

**Problem set 5**

(due Thursday, March 3rd before class)

**Problem 1 (Intertemporal Choice)**

Gerald is a CEO at Brainies Consulting Inc. His income in the first year is  $m_1 = \$200$  and in the second  $m_2 = \$200$ . Assume that the interest rate is  $r = 100\%$ : (His time horizon is limited to these two years.)

- Find  $PV$  and  $FV$  of Gerald's income.
- show on the graph  $(C_1; C_2)$  Gerald's budget set. Mark  $PV$ ,  $FV$  and the slope of his budget line
- explain what borrowing/lending strategy gives Gerald each of the two "extreme" consumption points. (how much does he borrow/lend in the first period, how much does he pay back/ receive in the second period?)
- suppose his utility function is

$$U(C_1; C_2) = \ln C_1 + \ln C_2$$

Find analytically Gerald's optimal choice and show it on the graph. Does the optimal consumption involve saving or borrowing?

**Problem 2 (Intertemporal Choice)**

The preferences of a manager and a sportsman are given by

$$U(C_1; C_2) = \ln C_1 + \frac{1}{1 + \delta} \ln C_2$$

Suppose  $r = \delta = 100\%$ .

- Give economic interpretation to coefficient  $\delta$ .
- Derive optimal consumption plan of a manager  $(C_1, C_1)$  if his income in two periods is given by  $m = (0, 3000)$ . Find optimal level of savings  $S$  in the first period.
- Derive optimal consumption plan of a sportsman,  $(C_1, C_1)$  if his income in two periods is given by  $m = (1500, 0)$ . Find optimal level of savings in the first period.
- Are the manager and the sportsman smoothing their consumption profiles?
- Show, using one of the secrets of happiness, that the optimal consumption of the manager is decreasing over time when  $r < \delta$ .

**Problem 3 (Annuity and Perpetuity)**

- Derive PV formula for perpetuity with payment  $x$  and interest equal to  $r$ ,
- Derive PV formula for annuity that pays  $x$ , maturity is  $T$  and interest rate is  $r$ .

**Problem 4 (Present Value, use a calculator)**

- Buying or renting You are moving in to Madison (you are going to stay here forever!) and you would like to find an apartment. You can either buy it or rent it. The monthly rent is \$500 and the monthly interest rate is 0.1%. Alternatively, you can purchase the apartment, paying \$600,000: How are you going to finance you new accommodation? Argue using the  $PV$  formula. Show
- You take a loan to buy a car that costs \$4000. What is your monthly payment if your want to pay back the loan after 3 years, (36 payments) and the monthly interest rate 0.5%: (Hint: Loan with constant payments is like annuity!)
- You are hired by Merrill Lynch –a financial management and advisory firm – to help asses the value of a T-bond (T-bond is a bond issued by the Department of the Treasury) with the face value  $F = \$1000$ ; coupon  $c = \$100$  (paid annually till  $T - 1$  (included) and face value  $F$  paid in  $T$ ) and time to maturity equal to  $T = 10$  years. The interest rate is equal to  $r = 10\%$ . Find the PV of such bond. Is it a good or bad deal to buy such bond for \$900?: Explain
- You want to receive \$40,000 per year when retired (61 and 80). How much do you have to save between 21-60 years. (Interest rate is 5%)
- You save \$20,000 per year when working (21 and 60). How much will you consume per year when you retire (age 61–80) (Interest rate is 5%)

**Problem 5 (Life cycle problems, use Excel program)**

a) You are going to earn  $m_t = \$200,000$  when working (age 21 and 60), and then you are going to live for the next 20 years with  $m_t = \$0$ . Find the constant level of consumption  $C$  during years (21-80) that can be financed from your income. (Interest rate is 5%). Find the level of savings  $S_t = m_t - C$  for periods  $t < 60$  and for  $t > 60$

b) Consider the problem as in a). Assume that apart from your regular income, at the age of 20 you inherit \$1000,000 (one million \$). Find  $C$  and  $S_t$ ?

c) Consider the problem as in b). Assume that you also leave a your offspring a bequest of \$1000,000 (one million \$). Find  $C$  and  $S_t$

d) Optional: Accumulated wealth in period  $t$  is given by  $W_t = W_{t-1}(1 + r) + s_t$  that is it coincides with wealth from the previous period plus interest and savings in  $t$ . The initial wealth of agent  $W_{20} = 0$ . Using Excel sheet, plot the behavior of wealth  $W_t$  over you life time for points a-c. When the wealth of our agent attains maximum? What can you say about the level of wealth at the end of life  $W_{80}$ ?

# Questionnaire Econ 301

**This is an anonymous questionnaire. Answer the questions but do not sign it. The questionnaire will be collected on Tuesday**

Which year are you in and what is your major?

## **I. Problem sets:**

1. How much time (on average) do you spend solving PS?
2. Are PS: supereasy, easy, OK, difficult, very difficult.
3. Are PS helpful in understanding the material?
4. How difficult is math needed to solve problems? supereasy, easy, OK, difficult, very difficult.

## **II. Class**

1. Do you find solving problem in class useful?
2. Do you prefer more intuitive or formal exposition of the material?
3. How about the pace of the course: too slow, slow, OK, fast, too fast.
4. What fraction of the theory presented in the class can you follow 20%, 40%, 60%, 80%, 100%
5. How would you improve the course?

## **III. Midterm**

1. Do you think the midterm was fair ?
2. The level of difficulty: Was it supereasy, easy, OK, difficult, very difficult?
3. The contents: where you surprised by any of the questions?
4. Length: what the midterm very short, short, OK, long , too long?

## **IV. TA sections**

1. Do you find them helpful in understanding the material?
2. Do you find them helpful in solving your assignments?