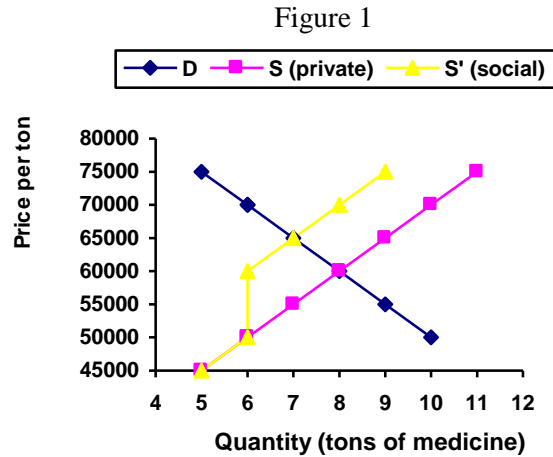1. Suppose that the production of pharmaceuticals generates pollution of the Columbia River, which is gradually killing a valuable fish population. Among other problems, fishermen in the area are experiencing a decline in their incomes. Suppose that the demand and supply of pharmaceuticals is shown in the graph below, where S represents the private market supply curve and S' represents the social supply curve and reflects the full social costs of production.

Figure 1

a. What costs might be reflected in the Social Supply Curve (S')?

The curve reflects the full costs of the production to society. These include the loss of income for the fishers, increased costs related to negative health effects of the pollution, lower property values along the river, etc.

b. What is represented by the vertical distance between the two supply curves?

The vertical distance represents the difference between the private costs of production and the social costs of production.

c. Why might the social supply curve S' be the same as the private supply curve at Q < 6?

It could be the case that at Q<6, the environment is able to absorb the pollution with no adverse effects on health of the fish or humans.

d. What is the equilibrium quantity and price of pharmaceuticals produced in the private market?
8 tons of pharmaceuticals at a price of $60,000 per ton.

e. What is the socially optimal quantity and price of pharmaceuticals?

7 tons at $65,000 per ton.

2. Garbage collection in Bozeman is currently done based on a flat monthly fee.

a. Discuss the incentives for households to reduce garbage generation under this framework.

Once a household chooses a particular size of garbage can, the flat fee doesn't provide a strong incentive to reduce garbage production. The household will have to pay the fee regardless of whether its garbage can is half-full because it recycles some of its waste or full because it does not recycle.

b. Now suppose that there were a $5.00 charge per bag for the collection of garbage rather than the flat fee setup used currently. Discuss the incentives for households to reduce garbage production under this framework.

The by the bag fee provides an incentive to reduce garbage production because households have to pay based on the quantity of garbage they produce – they have to pay $5.00 for each garbage bag they use.

3. Is a college education worth it? List three or four factors one should consider when deciding whether to attend college.

- *Cost, including opportunity cost of attending college (tuition, fees, books, as well as the value of earnings foregone)*

- *Expected return in earnings (how much higher will your earnings be relative to the next best career alternative you'd have pursued without a degree)*

- *Length of time you have to earn the returns to your investment*

- *Utility gained and lost by attending college*

(2 points)

4. What is the present value of a lump sum payment of $1000 received one year from now if the interest rate is 5%?
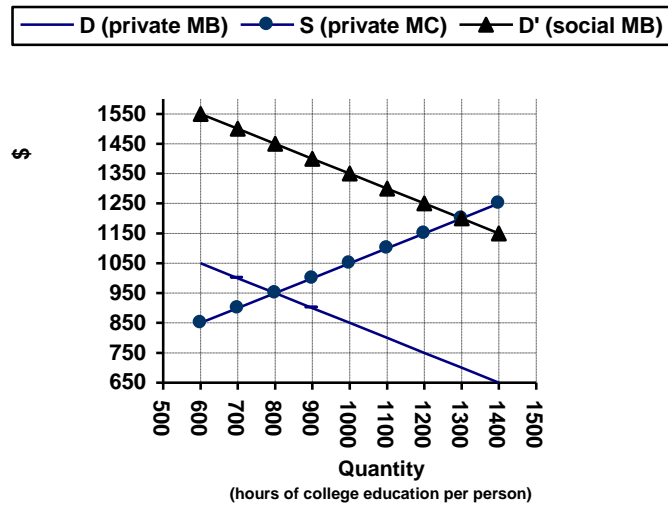
$$PV = FV/(1+r)^t$$

$$PV = 1000/(1.05) = 952.38$$

5. Research shows that the rate of return (in terms of higher starting salary) to earning a high school diploma is greater than that of earning a GED (the equivalent of a high school diploma, but earned by taking a test rather than by attending high school). Offer two explanations for why that is the case.

