Lecture Notes 10: Practice Midterm Examination

A few remarks before you start:

- During the actual exam, I will approach each student to sign his/her name on the class roster. Every student must sign his/her name, and only those who will sign will have their exam graded.
- Note that the 2 market tracking questions on this exam may not make much sense to you, or may be difficult to answer, as the patterns they relate to were pronounced during a different period. Still they are the type of questions you may encounter.
- If you get 23 correct answers in 120 minutes, it is excellent. 18 is very good. In fact, 13 correct answers is a good score and usually should put you safely within the B range.
- The rest of this page is very similar to what you will have on the actual exam, so make sure you read it before taking the midterm.

No exams can be taken outside the exam room.

Please write your name and I.D. number on the bottom of this page and on the bottom of last page (p.13), and sign the Honor Code Statement on the next page (read it now, to save you time during the actual midterm, as you will have to sign the same statement then). Make sure your exam contains 13 pages.

This is a closed-book exam. You are allowed to take into the exam a calculator(s) (no laptop/notebook computers) and a 8.5”×11” sheet of paper with formulas (no sample problems, no copies of notes or book pages).

Please write your name and I.D. number on your formula sheet and hand it in at the end of the exam.

You have 120 minutes to answer all the questions. Allocate the time wisely.

Please mark the correct answers on page 13. Only this page will be graded. (circle the appropriate letter, or mark it with an X). There is no penalty for wrong answers.

For each question, choose the single best answer out of those given in items a. to e. (i.e., the answer most accurate qualitatively, or the closest numerically, to what you think is the correct answer based on the material covered in class and in the readings).

Good Luck!

NAME (Please Print): _______________________________

I.D. Number: ____________________
MBA HONOR CODE

I will not lie, cheat or steal to gain an academic advantage, or tolerate those who do.

The Stern community believes that honesty and integrity are qualities necessary for rewarding academic and professional experiences. These qualities form the basis for the strong trust among all members of the academic community (students, faculty, and administrators) that is essential for excellence in education. The purpose of the Honor Code is therefore to express a commitment to promote principles of honesty, integrity and trust among Stern students. Therefore, prior to entering the program, each student is asked to commit to the principles of this Honor Code and by signing the Honor Code agrees to abide by the Code.

The Honor Code requires that each student act with integrity in all academic activities and that each student endeavors to hold his or her peers to the same standard.

Violations of the Honor Code include:

- Lying - Lying includes knowingly communicating an untruth in order to gain an unfair academic advantage or omitting to state a true statement when under the circumstances a person of integrity would be expected to disclose a matter.

- Cheating - Cheating includes using unauthorized materials to complete an assignment; copying the work of another student, or representing another’s work as one’s own work (plagiarism); falsifying one’s identity by having someone take an exam; unauthorized providing of materials or information to others during exams; and any other activity which gives a student an unfair academic advantage. All communications, written, oral or otherwise, among students during examinations, as are forbidden, as is the use of notes, books, calculators or other written material except when approved by the instructor.

- Stealing - Students are required to submit their own work. Ideas, data, direct quotations, paraphrasing, or any other incorporation of the work of others must be clearly referenced. To do otherwise constitutes plagiarism, which is using the work of another without giving proper credit.

This list is not inclusive, and is included for illustrative purposes.

Upon witnessing a violation of the Honor Code, a student has a moral obligation to inform the student whose conduct is believed to be in violation of the Code that the Code has been violated. Each member of the Stern community, as a person of integrity, has a personal obligation to adhere to this requirement. The student also has the right to inform a member of the faculty, and/or may submit a written complaint to the MBA Judiciary Committee.

Violations of this agreement to be governed by the Honor Code are viewed as serious matters that are subject to disciplinary sanctions imposed by the MBA Judiciary Committee of the Stern School, which is comprised of five MBA students and two faculty.

I affirm that I have read and understand the above.

