

Foundations of Finance, Midterm Exam  
 Sample questions from past semesters  
 Summer I, 2005  
 Prof. Joel Hasbrouck

(With answers in bold or starred: \*\*\*\*\*)

Sample instructions:

xxx minutes. Closed book. You may use a financial calculator and one sheet (8 1/2 x 11 in.) of notes. Answer all questions on the answer sheet (last page). Circle the answer that is most correct (or closest). Turn in all pages of the exam, all work papers, and your note sheet. No credit will be given for answers that are not clearly marked. There is a one-point penalty if any answers have to be transferred from the exam to the answer sheet. Your behavior is subject to the Stern Honor Code. If you have a cell phone or other non-calculator portable electronic device, it must be packed away, off of the desk surface. You may not use it during the quiz. Please make sure that it is turned off. Calculators which are not in the following list are not permitted without notifying me one day prior to the quiz.

My financial calculator is (circle one) HP-10b ... See updated list on the course web page;

I have read and understood the Stern Honor Code. \_\_\_\_\_ (Signature)

1. How many years will it take \$1,000 to grow to \$10,000 at an interest rate of 12% compounded quarterly?
  - a. 77.9 years
  - b. 20.3 years
  - c. 19.5 years (**4 P/YR; 10,000 FV; -1,000 PV; 12 I/YR; N: 77.9 quarters or 19.5 years**)
  - d. 14.3 years
  
2. A bank account pays 6% compounded quarterly. You wish to make 30 monthly deposits (at the end of each month) such that you will have \$10,000 in the account immediately after the final payment. The payment size is . . .
  - a. 309.90  
**6% comp quarterly is equivalent to 5.97% comp monthly.**  
**(4 P/YR; 6 NOM%; EFF%: 6.1364; 12 P/YR; NOM%: 5.97%)**  
**Alternatively (without NOM/EFF keys):**  
 $(1 + 0.06/4)^4 = (1+r/12)^{12} \Rightarrow (1.015)^4 = (1+r/12)^{12} \Rightarrow 1.061364 = (1+r/12)^{12} \Rightarrow$   
 $(1.061364)^{1/12} = (1+r/12) \Rightarrow 1.004975 = 1 + r/12 \Rightarrow r = 0.0597$   
**12 P/YR; 5.97 I/YR; 30 N; 10,000 FV; PMT: 309.90**
  - b. 309.79
  - c. 309.27
  - d. 328.41
  
3. A couple taking out a mortgage at an APR of 10% (compounded monthly) is given a choice between a 15-year mortgage or a 30-year mortgage. Both mortgages have monthly payments. They are looking at the total interest and amortization that they will pay over the life of each mortgage. Relative to the 30-year mortgage, they find that the 15-year mortgage has a higher monthly payment and . . .
  - a. lower total interest and identical total amortization. **The total amortization must be the same for all loans, but because we are paying the loan back faster, the total interest will be less.**
  - b. lower total interest and higher total amortization.
  - c. identical total interest and identical total amortization.
  - d. higher total interest and lower total amortization.
  
4. Tom and Sue are trying to buy a house for which they need to take out a 30-year fixed rate mortgage with monthly payments. They need to borrow \$150,000. Tom and Sue are worried that interest rates

might rise. If the maximum monthly payment they can afford is \$1,200, what is the maximum APR that will still allow them to purchase the house?

- a. 8%
- b. 9.23%
- c. 8.9%
- d. 8.94% **12 P/YR; 360 N; 150000 PV; -1,200 PMT; I/YR: 8.94%**

5. It is January 1, 1996 and The Republic of Ruthenia is in trouble. Two years ago (January 1, 1994) they borrowed \$10 Billion at 10% from a consortium of U.S. banks. The loan was to be repaid in ten equal annual payments. What was the initial payment size?

