First Hour Exam
Public Finance - 180.365
Fall, 2007
Answers

1 Multiple Choice (4 pts each)

Correct answer indicated by $\Rightarrow$

1. In a pure market economy

    (a) there is no role for government.
    (b) $\Rightarrow$government intervention might be needed.
    (c) large markets where people meet to buy and sell are required.
    (d) all of the above

2. For the government to provide goods and services, citizens

    (a) have to come to an agreement about how much is needed.
    (b) have to agree on a method of financing.
    (c) need to be informed about the opportunity costs.
    (d) $\Rightarrow$must do all of the above.

3. Normative economics

    (a) does not depend on market interactions.
    (b) only looks at the best parts of the economy.
    (c) examines how the economy actually works (as opposed to how it should work).
    (d) $\Rightarrow$embodies value judgments.

4. When different bundles of commodities give the same level of satisfaction, you are
    (a) $\Rightarrow$said to be indifferent between the bundles.
    (b) said to be confused.
    (c) not able to make a decision.
    (d) unhappy with any combination.
    (e) none of the above

5. Theory is always necessary for empirical research

    (a) $\Rightarrow$True.
    (b) False.
    (c) Uncertain.

6. In an economy with two people, i and j, efficiency for public goods is characterized by

    (a) MSB = MSB.
    (b) MRS = MRT.
    (c) ⇒$\text{MRS}_i + \text{MRS}_j = \text{MRT}$
    (d) MC = MB.
    (e) MRS - MRT = MSB

7. Summing demand curves horizontally means individuals experience a single market _____, while summing vertically means individuals experience a single market _____

    (a) price; price.
    (b) quantity; quantity.
    (c) quantity; price.
    (d) ⇒price; quantity.

8. A _____ is a person who wants to enjoy the benefits of a public good without contributing his or her marginal benefit to the cost of financing the amount made

    (a) ⇒free rider.
    (b) politician.
    (c) price maker.
    (d) price optimizer.

9. Congestible public goods

    (a) are nonrival in consumption.
    (b) can not be priced in the market.
    (c) ⇒are rival in consumption.
    (d) are never provided by the private sector.

10. When those that do not contribute to the costs of a public good are denied use, this is a case of

    (a) ⇒exclusion.
    (b) being nonrival.
    (c) price discrimination.
    (d) infeasibility.
    (e) all of the above.

11. If private cost and social marginal damages are increasing in Q, reducing output from the privately optimal level to the socially optimal level will

    (a) cause a loss of consumption to consumers.
    (b) reduce marginal damages.
    (c) reduce the total production costs.
    (d) ⇒cause all of the above.

12. Marginal damages are hard to measure because

    (a) $\Rightarrow$they can be generated from multiple sources.
    (b) they are hard to graph.
    (c) they happen over time.
    (d) no one cares about them.

13. Which of the following is correct?

    (a) SMC = PMC − MD.
    (b) MPB = MSB + MEB.
    (c) $\Rightarrow$SMC = PMC + MD.
    (d) MSC = MPB.
    (e) MSB =MSC + MPB.

14. Suppose you hear a politician state that society is only as well off as its worst-off member. Which social welfare function could be best used to model the politician's thoughts?

    (a) $\Rightarrow$Rawlsian social welfare function
    (b) Utilitarian social welfare function
    (c) Samuelsonian social welfare function
    (d) Pareto social welfare function
    (e) None of the above

15. Social welfare is determined by

    (a) Considering equity at the most efficient outcome
    (b) Considering efficiency given the most equitable distribution
    (c) $\Rightarrow$Considering both efficiency and equity
    (d) Victories by the Orioles
    (e) Maximizing equity given efficiency

16. According to the required reading from the 2003 *Washington Post*, a recent study by the U.S. Office of Management and Budget found that

    (a) $\Rightarrow$The benefits of tough new clean-air regulations in the past decade were five to seven times greater than their costs
    (b) The most efficient way to control pollution is through Pigouvian taxes
    (c) The 1990 Clean Air Act has not affected the problem of acid rain
    (d) Environmentalists are generally supportive of cost-benefit calculations in assessing environmental policy

17. Which of the following statements about tradable pollution permits is *not* true?

    (a) Tradable permits can be politically easier to enact than Pigouvian taxes because the permits can be given away to existing polluters for free

    (b) ⇒The Coase theorem says that the equilibrium price of pollution depends on who gets the permits; the price of pollution will be higher if the government auctions the permits than if it gives them away to existing polluters

    (c) Permits are better than Pigouvian taxes when the amount of damage caused by pollution is fairly easy to measure