Signature ______________________________________
1. The organized stock exchanges are examples of
   a. uniform-priced auctions (same price for different limit orders for XYZ if executed at the same time)
   b. discriminating-price auctions (different limit orders for XYZ are executed at the same time at different prices)
   c. secondary markets
   d. a and c above
   e. b and c above

2. Consider a single premium deferred annuity (SPDA), which costs $28,765.5 and promises annual payments of $20,000 beginning 21 years from now. If the advertised EAR for the SPDA is 9%, how many payments must the SPDA make?
   a. 11
   b. 12
   c. 13
   d. 14
   e. 15

3. Your local S&L provides you with the following information concerning a possible single payment loan. You pay 2 "points" (1 point = 1%) up front, and the interest rate you are charged is 10%. If you borrow $4,000 for one year on these terms, at what rate are you actually borrowing.
   a. 10.59%
   b. 11.04%
   c. 11.20%
   d. 12.24%
   e. 12.48%
4. The company Mr. Z works for will deposit $600 at the end of each month into his retirement fund. Interest is compounded monthly. Mr. Z plans to retire 15 years from now and estimate that he will need $2,000 per month out of the account for the next 20 years (after retirement). If the account pays 8.0% APR compounded monthly, how much does Mr. Z need to put into the account in addition to his company deposit in order to meet his objective?
   a. $0.00
   b. $57.59
   c. $90.99
   d. $95.88
   e. $104.49

5. If you deposit $2,500 at the end of each six months into an account which earns 5.5% interest compounded quarterly, how much will be in the account in 5 years?
   a. $13,953
   b. $16,931
   c. $26,605
   d. $28,357
   e. $32,188

6. When you were born, your dear old Aunt Minnie promised to deposit $1,000 into a savings account, bearing a 5% effective annual rate, on each birthday, beginning with your first. You have just turned 22 and want the dough. However, it turns out that dear old (forgetful) aunt Minnie made no deposits on your fifth and eleventh birthdays. How much is in the account right now?
   a. $31,976
   b. $34,503
   c. $43,888
   d. $47,983
   e. $51,889
7. A T-bill has a face value of $10,000 and is selling for $9,800. If the T-bill matures in 90 days, what is its effective annual yield?
   a. 8.16%
   b. 2.04%
   c. 8.53%
   d. 6.12%
   e. 8.42%

8. A coupon bond that pays interest of $100 annually has a par value of $1,000, matures in 5 years, and is selling today at a $72 discount from par value. The yield to maturity on this bond is
   a. 6.00%
   b. 8.33%
   c. 10.39%
   d. 12.00%
   e. 60.00%

9. Based on weekly market tracking from the first week of the Semester to the pre-midterm week, the yield of a 10-year T-bond behaved as follows over time:
   a. slightly decreased and then significantly increased
   b. significantly increased and then slightly decreased
   c. decreased and increased about the same number of times
   d. steadily increased and never decreased
   e. none of the above
10. An NYSE specialist’s order book and bid/ask prices for PQR stock are given by the following table:

<table>
<thead>
<tr>
<th>PQR Price</th>
<th>Limit Buy</th>
<th>Limit Sell</th>
<th>Specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td>100.87</td>
<td>100 sh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100.75</td>
<td>100 sh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100.62</td>
<td></td>
<td></td>
<td>ask</td>
</tr>
<tr>
<td>100.50</td>
<td>100 sh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100.37</td>
<td>100 sh</td>
<td></td>
<td>bid</td>
</tr>
<tr>
<td>100.25</td>
<td>100 sh</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A market buy order or a market sell order, each for 100 shares, may come in. Then,

a. a market buy will be executed at 100.87 and a market sell at 100.75
b. a market buy will be executed at 100.87 and a market sell at 100.25
c. a market buy will be executed at 100.62 and a market sell at 100.50
d. a market buy will be executed at 100.62 and a market sell at 100.37
e. a market buy will be executed at 100.50 and a market sell at 100.37

11. Exactly one year ago XYZ stock had just run up from $12 per share to $25 per share. Then, (one year ago) with a net worth of $20,000, you bought $40,000 worth of XYZ stock on margin at $25 per share. The rate at which your broker would lend to you was 8.5% (EAR). The stock recently declared its first dividend: $1 per share. (The dividend is payable in 10 days. The ex-dividend date is tomorrow.) The stock is presently trading at $27 per share. Commissions are $0.50 per share (each way, i.e., when buying and when selling a share), but paid when you close the position. If you close out your position today, what is your total profit or loss on the entire transaction?

a. Profit of $1500
b. Profit of $1400
c. Profit of $43,200
d. Loss of $100
e. Loss of $1600
12. Based on weekly market tracking from the first week of the Semester to the pre-midterm week, an investor who shorted 100 shares of IBM on the Thursday of the first week of the Semester and earned a 3-month T-bill rate on the proceeds, and then closed the position on the Thursday of the pre-midterm week, has (ignoring commissions and dividends):
   a. a loss of more than $1,000, but less than $10,000
   b. a loss of more than $10,000
   c. neither lost nor gained more than $100
   d. a profit of more than $10,000
   e. a profit of more than $1,000 but less than $10,000