- a. \$1.000B
- b. \$1.900B
- c. \$1.286B
- d. \$1.628B **(1 P/YR; 10 PV; 10 N; 10 I/YR; PMT -1.628)**

6. (Difficult) In the first two years, instead of the promised payments, Ruthenia just managed to make two payments of \$1.5B. They've just made the second payment of \$1.5B and they force the banks into a renegotiation. The banks agree that the interest rate will be reset to 9% (for the future) and the current loan balance will be paid off in 12 equal annual payments (with the first payment due one year from now). What is the size of each remaining payment?

- a. **\$1.25B The interest the first year is \$1B, leaving \$0.5B for amortization. The loan balance going into the second year is \$9.5B. Interest on this is \$0.95, leaving \$0.55 for amortization. So the loan balance right after the second payment is  $\$9.5 - \$0.55 = \$8.95B$ . **8.95 PV; 9 I/YR; 12 N; PMT: \$1.25B****
- b. \$1.28B
- c. \$2.30B
- d. \$1.20B

7. In a market with no dealer or specialist, the limit order book in ABC stock at 10:00 AM is:

Buys	Price	Sells
6,000 sh	99.80	
15,000 sh	99.90	
20,000 sh	100.00	
10,000 sh	100.10	
	100.20	5,000 sh
	100.30	3,000 sh
	100.50	4,000 sh
	100.60	10,000 sh

Between 10:00AM and 10:05, the following orders arrive in sequence, and (if possible) are filled.

- (i) A limit order to sell 1,000 shares at 100.20 arrives.
- (ii) A market order to buy 4,000 shares arrives.
- (iii) A market order to buy 5,000 shares arrives.
- (iv) A limit order to buy 2,000 shares at 100.20 arrives.

Which of the following is correct?

- a. The quotes at 10:00AM were 100.10 bid and 100.20 offered; the quotes at 10:05AM are 100.20 bid 100.50 offered.
- b. The quotes at 10:00AM were 100.20 bid and 100.10 offered; the quotes at 10:05AM are 100.20 bid 100.50 offered.
- c. The quotes at 10:00AM were 100.10 bid and 100.20 offered; the quotes at 10:05AM are 100.20 bid 100.30 offered.
- d. The quotes at 10:00AM were 100.10 bid and 100.20 offered; the quotes at 10:05AM are 100.30 bid 100.50 offered.

The initial quotes are the highest bid and the lowest offer on the book (100.10 bid; 100.20 offered)  
Then,

After order (i):		
Buys	Price	Sells
6,000 sh	99.80	
15,000 sh	99.90	
20,000 sh	100.00	
10,000 sh	100.10	
	100.20	6,000 sh
	100.30	3,000 sh
	100.50	4,000 sh
	100.60	10,000 sh

After order (ii):		
Buys	Price	Sells
6,000 sh	99.80	
15,000 sh	99.90	
20,000 sh	100.00	
10,000 sh	100.10	
	100.20	2,000 sh
	100.30	3,000 sh
	100.50	4,000 sh
	100.60	10,000 sh

After order (iii):		
Buys	Price	Sells
6,000 sh	99.80	
15,000 sh	99.90	
20,000 sh	100.00	
10,000 sh	100.10	
	100.20	
	100.30	
	100.50	4,000 sh
	100.60	10,000 sh

After order (iv):		
Buys	Price	Sells
6,000 sh	99.80	
15,000 sh	99.90	
20,000 sh	100.00	
10,000 sh	100.10	
2,000 sh	100.20	
	100.30	
	100.50	4,000 sh
	100.60	10,000 sh

The final quotes are 100.20 bid; offered at 100.50.

