Midterm 2

You have until 4:50pm to complete the exam, be certain to use your time wisely. Answer all questions directly on the exam. You must show all of your work to receive full credit. Calculators may be used although you may leave answers as fractions. Unless a problem says otherwise, you can assume that individuals can consume fractions of units and firms can use fractions of units of inputs and produce fractions of units of output. Remember to put your name on the exam. Good luck!

Name:

1. (20 points) Abel's demand for bread (B) and water (W) in terms of the price of bread (p_B), the price of water (p_W) and his income (I) are given by the following demand equations:

$$B(p_B, p_W, I) = \frac{I}{3p_B} \tag{1}$$

$$W(p_B, p_W, I) = \frac{2I}{3p_W} \tag{2}$$

   (a) Find an expression for the price elasticity of demand for bread. Your answer should contain only constants, price and income.

   (b) Suppose that bread is currently being sold for $5 a loaf, water is being sold for $1 a bottle and Abel has $120 in income. Use your expression from part (a) to determine whether the bakery's revenue will increase, decrease or stay the same if it decides to increase the price of a loaf of bread by a small amount.

   (c) The price of water increases to $2 while the price of bread and income stay the same as in part (b). Decompose the change in demand for bread from this price change into the component due to the substitution effect and the component due to the income effect.

2. (30 points) The demand for corn is given by the following linear demand function:

$$D(p) = 100 - 20p \tag{3}$$

where $D(p)$ is the number of bushels of corn demanded at a price of p per bushel. The supply of corn is given by:

$$S(p) = 5p \tag{4}$$

where $D(p)$ is the number of bushels of corn supplied by farmers at a price of p per bushel.

(a) What is the equilibrium price of a bushel of corn? What is the equilibrium quantity of bushels sold?

(b) Suppose that the government decides to subsidize corn growers by giving them a subsidy of \$5 per bushel of corn. So if consumers pay a price of p per bushel, the corn growers recieve a price of $p+5$ per bushel. What will the new equilibrium price paid by consumers be and what will the new equilibrium quantity of corn be once the subsidy is in place?

(c) How much will the government have to spend in total on subsidies?

(d) On a graph, show the deadweight loss generated by the subsidy program. Label all relevant points with their numerical values. Also calculate the numerical value of this deadweight loss.

3. (25 points) For each technology described below, draw a set of four isoquants corresponding to 10, 20, 30 and 40 units of output. Where possible, give exact numerical values for slopes, kinks and intercepts.

   (a) A firm uses programmers (P) and computers (C) to produce video games. A programmer with one computer can produce one video game. Extra computers do not increase the productivity of a programmer who already has a computer. No more than one programmer can use each computer.

   (b) A restaurant uses ingredients (I) and cooks (C) to produce entrees. Each additional pound of ingredients increases the number of entrees produced by exactly as much as the previous pound of ingredients, regardless of the current combination of ingredients and cooks. Each additional cook increases the number of entrees produced but by a smaller amount than the previous cook.

   (c) A firm uses machines (M) and workers (W). With the latest machine technology, it turns out that workers are now obsolete. Changing the number of workers has no impact on total output as the machines can now handle every aspect of production. Increasing the number of machines always increases the amount of total output.

   (d) A firm uses gears (G) and pulleys (P) to move cargo (you can think of output as the total tons of cargo moved). The technical rate of substitution is constant and the firm's technology exhibits increasing returns to scale.

4. (25 points) There are two types of consumers of hamburgers in Williamsburg, college students (C) and retirees (R). There are 50 students and 100 retirees. The demand for a single college student is given by:

$$H_C(p) = 100 - 2p \tag{5}$$

where $H_C(p)$ is the number of hamburgers a college student demands at a price of p. The demand for a single retiree is given by:

$$H_R(p) = 200 - 2p \tag{6}$$

(a) Is demand for hamburgers more elastic for a college student or a retiree? You only need to consider prices at which both types of consumers have positive demand. Be certain to fully justify your answer.

(b) Would you expect a college student's demand for fast food in general (which includes hamburgers) to be more or less elastic than a college student's demand for hamburgers? Be certain to explain your answer.

(c) Suppose that Williamsburg needs to raise $1000 in tax revenue and is planning to do so with a value tax placed on all fast food. Would this tax generate more or less deadweight loss than a value tax placed on just hamburgers (assuming that this tax on hamburgers would also generate $1000 in tax revenues)? Be certain to justify your answer.

(d) Derive an expression for the market demand curve for hamburgers in Williamsburg. On a graph with hamburgers on the horizontal axis and price on the vertical axis, graph this market demand curve labelling all intercepts, slopes and kinks with their numerical values.

(e) Assuming the supply curve for hamburgers is linear and upward sloping, show the effects of a value tax of 20% placed on hamburgers on the price paid by consumers and the price received by producers on your graph from part (c). The tax is levied on consumers, meaning they are the ones who must pay the tax to the government. Note that you will not be able to give exact numbers for the prices but you should give exact numerical values for the slopes and intercepts related to the demand curve.