13. Consider the following data for QRS stock, and its fourth quarter dividend (1/29 is Friday):
   Date:   1/29  2/1  2/2  2/3  2/4
   Closing price: $41  $42.5  $41.125  $41.75  $43.25
   Dividend per share is $0.50:
   Declared  Ex-date  Record date  Payable Date
   1/20  2/1  2/3  3/5
   The daily rates of return on QRS stock (buy at the close of the previous business day and sell on the close of the current day) for 2/1 and 2/2, respectively, are
   a. 3.66%, -3.24%
   b. 3.58%, -2.06%
   c. 4.88%, -2.06%
   d. 4.88%, -3.24%
   e. 3.66%, -2.08%
14. Mr. X, who has mean-variance preferences, considers the following two funds:
   Sure-thing fund:  Expected Return=16%, Standard Deviation of Return=15%
   Sure-bet fund:  Expected Return=12%, Standard Deviation of Return=8%
   The correlation between the funds’ returns is 0.7, and T-bill rate is 8%.  Mr. X forms portfolio Y using the two funds, and then combines Y with T-bills.  The weights of the funds within Y are:
   a. 43.56% in Sure-thing fund and 56.44% in Sure-bet fund
   b. 56.44% in Sure-thing fund and 43.56% in Sure-bet fund
   c. 39.62% in Sure-thing fund and 60.38% in Sure-bet fund
   d. 60.38% in Sure-thing fund and 39.62% in Sure-bet fund
   e. 50.00% in Sure-thing fund and 50.00% in Sure-bet fund

15. For the portfolio Y in the previous question (the portfolio formed by Mr. X), the standard deviation of portfolio Y’s return is:
   a. 11.50%
   b. 11.16%
   c. 10.69%
   d. 10.43%
   e. 10.22%
16. Mrs. R is using a model of expected returns, where the expected return next year depends on the current value of the variable TRM (which measures a yield spread, defined as the yield on a 30-year T-bond minus the yield on a 1-year T-note). Given the value of TRM, the expected one-year return on stock $i$ is

$$\gamma_i + \delta_i \text{TRM},$$

where TRM is in percentage points.

For (risky) stocks $A$, $B$, and $C$, Mrs. R finds that $\gamma_A = 1\%$, $\gamma_B = 2\%$, $\gamma_C = 3\%$, $\delta_A = 2$, $\delta_B = 1$, $\delta_C = 3$.

When T-bond’s annual yield is 6% and T-note’s annual yield is 5%, based on Mrs. R’s model, the expected returns on $A$ and $B$ satisfy:

a. $A$ is expected to have a higher return than $B$
b. $B$ is expected to have a higher return than $A$
c. $A$ and $B$ are expected to have returns above 5%
d. $A$ and $B$ are expected to have the same return
e. The model can be used only for one of the stocks but not for both $A$ and $B$

17. Use the data in the previous question, and note that our risk averse Mrs. R (who uses the above model for conditional expectations) realizes that she has mean-variance preferences. She also has an investment horizon of one year and wants to construct a portfolio from either (i) 1-year T-notes and stock $A$ only, or (ii) 1-year T-notes and stock $C$ only.

a. in case (i) she will short $A$, in case (ii) she will short $C$
b. in case (i) she will long $A$, in case (ii) she will short $C$
c. in case (i) she will short $A$, in case (ii) she will long $C$
d. in case (i) she will long $A$, in case (ii) she will long $C$
e. Need to know more about Mrs. R’s preferences and to know the standard deviation of $A$ and $C$ to be able to describe Mrs. R’s portfolio strategy.
18. Consider the following $W, X, Y, Z$ portfolios, all four positioned on a given mean-variance plane. Which one out of that group cannot lie on the efficient frontier (in that plane) as described by Markowitz?
   a. portfolio $W$ with expected return 15%, standard deviation 36%
   b. portfolio $X$ with expected return 12%, standard deviation 15%
   c. portfolio $Z$ with expected return 5%, standard deviation 7%
   d. portfolio $Y$ with expected return 9%, standard deviation 21%
   e. all the portfolios above can lie on the efficient frontier