    (d) Pollution permits are likely to achieve a given degree of pollution reduction more efficiently than a "command-and-control" approach

    (e) Some environmentalists oppose pollution permits on the grounds that they are immoral because they make it seem that polluting is OK as long as you pay a certain price

18. Which of the following statements is true?

    (a) Population growth has outstripped food production in the developing world, leading to increasing risk of famine and starvation

    (b) Known reserves of oil are dwindling quickly; at current levels of oil usage the world will run out of oil in the next two or three decades

    (c) Pollution gets worse and worse as economic development of a country progresses

    (d) ⇒None of (a)-(c) is true

    (e) All of (a)-(c) are true

19. In the early 1990s, upon the collapse of the government of Siad Barre, the country of Somalia degenerated into a situation of tribal and clan and even within-clan warfare, which resulted in a widespread humanitarian disaster, including a famine. The philosopher we have discussed whose analysis of society is closest to this situation is

    (a) John Rawls

    (b) ⇒Thomas Hobbes

    (c) Robert Nozick

    (d) Jeremy Bentham

    (e) Immanuel Kant

20. According to a required reading from the *Economist*

    (a) The U.S. has mostly avoided the "command-and-control" approach to environmental policy in favor of market based alternatives

    (b) The costs of environmental protection have substantially exceeded the benefits over the past thirty years

    (c) The Superfund environmental cleanup program is a successful example of how environmental protection policy can be run better

    (d) ⇒Permitting firms to pollute at some market-determined price could have achieved more enviornmental cleanup at lower cost than has been achieved

21. Al Gore won the 2007 Nobel Peace Prize for bringing attention to the evidence that gasses emitted by human activity are contributing to global warming. The Nobel Peace prize committee believed:

    (a) Global warming must be stopped because if the polar ice caps melt then Canada and Russia will go to war over who controls the Arctic

    (b) Global warming will make countries poorer and poor countries are more likely to go to war

    (c) The fight against global warming is "the moral equivalent of war" and the committee believes it's better to fight the moral equivalent of war than an actual war

    (d) He needed something to keep his mind off his recent weight gain

    (e) ⇒Awarding the prize to Gore would bring attention to an important issue and might help build political momentum for solutions

22. If we want to address the problems caused by emissions of the gasses that cause global warming:

    (a) The most efficient way to do so is by issuing strict regulations governing the kinds of technologies firms must use for producing goods and services

    (b) ⇒One drawback of a "cap and trade" scheme of tradable emissions permits is that policymakers do not know the likely price of emissions rights in advance

    (c) A "Pigouvian tax" has the disadvantage that it would be expensive in the government budget

    (d) Both (b) and (c)

23. President Bush made a variety of arguments in favor of his "No Child Left Behind" education act passed in 2001, which increased Federal funding for elementary education, required teacher salaries to be based more on merit, and required more student testing. From the standpoint of public finance theory, which of the following arguments makes most sense?

    (a) Education is a national public good because educated people have higher incomes, so it makes sense for the Federal government to pay for it

    (b) ⇒Increased testing of students provides a public good because the information about how well the school is doing can be obtained and used by anyone

    (c) Merit-based pay is desirable because it makes teachers better off

    (d) Increased testing produces a Pareto improvement because it makes it easier to distinguish good students from bad ones

24. Under an additive utilitarian social welfare function:
    (a) Efficiency of production is irrelevant
    (b) ⇒The happiness of every person matters equally
    (c) Redistribution from rich to poor people cannot be justified because it is not a Pareto improvement
    (d) Pareto efficiency will not be achieved even if the conditions of the First Welfare Theorem are satisfied
    (e) Subsidies cannot be justified to encourage activities that generate positive externalities

25. The state of Maryland is considering whether to permit slot machine gambling (with heavy taxes) as a way to raise government revenue.
    (a) A libertarian might say that this is a permissible way to raise revenue because everyone has the right to gamble if they want
    (b) A utilitarian might say that this is a mistake because some people will not be able to control the urge to gamble and will become miserable as a result
    (c) Someone who believes in Procedural Justice might be concerned whether the prospect of gambling revenues will lead to government policies that violate proper procedures that ordinarily regulate business behavior
    (d) ⇒All of (a)-(c)
    (e) None of (a)-(c)

2 Public Goods - Private and Optimal Provision

Ben and Jerry live by themselves far from others. They choose between consuming a private good, X, with a price of \$1 ($P_x = 1$) and a public good, fireworks, also with a price of \$1 ($P_f = 1$). They each have income of \$100. Each individual i has a utility function of the form

$$U_i = 2 \times \log X_i + \log(F_B + F_J) \tag{1}$$

which he maximizes subject to a budget constraint

$$X_i + F_i = 100. \tag{2}$$

Initially, Ben and Jerry provide the public good on their own, with no government intervention. Each knows that the other will provide fireworks. We assume that each behaves according to the *Nash equilibrium*: Each person solves for his optimal strategy given the other person's behavior. The equilibrium is the point at which each person is pursuing his or her optimal strategy, *given* the other person's behavior.

