

NET 2022 Answers

Power Round - Introductory Microeconomics Division

May 20, 2022

Problem 1: Present Value and Returns on Bonds (12 points)

Part A If you put money into a bank account with interest, the amount of money in the account grows based on the interest rate. So, the amount of money you have after one year is: $\$1000 \times 1.05 = \1050.00
(1 point is awarded for having an equivalent correct answer.)

Part B If interest compounds annually, then the amount of money in your account grows each year proportionally to the amount of money in the account in the previous year. So, after 10 years you have: $\$1000 \times 1.05^{10} = \1628.89 .
(1 point is awarded for having an equivalent correct answer.)

Part C The logic here is that payments made in the future are less valuable than payments made to you today because with money today you can always accrue annual interest (via depositing the money into a bank account). The present value of a payment made in the future is calculated as the amount of money you would need to be paid today to have that amount of money in the future. Therefore, a payment of \$100 1 year from now is worth $\frac{\$100}{1.05} = \95.24 today. A payment of \$110 10 years from now is worth $\frac{\$110}{1.05^{10}} = \67.53 today. The answer is the difference between these two present values: $\$95.24 - \$67.53 = \$27.71$.
(1 point is awarded for having an equivalent correct answer.)

Part D See Part C. Since present value decreases as the time received of a payment becomes larger, present value should decrease as i and t increase. Answer: $PV = Y/(1+i)^t$
(1 point is awarded for correctly including $(1+i)^t$ in your answer. 1 point is awarded for having the correct answer.)

Part E The present value of a bond is calculated as the sum of the present value of a series of payments made to you in the future. Since you receive one coupon of \$60 one year from now and another coupon and the original face value of the bond (for a total of \$1060) two years from now, the present value of this bond is: $\frac{\$60}{1.07} + \frac{\$1060}{(1.07)^2} = \$981.92$. The return on the bond is simply the difference between the amount you earned from the bond and the amount you paid initially (the face value): $\$981.92 - \$1000 = -\$18.08$

(1 point is awarded for correctly calculating the present value of the bond. 1 point is awarded for subtracting the face value of the bond from the calculated present value of the bond.)

Part F The resale price is calculated based on the present value of the bond at the moment the bond is sold. Since the bond is sold after 4 years, the resale price is: $\frac{\$50}{1.07} + \frac{\$50}{(1.07)^2} + \frac{\$550}{(1.07)^3} = \539.36 .
(1 point is awarded for having an equivalent correct answer.)

Part G Since the interest rate changes from year to year, the present value of each individual payment changes to account for this. The present value of the bond is: $\frac{\$50}{1.05} + \frac{\$50}{(1.05)(1.07)} + \frac{\$1050}{(1.05)(1.07)(1.1)} = \941.74
(1 point is awarded for accounting for a changing interest rate - e.g. calculating $\frac{\$50}{1.05} + \frac{\$50}{1.07} + \frac{\$1050}{1.1}$. 1 point is awarded for having an equivalent correct answer.)

Part H The total return on the bond is the sum of the value of the coupons received and the difference between the resale price of the bond and the price you bought the bond at. Therefore, the total return on the bond is: $\$50 + \frac{\$50}{1.03} + \frac{\$1050}{(1.03)^2} - \$1000 = \$88.27$

(1 point is awarded for correctly calculating the resale price of the bond and including it in your work towards the answer. 1 point is awarded for having an equivalent correct answer.)

Problem 2: Property Rights and Externalities (14 Points)

Part A Simply subtract the utility values for music and silence row-wise like so:

Hours of Music	Hours of Silence	Ossian's Utility	Percy's Utility	MU of Music	MU of Silence
0	4	0	10	X	1
1	3	4	9	4	2
2	2	7	7	3	3
3	1	9	4	2	4
4	0	10	0	1	X

Part B These allotments of music and silence render total utilities equal to Ossian's utility plus Percy's utility. Summing, we get (vertically ordered) 10, 13, 14, 13, and 10 total dollars of utility. Therefore, the social planner will choose 2 hours of music and 2 hours of silence.