19. Stocks $A, B,$ and $C$ have the same expected return and standard deviation. The following table shows the correlations between the returns on these stocks:

<table>
<thead>
<tr>
<th></th>
<th>Stock $A$</th>
<th>Stock $B$</th>
<th>Stock $C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock $A$</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock $B$</td>
<td>0.9</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Stock $C$</td>
<td>0.1</td>
<td>-0.4</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Given these correlations, a portfolio with the lowest total risk (among the following) is
   a. equally invested in stocks $A$ and $B$
   b. equally invested in stocks $A$ and $C$
   c. equally invested in stocks $B$ and $C$
   d. totally invested in stock $C$
   e. same total risk for all the above

20. Suppose you held a well-diversified portfolio with a very large number of securities, and that the single index model holds. If the standard deviation of your portfolio’s return was 0.20 and the standard deviation of the index return was 0.16, the beta of the portfolio would be approximately
   a. 0.78
   b. 1.25
   c. 1.53
   d. 2.01
   e. none of the above
• Use the following information in questions 21, 22, and 23:
The expected rate of return on the market portfolio is 13%, and the standard deviation of market’s return is 10%. The riskless rate is 5%. Consider two assets, $Q$ and $R$, for which you (correctly) estimated that $\sigma_Q = 5\%, \beta_{QM} = 0.5, E_Q = 9\%, \sigma_R = 8\%, \beta_{RM} = 0.5, E_R = 9\%$.

21. Compared to the implications of the CAPM,
   a. asset $Q$ is overpriced, asset $R$ is underpriced
   b. asset $Q$ is underpriced, asset $R$ is overpriced
   c. both are fairly priced
   d. both are overpriced
   e. both are underpriced

22. Investors with mean-variance preferences (who behave according to the assumptions of the CAPM) could hold as their entire portfolio
   a. asset $Q$, but not asset $R$
   b. asset $R$, but not asset $Q$
   c. either $Q$ or $R$
   d. neither $Q$ nor $R$
   e. cannot answer without specifying investors’ risk aversion.

23. Regarding the comovements of asset’s $Q$ and $R$ returns with the market, as measured by the correlation with the market’s return,
   a. asset $Q$ has a lower correlation than asset $R$ with the market
   b. asset $R$ has a lower correlation than asset $Q$ with the market
   c. both have same correlations with the market
   d. both are independent of the market
   e. cannot analyze correlation with the market without determining overpricing/underpricing
24. In a world where the CAPM assumptions hold for any stock \( j \), \( j = 1, \ldots, n \), and for any investor ("CAPM world"), you run the market-model regression using excess returns (returns in excess of the riskless rate):

\[
R_j = \alpha_j + \beta_j R_M + \epsilon_j
\]

You find that:

a. \( \alpha_j \) varies across stocks, capturing firm specific variations, and can take any value
b. \( \alpha_j \) varies across stocks, capturing unique as well as systematic variations, and can take any value
c. \( \alpha_j \) is strictly positive for all stocks
d. \( \alpha_j \) is zero for all stocks
e. \( \alpha_j \) is strictly negative for all stocks

25. In the CAPM world (as in question 24 above), you meet an investor who holds asset Z as his total portfolio, where \( E_z = 12\% \), \( \sigma_z = 8\% \). \( r_f \) is 6\%, and \( E_M = 15\% \). Asset Y has \( \beta_{YM} = 0.5 \) and \( \sigma_y = 8\% \). The correlation between asset’s Y return and the market return is

a. 0.75  
b. 1.00  
c. 1.25  
d. 0.25  
e. –0.25
Mark your answers on this page:

1. (a) (b) (c) (d) (e)
2. (a) (b) (c) (d) (e)
3. (a) (b) (c) (d) (e)
4. (a) (b) (c) (d) (e)
5. (a) (b) (c) (d) (e)
6. (a) (b) (c) (d) (e)
7. (a) (b) (c) (d) (e)
8. (a) (b) (c) (d) (e)
9. (a) (b) (c) (d) (e)
10. (a) (b) (c) (d) (e)
11. (a) (b) (c) (d) (e)
12. (a) (b) (c) (d) (e)
13. (a) (b) (c) (d) (e)
14. (a) (b) (c) (d) (e)
15. (a) (b) (c) (d) (e)
16. (a) (b) (c) (d) (e)
17. (a) (b) (c) (d) (e)
18. (a) (b) (c) (d) (e)
19. (a) (b) (c) (d) (e)
20. (a) (b) (c) (d) (e)
21. (a) (b) (c) (d) (e)
22. (a) (b) (c) (d) (e)
23. (a) (b) (c) (d) (e)
24. (a) (b) (c) (d) (e)
25. (a) (b) (c) (d) (e)

NAME (Please Print): _______________________________

I.D. Number: _____________________
Midterm Solution [You should solve the problems before peeking here!]