For example, Ben solves a problem of the form

$$\max U = 2 \times \log \overbrace{(100 - F_B)}^{=X_B} + \log(F_B + F_J) \tag{3}$$

and his behavior will be optimal at the point where the marginal utility of choosing to provide a bit more fireworks is zero. Since marginal utility is the derivative of utility, this can be found by differentiating (3) with respect to F_B:

$$\left(\frac{dU}{dF_B}\right) = -2/(100 - F_B) + 1/(F_B + F_J) = 0 \tag{4}$$

- Draw *and label* a graph showing Ben's marginal utility of fireworks, *conditional* on low and high values for Jerry's quantity of fireworks provided (that is, show how the graph of $-2/(100 - F_B) + 1/(F_B + F_J)$ will move as a consequence of whether Jerry chooses to provide low or high amounts of fireworks; your graph does not need to be numerically accurate – it should mainly show the slope of marginal utility, and how the point where it reaches zero depends on Jerry's choice).

  Answer:
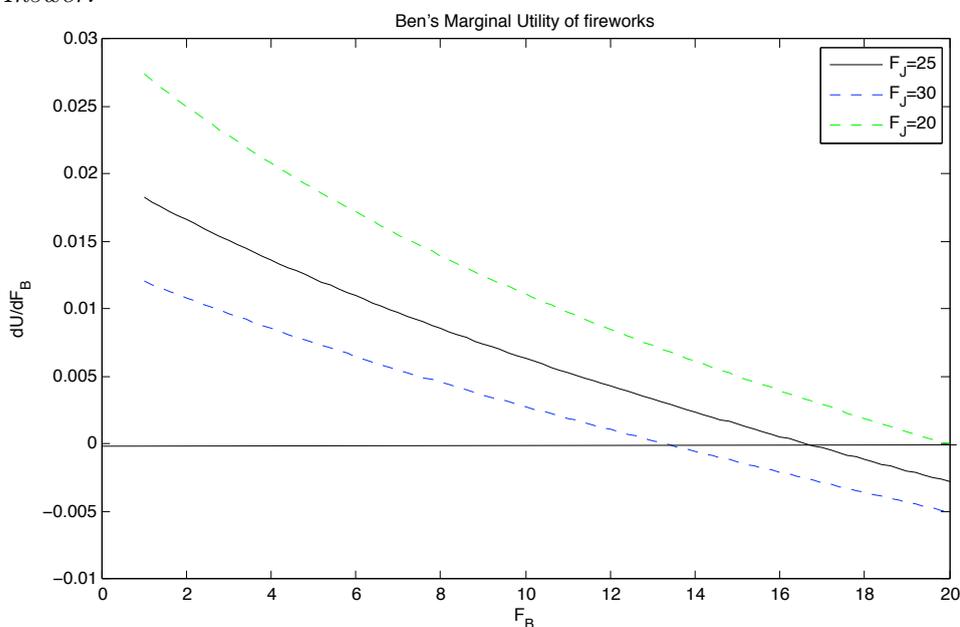
The graph should reflect the relationship between Ben's marginal utility of fireworks and Jerry's firework provision. In other words, the horizontal axis should be Jerry's firework provision amount, F_J, and the vertical axis is Ben's marginal utility of firework, $\frac{dU}{dF_B}$. From (4) we can see that the first derivative of $\frac{dU}{dF_B}$ with respect to F_J is negative, and the second derivative is positive. So we know that the graph should be downward sloping and be convex, and as F_J increase, the marginal utility will reach zero at some point (i.e. intersect with the horizontal axis).

- Solve equation (4) to show that Ben's optimal provision of fireworks conditional on Jerry's choice is given by

$$(100 - F_B)/(2 \times (F_B + F_J)) \quad = \quad 1 \tag{5}$$

Answer:

Ben's optimal provision of fireworks is determined by (4), i.e.

$$-2/(100 - F_B) + 1/(F_B + F_J) = 0.$$

Move the first term of LHS to right,

$$2/(100 - F_B) = 1/(F_B + F_J)$$

Then multiply both sides by $(100 - F_B)/2$, and we have:

$$(100 - F_B)/(2 \times (F_B + F_J)) = 1.$$

- Explain why this can be interpreted as Ben's Marginal Rate of Substitution (MRS) of fireworks for other goods

