connect to a certain telecommunication service (e.g., obtaining a phone service). There are 20 type H consumers who place high value to connecting to this service, and 60 type L consumers who place a lower value for this connection.

Let p denote the connection fee to this service, and q the actual number of consumers connecting to this service. Then, the utility function of each type

$$U_H \stackrel{\text{def}}{=} \begin{cases} 2q-p & \text{connected} \\ 0 & \text{disconnected} \end{cases} \quad \text{and } U_L \stackrel{\text{def}}{=} \begin{cases} q-p & \text{connected} \\ 0 & \text{disconnected.} \end{cases}$$

In the space below, draw the demand function for connecting to this telecommunication service. Label the axes and prove and explain the graph.

(6) Consider the broadcasted news scheduling model with three broadcasting stations labeled A, B, and C, facing 600 potential viewers whose ideal watching time is 5pm; 100 viewers whose ideal time is 6pm, and 200 viewers whose ideal time is 7pm.
Assume that each station can air its news broadcast at one and only one time period. Also assume that each station earns exactly \$1 per viewers (as determined by rating surveys conducted during the broadcasting hours). Let t_i denote the broadcasting time of station i, $i = A, B, C$.

(6a) [10 pts.] Find one Nash equilibrium in broadcasting time. Prove your answer!

(6b) [10 pts.] We now define the utility of a viewer whose ideal time is $\hat{t}$ and watches the program at time t by $U_{\hat{t}}(t) \stackrel{\text{def}}{=} \beta - \delta|t - \hat{t}|$. Define the social welfare function and determine whether the Nash equilibrium in scheduling time you found in (7a) is socially optimal. Prove your answer!

Scratch Paper

This page will NOT be read by the instructor !

THE END