DARTMOUTH COLLEGE
Department of Economics

Economics 36 Professor Katerina Simons
Theory of Finance

PROBLEM SET I

Net Present Value and Applications

1. Your net income is $40,000 today and you expect it to be $60,000 when you are paid again in one year and $70,000 the year after. The relevant interest rate will be 8% next year and it will increase to 14% the year after.
   (a) If you are able to borrow and lend at these interest rates, what is the maximum possible consumption in each of the three years?
   (b) You actually plan to consume $20,000 this year and to increase this at a rate of 10% per year for the next two years. What will be your asset balance after receiving the second income payment of $60,000?
2. Norman Gerrymander has just received a $ 2 million bequest. How should he invest it? There are four immediate alternatives:
   (a) Investment in one-year U.S. government securities yielding 5 percent.
   (b) A loan to Norman's nephew Gerald, who has for years aspired to open a big Cajun restaurant in Duluth. Gerald had arranged a one-year bank loan for $900,000, at 10% but asks for a loan from Norman at 7%.
   (c) Investment in the stock market. The expected rate of return is 12%.
   (d) Investment in local real estate, which Norman judges is about as risky as the stock market. The opportunity at hand would cost 1 million and is forecasted to be worth 1.1 million after one year.
3. Show that your answers to the previous question are consistent with the rate of return rule for investment decisions.

4. You win a $1 million lottery which pays you $50,000 per year for 20 years. The first payment is in one year. How much is your prize really worth at an interest rate of 8%.

   How would your answer differ if the first payment occurs at the beginning of the first year (today)? This is an annuity due. Modify the regular annuity formula by adding the first payment and subtracting the last payment:

5. Your great aunt left you $20,000 when she died. You can invest the money to earn 12% per year. If you spend $3540 per year out of this inheritance beginning today, how long will the money last?

6. You take a $100,000 mortgage from a bank for 30 years at an APR of 10.5%. What is the monthly payment?

7. You are 40 years old and wish to retire at age 65. You expect to be able to average a 6% annual rate on savings over your lifetime. You would like to save enough money to provide $8,000 per year beginning at age 66 in retirement income to supplement other sources (social security, pension plans, etc.). Suppose you decide that the extra income need be provided for only 15 years (up to age 80). How much must you save each year between now and retirement to achieve your goal? Assume that your first contribution to the savings plan will take place one year from now.

8. If the interest rate is 7%, what is the value of the following two investments?

(a) an investment that offers you $100 a year in perpetuity with the payment at the end of each year.

(b) A similar investment with the payment at the beginning of each year.

9. Yesterday, company X paid its annual dividend of $1.66 per share. It is expected that dividends will grow at a 20 percent annual rate for the next 5 years. Thereafter, the growth rate will level off at 8% per year. The current stock price is $30 per share. If the required return on this stock is 18%, should you buy the stock?

10. California Electronics, Inc. expects to earn $100 million per year in perpetuity if it does not undertake any new projects. The firm has an opportunity that requires an investment of $15 million today and $5 million in one year. The new investment will begin to generate additional annual earnings of $10 million two years from

today in perpetuity. The firm has 20 million shares of common stock outstanding, and the required rate of return on the stock is 15 percent.

a) What is the price of a share of the stock if the firm does not undertake the new project?

b) What is the value of the growth opportunities resulting from the new project?

c) What is the price of a share of the stock if the firm undertakes the new project?

11. In September 2003, International Paper's stock sold for about $73. Security analysts were forecasting a long-term earnings growth rate of 8.5 percent. The company was paying dividends of $1.68 per share.

(a) Assume dividends are expected to grow along with earnings at g = 8.5 percent per year in perpetuity. What rate of return r were investors expecting?

(b) Suppose instead that International Paper was expected to earn about 12 percent on new investments and to pay out about 50 percent of earnings as dividends. What do these forecasts imply for g ? For r ? Use the perpetual-growth DCF formula.