Answers to Practice Exam Questions

Question 1:
(Answers based on p. 6-9 of textbook.)

Indicate for each statement below whether it is true or false.

a) "By definition, all existing firms are on the Production Possibility Frontier".
  **No, firms that are inefficient are in the interior of the PPF.

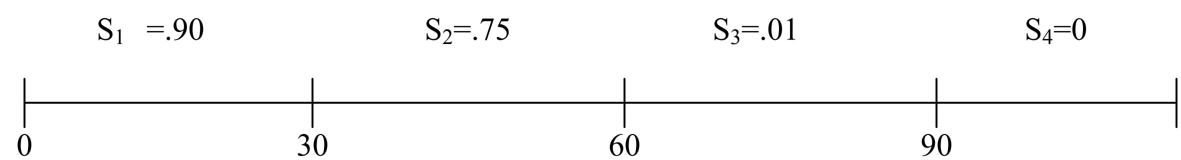
b) "A firm that is on the Production Possibility Frontier is technically efficient."
  **True.

c) "A firm that is on the Production Possibility Frontier produces at the lowest possible costs."
  **No, a firm on the PPF is technically inefficient, but may not be allocatively efficient.

d) "If a firm produces at lowest possible costs, it is on the PPF.
  **True, being on the PPF is a necessary (but not sufficient) condition for being efficient.

Question 2:

Consider the hypothetical life cycle below:



a. Explain the meaning of S_1, S_2, S_3, and S_4.
  **Conditional survival probabilities.

b. Calculate the following probabilities:

**P(0 < t < 30) = 1 - .90 = .10

**P(30 < t < 60) = .90(1 - .75) = .225

**P(60 < t < 90) = .90*.75*(1 - .01) = .66825

**P(90 < t < 120) = .90*.75*.01 = .00675

**These are Unconditional probabilities.
CHECK: Make sure they sum to 1.

c. What is the life expectancy, E[t]?

**E[t] = 15*.10 + .45*.225 + 75*.66825 + 105*.00675
= 62.45

Question 3:

In Ashenfelter and Greenstone's article "Using Mandated Speed Limits to Measure the Value of a Statistical Life"(JPE 2004)→

a) What are the benefits and the costs to increasing the speed limit from 55 mph to 65 mph?

***Benefits include time saved, while costs include more lives are lost.

To find the cost of a mile of travel time per driver, the authors calculate:

(1) c = w*(h/m), where

c = measure of the cost of a mile spent traveling
w = cost of an hour spent traveling
h = number of hours spent traveling
m = miles traveled

b) Explain equation (1).

***The equation tries to find the cost of a mile of travel time per driver by equating c (the cost of a mile spent traveling to w*(h/m). W is the wage rate, since for most workers, a natural measure of their time is their wage rate. (h/m) is just the inverse of miles per hour, so hours per mile. By multiplying the wage rate and the hours per mile, we get c, the cost of a mile spent traveling. For example, let the wage rate be $10 and speed limit be 55 mph. Then the cost of a mile is c = 10*(1/55) = $0.18. If we increase the speed limit to 65 mph, then our c = 10*(1/65) = $0.15. So, the cost of a mile is less with a higher speed limit.

c) Why do the authors choose to use a Difference in Differences (DD) estimator?

***A DD estimator is chosen since we have data that is before and after the implementation of the policy change for states that did not undergo the speed limit change and for states that did.

Question 4:

A government in a developing country mandates the use of seat belts in cars. The policy increases the costs per car by 40 kopecs, and reduces the probability of a traffic fatality from 0.0015 to 0.0012 per car.

a. Use this information to calculate an estimate of the implicit value of a life.
b. Is this an upper or a lower bound?

**A)

Cost: 40

Benefits: .0015 - .0012 = .0003

.0003 life > 40 kopecs (because the law was adopted)

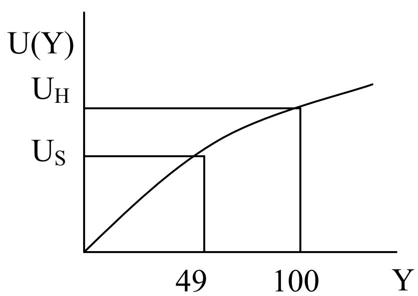
1 life > 40/.0003 = 133,333.33 kopecs

**B) Lower bound

Question 5:

Consider an individual with:
*$U(Y) = Y^{1/3}$ where Y is income
*Current Y = $100
*Y if sick = $49
*Probability of getting sick, p = .20

a) Draw the utility function and indicate the utility of being sick and the utility of being healthy.



$U_H = 100^{1/3} = 4.64$
$U_S = 49^{1/3} = 3.659$

b) Is the individual risk averse, risk neutral, or risk loving? Why?