8. One year ago XYZ stock had just run up from \$12/share to \$25/share. With a net worth of \$20,000, you bought \$40,000 worth of XYZ stock on margin at 25. The call money rate was 8.5%. The stock just paid a \$1/share dividend, and is presently trading at \$27 per share. Commissions are \$.25/share (each way). If you close out your position today, one year after setting it up, what is your total profit or loss on the entire transaction.
- \$500
  - \$2,300
  - \$3,000
  - \$3,100

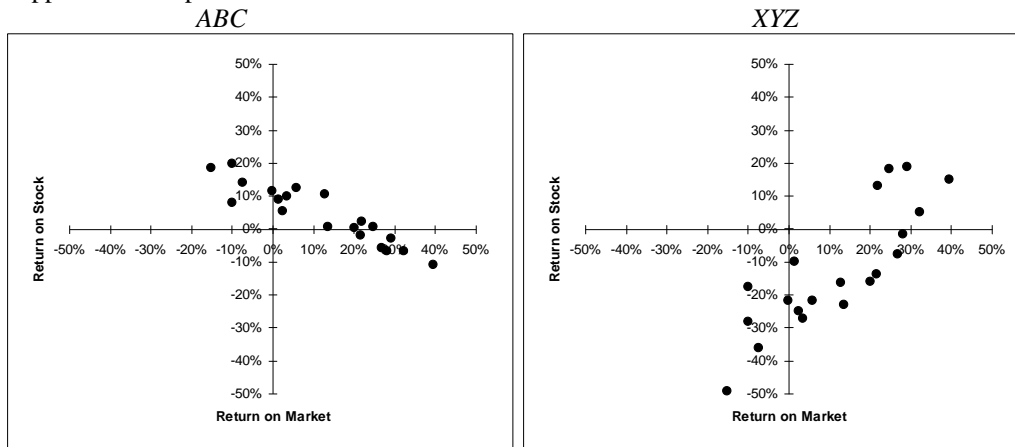
The number of shares is  $40,000/25=1,600$ .

Appreciation of stock	$1,600 \times 2$	3,200
-Loan interest	$-0.085 \times 20,000$	-1,700
Dividends	1,600	1,600
-Commissions	$-2 \times 0.25 \times 1,600$	-800
Profit		2,300

9. The SML predicts that a stock can have an expected return below the risk-free rate as long as:
- $\beta < 1$
  - $\beta > 1$
  - $\beta > 0$
  - $\beta < 0$  \*\*\* (In the CML,  $\sigma$  can't go below zero; but on the SML,  $\beta$  can go below zero.)
10. According to the CAPM, a risk-averse investor . . .
- will never buy stock on margin
  - will always hold at least part of her portfolio in risk-free securities
  - will always hold at least part of her assets in the market portfolio.
  - None of the above \*\*\* **Margined portfolios are on the CML, as is a portfolio of 0% risk-free and a portfolio of 100% risk-free.**
11. According to portfolio theory, holding large numbers of securities is likely to . . .
- eliminate almost all the risk in a portfolio.
  - eliminate almost all the market risk in a portfolio.
  - eliminate almost all the unsystematic risk in a portfolio. \*\*\* **Unsystematic risk is diversifiable; market risk is not. Therefore a portfolio will still reflect market risk.**
  - None of the above.
12. Our broker's recommended mix is 60% in stock and 40% in bonds. This portfolio has an expected return of 9% and a standard deviation of 13%; the T-bill return is 5%; the correlation between stocks and bonds is 0.3. Suppose that with a net worth of \$10,000 we desire a combined portfolio that has a return standard deviation of 5%. The expected return on our portfolio and the dollar amount we place in stock are:
- 6.54% and \$2,310 \*\*\*  $\sigma_C = y \sigma_P \Rightarrow 5 = 13 y \Rightarrow y = 0.38 \Rightarrow$  **Of our 10,000, 3,800 goes into P. Of this, 60% (2,310) goes into stock. From the formula for the CAL,  $E_{r_P} = 5\% + ((9\% - 5\%)/13\%)5\% = 6.54\%$ .**
  - 6.54% and \$6,000
  - 5.40% and \$2,310
  - 5.40% and \$6,000
13. The stock of ABC has  $\beta_{ABC} = 0.8$ ;  $\sigma_{ABC} = 30\%$ ;  $E_{r_{ABC}} = 10\%$ . If  $r_f = 6\%$  and  $E_{r_M} = 12\%$ , then ABC is probably . . .
- Overpriced \*\*\* **The SML predicts that given ABC's risk, a fair return would be,  $E_{r_{ABC}} = 6\% + 0.8(12\% - 6\%) = 10.8\%$ . The actual  $E_{r_{ABC}}$  is lower than this (10%). Therefore, ABC does not earn enough to justify its risk. The stock is overvalued (overprice).**
  - Underpriced
  - Correctly priced
  - Can't say whether or not ABC is correctly priced based on information given.
14. Which of the following statements is/are correct? (If A and B are two different investments.)
- If  $\beta_A > \beta_B$ , then the proportion of A's total return variance that is systematic is higher than that of B
  - If  $\beta_A > \beta_B$ , then the SML predicts that the return on A is always greater than the return on B
  - If  $\beta_A > \beta_B$ , then A has a higher return standard deviation
  - None of the above \*\*\* **Answer b is wrong because the SML is a statement about expected returns. In any given year, B's return might be greater than A's. a is also wrong: the proportion of risk that is systematic is the  $R^2$  in the security characteristic line estimation (index model). A stock can have a low  $\beta$**