Answer:

Ben's MRS is the ratio of his marginal utility of fireworks to his marginal utility of private goods. Since Ben's utility function is

$$U_B = 2 \times \log X_B + \log(F_B + F_J)$$

the marginal utility of fireworks is: $\frac{dU_B}{dF_B} = 1/(F_B + F_J)$

the marginal utility of private goods is: $\frac{dU_B}{dX_B} = 2/X_B$

so the ratio of the MRS of fireworks to the MRS of the private good is:

$$\frac{dU_B/dF_B}{dU_B/dX_B} = X_B/2 \times (F_B + F_J)$$

After substituting $X_B = 100 - F_B$, we get the left hand side of (5).

- Use the fact that Jerry's problem is basically the same as Ben's (substituting "J" for "B" and vice versa) to show that, with private provision only, Ben and Jerry will each supply only $F_B = F_J = 20$ units of fireworks, for a total supply of $F_B + F_J = 40$.

Answer:

As we know, the optimal supply of fireworks for Ben is given by (5), i.e.

$$(100 - F_B)/(2 \times (F_B + F_J)) = 1$$

therefore: $F_B = (100 - 2 \times F_J)/3$

Similarly, the problem for Jerry is $F_J = (100 - 2 \times F_B)/3$

This yields two equations with two unknowns, which we can combine to solve out F_B and F_J. Specifically,we substitute the second equation into the first one,

$$F_B = (100 - 2 \times (100 - 2 \times F_B)/3)/3$$

Multiply both sides by 9, we have

$$9 \times F_B = 300 - 2 \times (100 - 2 \times F_B)$$

or $5 \times F_B = 100$, i.e. $F_B = 20$.

Substitute $F_B = 20$ into the second equation for F_J we find that $F_J = 20$, and the total supply of fireworks is $F_B + F_J = 40$.

The socially optimal level of provision is the quantity at which the sum of the individuals' marginal rates of substitution equals the ratio of prices (which is \$1/\$1 = 1 in this example). That is,

$$MRS_B + MRS_J = 1 \tag{6}$$

- Use the fact that total fireworks $F = F_B + F_J$ to show that the socially optimal amount of fireworks is $F \approx 66.6$.

  Answer:

  We have known that Ben's MRS of fireworks to private good is

  $$MRS_B = (100 - F_B)/2 \times (F_B + F_J)$$

  In same way, Jerry's MRS is

  $$MRS_J = (100 - FJ)/2 \times (F_B + F_J)$$

  Substituting these two expressions into (6), we have,

  $$(100 - F_B)/[2 \times (F_B + F_J)] + (100 - F_J)/[2 \times (F_B + F_J)] = 1$$

  Since $F = F_B + F_J$, we can write this equation as $(200 - F)/(2 \times F) = 1$, and solving this we obtain $F \approx 66.6$.

- Explain why the private market underprovides fireworks, using the terminology we have discussed in class.

  Answer:

  The private market underprovides fireworks because of the *free rider problem*. Fireworks are *public goods*; they are *nonrival* since both Ben and Jerry can enjoy them without impinging on the other's enjoyment, and fireworks are *nonexcludable* since they explode high in the sky for both

Ben and Jerry to see. Both Ben and Jerry benefit equally from a firework sent up by either of them, what matters to them is *the total amount of fireworks*. In other words, Ben and Jerry each have to forgo a serving of private good to provide a firework, but both Ben and Jerry benefit from each firework that is provided. There is clearly a *positive externality* of fireworks, and this situation leads naturally to underproduction.

The other way to answer this question is from the individuals' own perspectives. Ben and Jerry will choose to consume combinations of fireworks and private goods at the points that their indifference curve are tangent to their budget constraints. The slope of budget constraints is 1, since price of fireworks and private goods are both 1. The slope of indifference curve is MRS, or the ratio of marginal utilities.

In private market, both Ben and Jerry will set their marginal utility as $MU_F/MU_P = 1$, or $MU_P = MU_F$. While the social optimal condition of public goods, the fireworks here, is that the marginal cost of the good equal to the *sum* of MRS, or $MU_{BF}/MU_{BP} + MU_{JF}/MU_{JP} = 1$. Since Ben and Jerry's preference are identical, this is equivalent to $2 \times (MU_F/MU_P) = 1$, or $MU_F = 1/2 \times MU_P$. That is to say, in the private market the marginal utility of fireworks equals the marginal utility of private goods, while in the social optimum the marginal utility of fireworks equals half of the marginal utility of private goods, and because marginal utility diminishes with increasing consumption of a good, more fireworks are consumed in the social optimum.