**Risk averse since the utility function is concave.
=> $U'(Y) = (1/3)\, Y^{-2/3} > 0$
$U''(Y) = -(2/9)\, Y^{-5/3} < 0$

c) Calculate the individual's expected utility without insurance, $E[U_0]$ and his expected income without insurance, $E[Y_0]$.

** $E[Y_0] = .2*49 + .8*100 = 89.8$
** $E[U_0] = .2*(49)^{1/3} + .8*(100)^{1/3} = 4.4451$

d) What is the maximum premium (π) the individual is willing to pay to fully insure the risk of getting sick?

With Insurance: $U_1 = (100 - \pi)^{1/3} > 4.4451 = E[U_0]$

$100 - \pi > (4.4451)^3 = 87.8323$

$\pi < 100 - 87.8323 = 12.1677$

Note: Expected income loss is .2*(100 – 49) = 10.2. The individual is willing to pay more than her expected income loss because she is risk averse.
e) Determine the degrees of Absolute risk aversion and of Relative risk aversion for this individual.

Absolute risk aversion:

$$r_A = \frac{-U''(Y)}{U'(Y)} = -\frac{-(2/9)\,Y^{-5/3}}{(1/3)\,Y^{-2/3}} = \frac{2}{3Y}$$

Relative risk aversion:

$$r_r = \frac{-Y*U''(Y)}{U'(Y)} = (Y)*\frac{-(2/9)\,Y^{-5/3}}{(1/3)\,Y^{-2/3}} = 2/3$$

<u>Question 6:</u>

Let U[Y] = - exp(-Y) and

Probability of getting sick = .2
Current income = $3
Income if sick = $0

Using the above information show that E[U(Y)] ≠ U(E[Y])

**First,

E[Y] = .8*3 + .2*0 = 2.4

Plugging this into the utility function
=> U(E[Y]) = -exp(-2.4) = -.0907

**Second,

E(U[Y]) = .2(- exp(-0)) + .8(-exp(-3)) = -.24

➔ E(U[Y]) < U(E[Y]) => risk averse

<u>Question 7:</u>
(Answers from p.148 in text. Note: More can be said, sketchy solutions,)

a) What are Health Maintenance Organizations?

***"combine the financing and delivering of care into one organization by providing medical care to enrollees in exchange for a prepaid premium.", "an assigned or chosen primary care provider acts as a gatekeeper and refers the patient for specialty and inpatient care."

→Each subscriber is assigned a primary care provider who controls access to specialty care and impatient services for patients.

b) Briefly describe their role in the US health care system.

***In the US healthcare system, HMO's had 23% of market share in 2001, which is a decline from 31% in 1996.

<u>Question 8:</u>

What is Fee For Service reimbursement? What are the pros and cons in terms of incentives? (your answer should not exceed 1/2 page in length).
(Answers taken from text, p. 346. Note: More can be said.)

***Fee for service reimbursement is when physicians are reimbursed for each medical service that they provide.

***Pro's→ Physicians won't refuse to give you service because of it's cost

***Con's→Physicians might prescribe medical care that the patient may not need so they can get paid more. Since consumers are not as informed about their medical conditions, physicians might take advantage of them for their own economic self-interests.

<u>Question 9:</u>

Describe a number of stylized facts that characterize the US pharmaceutical industry (your answer should not exceed 1/2 page in length)
(Answers taken from text, Ch. 14. Note: More can be said.)

***Fairly competitive industry characterized by a few large firms that produce brand-name products and many smaller firms that produce generic drugs.

***707 firms where the 8 largest firms account for 50% of industry output(1997).

***1938 Federal Food, Drug and Cosmetic Act gave drug manufacturer's to assign drugs to: OTC: Over the Counter or Rx: prescription.

***In 1950's, anti-substitution laws were in place that required pharmacists to give a brand-name product even if lower-priced therapeutically equivalent generics were available.

***Barriers to entry exist: (1) government patents, (2) first-mover or brand loyalty advantage, and (3) control over a key input, such as a specific chemical or active ingredient.

Question 10:

Consider a monopolistic tobacco firm with the following demand function:
$q = 18 - 6p + 2A^{1/2}$

where A is advertising expenditures, p is price, and q is quantity. Marginal costs are constant and equal to 1.

**Recall from before: $q = \alpha + \beta*p + \gamma*A^{1/2}$ and marginal costs are constant = c. We could just use the formulas that were derived in class to figure out the answers to this problem.

a) Write down the profit function.

$$\pi = (p - 1)*(18 - 6p + 2A^{1/2}) - A$$

b) Calculate the optimal price (p), optimal quantity (q), and optimal advertising expenditures (A).

