Wilfrid W. Csaplar Jr., Ph.D. Business 205 Exam #3 2012/11/9

Write your name on the cover of the test booklet and nowhere else. Enclose this sheet with the booklet. Failure to follow these directions will cost you 1 point. The test has 2400 points (to be scaled down to 20 points) and is scheduled to take 120 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 12-point question should take 6 minutes. I cannot give much extra time.

Show all work for all questions.

1) (6 points) For EITHER total costs OR marginal revenue, state the dimension (units) of the variable and give one sentence of explanation.

2) (8 points) Find the limit of the sequence to the right showing all work. $\lim_{n\to\infty}\left(\dfrac{6+\frac{5}{n^3}}{3+\frac{2}{n^2}}\right)$

3) (12 points) The government spending multiplier process from *Principles of Macroeconomics* can be written as $\Delta Y = \sum_{i=0}^{\infty}\Delta G * MPC^i$ where ΔY is the change in real GDP, ΔG is the initial change in government spending, and MPC is the marginal propensity to consume and is usually assumed to be around 0.9. Is this series convergent? Explain your logic showing all work. I will give you 1 extra point if you tell me what ΔY converges to. (I realize I told you the answer, but not how to prove it.)

4) (12 points) Suppose the population vector [Bethany, Washington]^T fits the relationship $\mathbf{x_i}=P^i\mathbf{x_0}$ where the P matrix is $\begin{bmatrix}.7 & .1\\ .3 & .9\end{bmatrix}$. If $\begin{bmatrix}200\\ 1000\end{bmatrix}=$, then what will their populations be in two years?

5) (14 points) Plot the points (2, 4) and (-10, -1). Find the distance between them.

6) (16 points) Π= P(Q)*Q – C(Q) where P(Q) = $3000*Q^{-2/3}$ and C(Q) = 3 + 27Q. Find the first two derivatives of the profit function. Where are the local maxima or minima? Show all work. Given your second derivative, tell me if the point(s) is(are) maxima or minima

7) (16 points) Use Cramer's Rule to solve $\begin{bmatrix}2 & 3\\ 1 & -1\end{bmatrix}\begin{bmatrix}X\\ Y\end{bmatrix}=\begin{bmatrix}19\\ 2\end{bmatrix}$. Find A^{-1} and use the meth multiplying by the inverse to get the same result.

8) (18 points) Suppose you run a perfectly competitive firm so the price is fixed at 100. The total cost function is given by TC = Q + ½Q^2, then what is the profit function? Find the profit maximizing output assuming your company can only produce in the interval [0, 80] due to capacity constraints. Is the constraint binding? If yes, what is the shadow price of the constraint? If no, then find the profits at the profit maximizing point.

9) (18 points) Find all solutions to the following set of equations. w – 2x + 2y = 0, 2w + x + 4y = 0, w +3x + 2y = 0.

10) (20 points) Answer EITHER Part A OR Part B.
Suppose a regulated monopoly has a demand function of $Q_D = 80 - 2P$, what is their revenue function as a function of P? Their total cost function is $TC = 20Q + 10$. Write the total cost function as a function of P. Find the profit function as a function of P. Find the profit maximizing price subject to the constraint that $P \leq 20$. What is the shadow price of the price ceiling?
B) Suppose the demand function is given by $Q_D = 135 - 5P_D$ and the supply function is given by $Q_S = -15 + 25P_S$. The tax rate is represented by t. What is the equation relating the two prices? What is the equation which says we are in equilibrium? Find the equation which determines the quantity produced at equilibrium as a function of t. What is the function for total tax revenue? Find the tax rate which maximizes tax revenue. Prove it is a maximum not a minimum. For each step, show all work and briefly explain what you did. Do not worry about finding the Q and prices for the optimum tax.

11) (20 points) Suppose $U(B, M) = 6B^{1/2}M^{1/3}$. Find the slope of the indifference curve at the point (25, 64). Note that B is on the x-axis. Given your answer, how many books would this person be willing to trade for one unit of music? Briefly state how you reached that conclusion. What is the returns to scale? Explain your logic.

12) (22 points) Draw a Venn diagram Bethany College students as the universal set. Have a subsets the following: students majoring in Accounting (A), students involved in sports (S), and students involved in a fraternity or sorority (F). Given your diagram, what percentage of Bethany students are in each of the following sets: $A \cup F$, $S \cap F$, and $\bar{S}$? Briefly explain your logic.

13) (24 points) Find the boarded Hessian for the production function $Q(L, K) = 5LK$. Determine if the function is quasi-concave, quasi-convex, or neither.

14) (30 points) Suppose that \$1 worth of farm products (f) uses \$.25 worth of farm products. \$1 of machinery (m) uses \$.3 units of farm products and \$.4 of energy (e). \$1 of energy uses \$.2 of farm products and \$.5 units of machines. Set up the open Leontief Input-Output Matrix. If there is demand for \$600 of farm products, \$1200 of machinery, \$120 worth of energy, then how much of each must be made? Use any method you like assuming it uses matrices. However, it should work nicely if you use the minor/cofactor/adjoint method of finding the inverse and wait until after you multiplied the inverse by the appropriate vector to divide by the determinant.
B) (4 points) If \$1 of farm products uses 5 units of labor, \$1 of machines uses 3 units of labor, and \$1 of energy uses 1 unit of labor, then how much labor is needed? Make sure you set it up in matrix format before you give me the answer.