M.I.T. **Spring 1999**
Sloan School of Management **15.415**

Problem Set 3

Due Friday, March 5

1. **The Dividend Growth Model I**

   A company has a market capitalization rate of 15%, a constant growth rate of 10%, and a dividend payout ratio of 45%. What should its P/E be?

2. **The Dividend Growth Model II**

   A stock is not paying any dividends until three years from now. The dividend is expected to be \$2 per share, the dividend payout ratio is expected to be 40% and the return on equity is expected to be 15%. If the cost of equity is 12%, what is the value of the stock today?

3. **The Dividend Growth Model III**

   The stock of Nogro Corporation is currently selling for \$10 per share. Earnings per share in the coming year are expected to be \$2. The company has a policy of paying out 50% of its earnings each year in dividends. The rest is retained and invested in projects that earn a 20% rate of return per year. The situation is expected to continue indefinitely.

   (a) Assuming that the Dividend Growth Model applies, what is Nogro Corp's cost of equity?

   (b) By how much the stock price would change if all earnings were paid as dividends and nothing were reinvested? Explain your answer.

   (c) If Nogro Corp. were to cut its dividends to 25% of earnings, what would happen to its stock price?

   (d) What if Nogro eliminated its dividends?

4. **The Dividend Growth Model IV**

   The common stock of General Dynamics (GD) is currently selling for \$94.50 per share. The stock's current dividend is \$2.40 per share (assume that this will be paid in one year). The firm's P/E ratio is 10. Assume that GD's cost of equity is 12%.

   (a) Using the Dividend Growth Model model, what is GD's dividend growth rate?

   (b) What is its ROE?

5. **Stock Index**

Every day, the press reports the performance of the Dow Jones Industrial Index and the S&P 500. For example, the WSJ on September 30, 1997 contains the statement:

> The industrials surged 69.25 points to close at 7991.43 and the Standard and Poor's 500-stock index climbed 8.12 to 953.34.

In this problem, we will try to get a sense of what these numbers mean.

The DJIA and the S&P 500 are two very different indices. The DJIA is made up of 30 "blue chip" stocks traded on the New York Stock Exchange (NYSE). Examples of these stocks include AT&T, Coca-Cola, Exxon, IBM, and McDonalds. You can find the full list of the stocks in the WSJ every day. By contrast, the S&P 500 consists of 500 stocks chosen from the NYSE, the American Stock Exchange (AMEX), and the over-the-counter market. Examples include Coca-Cola, Microsoft, and Procter & Gamble.

The DJIA is an *price-weighted index*, meaning that the weight of each stock in the index is proportionate to its price. In particular, it may be computed as

$$\text{Index Value} = \frac{\text{sum of prices of stocks in the index}}{\text{divisor}}.$$

The divisor is printed periodically in the WSJ, and it is adjusted for stock splits and for stocks that enter or leave the index.

The S&P 500 is a *value-weighted index*, meaning that the weight of each stock in the index is proportionate to its market value. The index may be computed as

$$\text{Index Value} = \frac{\text{sum of market values of stocks in the index}}{\text{divisor}}.$$

Likewise, the divisor for the S&P 500 is adjusted for stock splits and changes in the stocks underlying the index.

(a) Attached to this problem set is a list of the 30 stocks underlying the DJIA and their price changes on September 29, 1997. The current divisor the DJIA is 0.25450704. Calculate the change in the DJIA accurate to four decimal places.

(b) You will now create your own personal stock index. The stocks in your index will consist of the following three stocks: Neiman-Marcus, Jacobson Stores, and Reebok International. Using the data provided in the table below, construct a price-weighted index of the three companies with the divisor selected so that the index's value at the end of 1992 is 100.

(c) Create a value-weighted index for these three companies, with the divisor selected so that the index's value at the end of 1992 is 100.

(d) Assuming that the divisor is constant, track both indices over time (i.e., compute the value of the index at the end of 1993, 1994, 1995, and 1996). Discuss the difference in the performance of the indices. In particular, explain reasons why one of the indices outperforms the other.

(e) Compute the returns on the indices. Computing the returns require you to include yearly dividends, which are provided in the table. (Note: Dividends are paid at the end of the corresponding year.)

(f) Calculate the sample mean and sample standard deviation of the indices' returns.

Neiman-Marcus			
Year	End of Year Price	Yearly Dividend	End of Year Shares Outstanding
1992	\$18.25	\$0.20	36.87 million
1993	\$18.75	\$0.20	37.94 million
1994	\$13.50	\$0.20	37.95 million
1995	\$23.50	\$0.10	37.96 million
1996	\$25.50	\$0.10	38.00 million

Jacobson Stores			
Year	End of Year Price	Yearly Dividend	End of Year Shares Outstanding
1992	\$14.50	\$0.50	5.78 million
1993	\$13.50	\$0.50	5.78 million
1994	\$10.00	\$0.50	5.78 million
1995	\$ 9.00	\$0.50	5.78 million
1996	\$ 9.25	\$0.38	5.78 million

Reebok International			
Year	End of Year Price	Yearly Dividend	End of Year Shares Outstanding
1992	\$34.00	\$0.30	89.36 million
1993	\$30.00	\$0.30	83.69 million
1994	\$39.50	\$0.30	80.94 million
1995	\$28.25	\$0.30	74.80 million
1996	\$42.00	\$0.23	55.84 million

6. **Correlation and the Portfolio Frontier**

You consider investing in two companies, company A and company B. The expected return on company A is 12% and the standard deviation is 16%. The expected return on company B is 17% and the standard deviation is 25%.

(a) The correlation between companies A and B is 0.3. Compute the expected return and standard deviation of a portfolio that has 0% A, 10% A, 20% A, etc, until 100% A. Plot the portfolio frontier formed by these portfolios.

(b) Repeat the previous question, assuming that the correlation is 0.7.

(c) Explain intuitively why the portfolio frontier is different in the two cases.