**c is wrong: Stock B might have a relatively low  $\beta$ , but large unsystematic errors.**

Suppose that we plot the returns for two stocks vs. the market:



15. Based on the above plots, when we estimate the market index model ( $r_i = \alpha_i + \beta_i r_M + e_i$ ) for each stock we expect to find:
- $\beta_{ABC} > \beta_{XYZ}$
  - $\beta_{ABC} < \beta_{XYZ}$  \*\*\* **Beta is the slope of the best fit straight line.**
  - Can't say.
16. (Difficult) Historical data suggest that  $Er_M = 12\%$ ,  $\sigma_M = 20\%$  and  $r_f = 4\%$ . An investor's portfolio has an expected return of 10% and risk of  $\sigma_C = 16\%$ . Based on these numbers,
- We can give her the same expected return at lower risk.
  - We can give her lower risk at the same expected return.
  - Both a and b. \*\*\* **From the CML,  $Er_C = 4\% + [(12\% - 4\%)/20\%] \times 16\% = 10.4\%$ , so by moving her to the CML, we can increase her expected return. Or, for a portfolio with  $Er_C = 10 = 4\% + [(12\% - 4\%)/20\%] \xi \sigma_C$  should have a risk of  $\sigma_C = 15\%$ , so we could decrease her risk.**
  - Her portfolio can't be improved upon. According to the CAPM, it shouldn't exist.
17. ABC has a  $\beta = 1.2$ , we estimate the market risk premium as  $Er_M - r_f = 9\%$ ; the current risk-free rate is  $r_f = 6\%$ . ABC has just paid its annual dividend of \$2 per share. This dividend is expected to grow at 4% per year indefinitely. Using the constant-growth valuation model, a share of ABC stock should sell for
- 16.25  
 $Er_i = r_f + \beta_i(Er_M - r_f) = 6 + 1.2(9) = 16.8$ ;  $D_1 = D_0(1+g) = 2(1.04) = 2.08$ ;  
 $P_0 = D_1/(k-g) = 2.08/(0.168 - 0.04) = 17.93$
  - 17.24
  - 17.10
  - 18.25
18. ABC has a  $\beta = 1.5$ , we estimate the market risk premium as  $Er_M - r_f = 9\%$ ; the current risk-free rate is  $r_f = 5\%$ . ABC is expected to pay a dividend one year from now of \$3 per share. Using the constant-growth valuation model, what growth rate is required to justify a share price of \$30?
- 8.0%
  - 10.0%
  - 9.5%
  - 8.5%  $Er_i = r_f + \beta_i(Er_M - r_f) = 5 + 1.5(9) = 18.5$ ;  $30 = 3/(0.185 - g) \Rightarrow (0.185 - g) = 0.10 \Rightarrow g = 8.5\%$