(1) $\frac{\partial \pi}{\partial p} = 18-6p + 2A^{1/2} -6p + 6 = 24 - 12p + 2A^{1/2} = 0$

(2) $\frac{\partial \pi}{\partial A} = (p - 1) A^{-1/2} - 1 = 0 \Rightarrow A^{1/2} = p - 1$

**Substituting (2) into (1) gives us:

$$24 - 12p + 2*(p - 1) = 0$$
$$24 - 12p + 2p - 2 = 0$$
$$p = 2.2$$

$$\Rightarrow A = 1.44$$

$$\Rightarrow q = 18 - 6(2.2) + 2(1.2) = 7.2$$

$$\Rightarrow \pi = (2.2 - 1)*7.2 - 1.44 = 7.2$$

Assume there is a ban on tobacco advertising. (A = 0)

c) Calculate the new profit maximizing levels of p and q.

$$\pi_0 = (p - 1)*(18 - 6p)$$

$$\frac{\partial \pi_0}{\partial p} = 18 - 6p + 6p + 6 = 24 - 12p = 0$$

$$\Rightarrow p = 2$$

$\Rightarrow q = 18 - 6*2 = 6$

$\Rightarrow \pi_0 = (2 - 1)*(6) = 6$

Note: Profits are lower, price is lower with advertising ban.

Question 11:

A person weighs 205 pounds and has a BMI (Body Mass Index) of 29.

a) Determine his/her height (in meters).
b) Is this person obese?
c) Mention at least three different causes of the increased prevalence of obesity in the USA. Which one is quantitatively the most important cause?

**A) 205 lbs = 92.99 kg

$BMI = w/h^2$

$h = \sqrt{weight / BMI} = 1.79 \approx$ 5' 10"

**B) No

**C) Look at article, "Why Have Americans Become so Obese?" by Cutler, Glaeser, and Shapiro in Journal of Economic Perspectives (2003). Some possible answers include:

*Increased calorie intake (Quantitatively the most important).
*Access to new technological innovations in food processing and packaging.
*Decrease in the cost of food and income increased.

**D)

For Cindy: $24 = w/h^2$
For Daisy: $24 = (w + 5) / (h + .12)^2$

Solving two equations and two unknowns→

(1) $w = 24h^2$
(2) $24(h^2 + .24h + .0144) = w + 5$
$24h^2 + 5.76h + .3456 = w + 5$

Plugging in from (1) and solving for h→

$24h^2 + 5.76h + .3456 = 24h^2 + 5$
$h^C = .808$ meters
$w^C = 15.6687$ kilograms

Therefore, Daisy's height and weight is:

$h^D = .928$
$w^D = 20.6687$

Question 12:

In Naci Morgan and Erdal Tekin's, "The Determinants of the Willingness to Donate an Organ" (NBER working paper No. 11316) a Probit regression (output below) is reported.

a) What is the purpose of this Probit regression?

**A probit regression is used when the dependent variable takes on the values of either 0 or 1. In this case, the dependent variable is whether or not someone is an organ donor. Since the paper uses data on individuals, if someone is an organ donor then they get a 1, if not then they get a 0. In this case, the probit regression tries to determine the probability that someone is an organ donor.

b) Mention at least three variables that are statistically significant and show why.

All the variables that have stars by their coefficients (one*, two, or three***) are statistically significant. To show why, just divide the coefficient by its standard error, take the absolute value, and if it is over 2, then it is statistically significant. For example, the coefficient on male is -.099 with a standard error of .009. If we do: |-.099/.009| = 11 it is obviously greater than 2 and thus, statistically significant.

c) What do the three variables in b) that you mentioned say about organ donation?

***Males: Everything else held constant, a male is less likely to donate an organ.

***Catholics: Everything else held constant, a Catholic person is less probable to donate an organ.

***Accident: Everything else held constant, a person that was involved in an accident is most probable to donate an organ.

Question 13:

In JPAM 2004, Janet Currie and Marianne Bitler analyze whether WIC works. ("Does WIC work? The Effect of WIC on Pregnancy and Birth Outcomes").
(Answers taken directly from article and notes. Note: More can be said, sketchy solutions,)

a) Describe WIC.

***WIC is short for "Special Supplemental Nutrition Program for Woman, Infants, and Children" and began in 1972. It "provides participants with healthy foods (generally in the form of vouchers) and nutritional counseling." Individuals are eligible if income < 185% of poverty line, or if in Medicaid, Food Stamps, or AFDC. WIC went from 1 million participants in 1977 to 7.6 million participants in 2003.

b) Which self-selection effect plays a role in the analysis and how do the authors control for it?

***The self selection problem is one that says that WIC participants non-randomly select themselves into the program meaning that these participants have similar characteristics that affect both WIC participation and health outcomes. The authors control for it by using instrumental variables.

c) What are the benefits and costs of WIC?