Here are three of the most commonly cited explanations:

*(1) **Learning Differences***: *perhaps there are things that are learned during high school that actually increase an individual's productivity and cannot be captured on the GED test. For example, those who attend high school may learn socialization or networking skills that high school dropouts do not learn.*

*(2) **Signaling***: *a high school diploma may signal to employers that you are a productive individual, whereas a GED may signal other things to employers (e.g., that you dropped out of high school and perhaps are not as productive as your peers)*

*(3) **Selection***: *those who take the GED may be those who would have had lower earnings anyway. That is, they are a selected rather than random group of the high-school population, with the selection being related with factors associated with lower earnings (low grades, poor motivation, and excessive absences, for example).*

6. Suppose that the production costs and benefits of college education are shown in the graph below, where S represents the social supply curve and reflects the full social costs of production, which are equal to the private marginal costs of production. D is the private demand curve and represents the private marginal benefits of college education, and D' is the social demand curve and represents the social marginal benefits of college education.

a. What benefits might be reflected in the Private Demand Curve for college education (D)?

D represents the marginal gains to private individuals from additional units of college education. These would include increases in earnings, increases in job opportunities, and increased utility.

b. What benefits might be reflected in the Social Demand Curve or college education (D')?

D' represents the marginal gains to society from additional units of education for one of its members. The social benefits include all the private benefits plus any positive spillovers; for example, lower crime rates, reduced welfare dependency, and a more productive citizenry.

c. What is represented by the vertical distance between the two demand curves? (1 point)

The vertical distance between the two demand curves represents the difference between the private and social marginal benefits of education. Since education is associated with positive externalities, the social marginal benefits of education are higher than the private marginal benefits, and the two demand curves reflect this difference.

d. What would be the equilibrium quantity and price of college education in a market without intervention?

In a market without intervention, people would compare the private marginal costs against the private marginal benefits of education; they would find equilibrium between D and S. This occurs at 800 hours, and a price of $950.

e. What is the socially optimal quantity and price of college education?

The socially optimal quantity occurs where the social marginal costs and benefits are equalized; at 1300 and a price of $1200.

f. Explain why your answers to parts d and e differ.

In part d, only private benefits were taken into account; in part e, the full social benefits of education are accounted for. Society is willing to pay for the extra 500 hours of education (i.e., they get benefits greater than costs for those hours), whereas left to their own devices, individuals would choose only 800 hours.

Homework 5 -- Multiple Choice

1. When production of a product causes pollution, we know that in the absence of government intervention, the producer's decision
   a. will result in economic equity
   b. will result in economic efficiency
   c. will result in economic inefficiency
   d. will result in an underproduction of the product from society's perspective

2. Pollution causes
   a. spillover costs
   b. negative externalities
   c. inefficient resource allocation
   d. inequitable burden of costs placed on society
   e. all of the above

3. When the production of a good results in negative externalities, the free market system fails by producing _____ of the good and _____ resources to its use.
   a. too little, under allocating
   b. too little, over allocating
   c. too much, under allocating
   d. too much, over allocating

4. Suppose the marginal social benefit of employing an additional police officer in Bozeman is $25,000, while the marginal social cost of employing the officer is $35,000. In this instance, Bozeman should
   a. hire the additional officer since the city gets a benefit from hiring him or her
   b. hire the additional officer since the cost is only $25,000
   c. not hire the additional officer since the marginal cost is lower than the marginal benefit
   d. hire the additional officer because we need to stop crime at all costs
   e. not hire the additional officer since the marginal cost is higher than the marginal benefit

5. Market failure occurs when Cement Company, Inc. does not take into account spillover costs. Therefore, the firm produces
   a. too little output and charges too high a price for its product
   b. too little output and charges too low a price for its product
   c. too much output and charges too high a price for its product
   d. too much output and charges too low a price for its product

6. The form of capital where education builds productivity is
   a. physical capital.
   b. human capital.
   c. human principal.
   d. brain capital.

7. In determining whether a further investment in education for a individual is worth the costs, an economist would look at whether the sum of
    a. the annual education costs is exceeded by the sum of annual income to the person.
    b. the annual education costs is exceeded by the sum of the increases in income that are attributable to the increased education.
    c. the present value of the annual education costs is exceeded by the sum of the present value of the annual income to the person.
    d. the present value of the annual education costs is exceeded by the sum of the present value of the increases in income that are attributable to the increased education.

8. In the presence of positive externalities a free market will charge _____ and produce _____ of a good from a social efficiency perspective.
    a. the correct amount, the correct amount
    b. the correct amount, too little
    c. too much, the correct amount
    d. too little, too little

9. To evaluate the cost of a college education against its monetary benefits, economists use the concept of
    a. actual costs and benefits.
    b. enumerated costs and benefits.
    c. present value.
    d. plausible ignorance.

10. Since 1980 the percentage of workers with a college degree has increased; at the same time the relative earnings of the college educated have increased. Which of the following can explain this outcome?
    a. a large increase in supply of college-educated workers and a larger decrease in demand for college-educated workers
    b. a large increase in supply of college-educated workers and a small decrease in demand for college-educated workers
    c. a large decrease in supply of college-educated workers and a small increase in demand for college-educated workers
    d. a large increase in supply of college-educated workers and a larger increase in demand for college-educated workers