Part C There are two arguments one could take here. First, with these rights, Judge Ronald has essentially created a market for music, with Percy as the producer and Ossian as the consumer. Ossian's utility for music and Percy's utility from silence are the marginal benefits and marginal costs, respectively. Crossing these gives 2 hours of music and 2 hours of silence at a cost equal to marginal costs/benefits, which is \$3 per unit (or \$6 total).

The other argument is to look at consecutive willingness to pay/accept: starting at 0 hours of music, Ossian is willing to pay at most 4 dollars to move to 1 hour of music and Percy is willing to accept at least 1 dollar to move to 3 hours of silence. Therefore, a trade can happen. Starting at 1 hour of music, Ossian is willing to pay at most 3 dollars to move to 2 hours of music and Percy is willing to accept at least 2 dollars to move to 2 hours of silence. Therefore, another trade can happen. Starting at 2 hours of music, Ossian is willing to pay at most 2 dollars to move to 3 hours of music and Percy is willing to accept at least 3 dollars to move to 1 hour of silence. Therefore, no further trade can happen. Thus, equilibrium is 2 hours of music/silence, and the transfer of money that will allow this to happen is some payment between 3 and 7 dollars from Ossian to Percy (which is the range between Percy's minimum willingness to accept for movement from 4 hours of silence to 2 hours and Ossian's maximum willingness to pay for movement from 0 hours of music to 2 hours). Two points for the correct equilibrium quantities and one point for the correct price (either per-unit or total).

Part D Because the numbers we chose are symmetric, it so happens that the exact same argument from part C will work for this part, only swapping the names of the players and the names of the goods (i.e. silence and music). Therefore, the equilibrium is 2 hours of music/silence, and the transfer of money that will allow this to happen is some payment between 3 and 7 dollars from Percy to Ossian. Notice that the quantity of music/silence you found is the same in parts B, C, and D. This is not a coincidence - in fact, it is the heart of the Coase Theorem. Three points in the same allotment as part C and an additional point for noticing that the quantities are all the same.

Part E No. Notice that, regardless of what the status quo is, the most Ossian can benefit from arbitration is by going from 0 hours of music to 4, sending his utility from 0 to 10. Similarly, the best Percy can do is go from 0 hours of silence to 4, sending his utility from 0 to 10. Therefore, each neighbor is at most willing to spend \$10 on arbitration fees (recall that utility was measured in dollar terms). Therefore, it is clearly impossible for the neighbors to agree to pay more than \$20 for arbitration, so Judge Ronald's services will not be sought out.

Problem 3: Oligopoly Types (14 points)

Part A 1: $(144 - q_1 - q_2)q_1 = \pi_1$ 2: $(144 - q_1 - q_2)q_2 = \pi_2$

Part B 1: Arrive at a formula with only q_1 or q_2 for example $q_1 = \frac{144 - \frac{144 - q_1}{2}}{2}$ 2: $q_1 = 48$ $q_2 = 48$ 3: $P = 53$. 2304 is the profit for both firms

Part C 1: $P = MC = 5$ 2: $\pi = 0$ for both firms. 3: Quality points for describing the factors that may lead to this, not limited to but including: a “race to the bottom” in terms of prices where firms compete until prices equal MC. Since this case is the same as in perfect competition, we will expect to see lower profit for each firm. In fact the profit should be 0 under certain conditions (these conditions are not required for the answer).

Part D 1: Monopoly

Part E 1: Set $MR = MC$. $5 = 149 - 2Q \implies Q = 72$ 2: $P = 77$. $\pi = 5184$

Part F 1: Monopoly, Cournot, Bertrand for π 2: Bertrand, Cournot, Monopoly for CS. 3: Quality mark for an answer that logically follows from previous answers, even if previous answers were wrong.