***Benefits include:

- reduction of about 1 night hospital stay per infant
- reduction of about ¼ night hospital stay per mother
- infant is 14% less likely to be in an intensive care unit

***Costs: about $50 per month for each participant

Question 14:

For a certain cohort the following lifetime probabilities are given:

$$P(0 < t < 30) = 0.08$$
$$P(30 < t < 60) = 0.28$$
$$P(60 < t < 80) = 0.60$$
$$P(80 < t < 120) = 0.04$$

where t denotes (completed) lifetime.

**Reminder: The probabilities should all add up to 1.

$$.08 + .28 + .60 + .04 = 1$$

Hence: $P(t > 120) = 0$

a) Calculate the life expectancy, E[t].

$$E[t] = 15*.08 + 45*.28 + 70*.60 + 100*.04 = 59.8$$

b) Calculate the following (conditional) survival probabilities:

$S_1 = P(t > 30) = 1 - P(t < 30) = 1 - .08 = .92$

$$S_2 = P(t > 60 | t > 30) = \frac{P(t > 60)}{P(t > 30)} = \frac{.60 + .04}{.92} = .6957$$

$$S_3 = P(t > 80|t > 60) = \frac{P(t > 80)}{P(t > 60)} = \frac{.04}{.64} = .0625$$

$$S_4 = P(t > 120|t > 80) = \frac{P(t > 120)}{P(t > 80)} = 0$$

Question 15:

Researcher A has cross-section data with the following variables: a) height, b) weight, and c) whether the respondent participated in a Weight Watchers (WW) program at some point in time during the past twelve months. The data is based on a random sample from the US population, and was collected in the second week of February 2005. The BMI for people who did not participate in a WW program is 24.6, whereas the BMI for people who did participate in a WW program is 33.9. The difference is statistically significant. On the basis of this result, researcher A concludes that WW programs are ineffective.

a) Do you agree? Explain.

***NO. The only thing the researcher can say is that people who participate in WW programs have a higher BMI on average.

Researcher B has longitudinal data on a random sample of people who participated in a WW program at some point in time during the past twelve months. Her data set contains information on height and weight a year ago and height and weight now. She finds that the average BMI decreased from 34.3 to 34.0. The difference is statistically significant. On the basis of this result, researcher B concludes that WW programs are effective.

c) Do you agree? Explain.

***NO. Because people are not randomly selected into the WW program, the result cannot be interpreted as causal evidence on the WW program's effect. People who participate are likely to be eager to lose weight, and might have lost weight even without the WW program. Causal inference requires an appropriate control group, which is not available here.

Question 16:

A pharmaceutical firm considers the development of a new drug. The fixed costs of developing the drug are $40,000,000 while the marginal costs per capsule will be $0.03. A patent will ensure that the firm is a monopolist.

The annual demand function will be $q = 6{,}000{,}000 - 400{,}000\,p$, where q is the annual number of capsules demanded and p is price per capsule. First consider the case in which the firm is a static profit maximizer.

a) Will the firm choose to develop the drug?

***The firm will develop the drug if they will make positive profits.

Firm will maximize:

$$\max_q (15-.0000025q)*q - .03q - 40,000,000$$

$$\frac{\partial \pi}{\partial q} = 15 - .000005q - .03 = 0$$

$$14.97 = .000005q$$

$$q = 2,994,000$$

Plugging in q→

$$(7.515)*(2,994,000) – 89,820 - 40,000,000$$

$$-17,589,910 < 0$$

***Will NOT develop the drug since negative profits.

Now consider the case in which the firm behaves on the basis of maximizing profits during the first two years.

b) Determine at which annual discount rates the firm would choose to develop the drug.

***Let $\beta = 1/(1 + r)$, then try to maximize the present value profits.

$$\max_q (15-.0000025q)*q - .03q - 40,000,000 + \beta[15-.0000025q)*q – \beta*.03q$$

$$\frac{\partial \pi}{\partial q} = 15 - .000005q - .03 + \beta 15 – \beta(.000005q) - .03*\beta = 0$$

$$q = 2,994,000$$

Plugging this in and solving for β yields→

$$(7.515)*(2,994,000) – 89,820 - 40,000,000 + \beta[(7.515)*(2,994,000) – 89,820] > 0$$

$$-17589910 + \beta*22,410,090 > 0$$

$$\beta > .7849$$

***The firm would choose to develop the drug at a discount *factor* higher than .7849. This corresponds to a discount *rate* smaller than 1/.7849 –1 = 0.2740, or 27.4 percent. ($\beta = 1/(1 + r)$ implies $r=1/\beta –1$).