1. (d)

2. (e) \( C_{20} = 28765.5 \times FVIF(0.09,20) = 161,213.68 \)
   \( C_{20} = 20,000 \times APVF(0.09, t) = 20,000 \times [1-(1.09)^{-t}] / 0.09 \)
   Now can use your financial calculator to get \( t \)
   (e.g., on hp10B: - 161,213.68 PV, 0 FV, 20,000 PMT, 9 I/YR, entering N yields 15).
   Alternatively: \( t = -\ln(1-161,213.68 \times 0.09 / 20,000 )/\ln(1.09) = 15 \)

3. (d) Proceeds = $4,000 \times 0.98 = 3,920.
   \( 3,920 = 4,000 \times 1.1 / (1 + r) \). So, \( r = 0.1224 \).

4. (c) Need = \( 2,000 \times [(1-(1 + 0.08/12)^{-240}) / (0.08/12) = $239,108.58 \)
   \( 239,108.58 = C \times [1+(0.08/12)^{180} - 1] / (0.08/12) \). So \( C=690.99 \),
   and Mr. Z must pay 690.99 – 600 = $90.99 more.

5. (d) \( EAR = (1 + 0.055/4)^4 – 1 = 5.61\% \)
   Semiannual rate = \( 1.0561^{0.5} – 1 = 2.77\% \),
   so \( FV = 2,500 \times (1.0277^{10} – 1) / 0.0277 = $28,357 \)

6. (b) \( FV = 1,000 \times (1.05^{22} – 1) / 0.05 = $38,505. \)
    \( 38,505 – 1,000 \times 1.05^{17} – 1,000 \times 1.05^{11} = $34,503 \)

7. (c) \( (10,000 - 9,800) / 9,800 = 0.020408 \); \( 1.020408^{365/360} – 1 = 8.53 \)

8. (d) Use the financial calculator with 1,000 FV, 100 PMT, 5 N, -928 PV, then
   I /YR gives 11.997%.

9. See your market-tracking data...

10. (c) A market buy will be executed at 100.62, lower of ask and lowest limit sell.
    A market sell will be executed at 100.50, higher of bid and highest limit buy.

11. (d) Dividend is not due to you until tomorrow and so is irrelevant; the price run-up
    prior to purchase is also irrelevant. Therefore,
    Borrow at 8.5% one year ago: \( +20,000 \)
    Buy 1600 shares of XYZ, at $25 each, one year ago: \( -40,000 \)
    Repay loan ($20,000 \times 1.085) today: \( -21,700 \)
    Sell shares of XYZ, at $27 each, today: \( +43,200 \)
    Commission (2 \times 1600 \times $0.50): \( -1,600 \)
    Total Profit \( -100 \)

12. See your market-tracking data...
13. (d) 2/1 return: \( \frac{(42.5 + 0.5 - 41)}{41} = 0.0488 \)
   2/2 return: \( \frac{(41.125 - 42.5)}{42.5} = -0.0324 \)

14. (a) Asset 1 is the Sure-thing fund, asset 2 is the sure-bet fund. \( \sigma_{12} = 0.7 \times 15 \times 8 = 84. \)
    \( \sigma_1^2 = 15 \times 15 = 225, E[R_1] = 16-8 = 8. \)
    \( \sigma_2^2 = 8 \times 8 = 64, E[R_2] = 12-8 = 4. \)
    \( w_1 = \frac{(64 \times 8 - 84 \times 4)}{(64 \times 8 - 84 \times 4 + 225 \times 4 - 84 \times 8)} = 0.4356. \) So \( w_2 = 0.5644. \)

15. (e) \( \sigma_Y^2 = 0.4356^2 \times 225 + 0.5644^2 \times 64 + 2 \times 0.4356 \times 0.5644 \times 84 = 104.383. \)

16. (d) Conditional on TRM = 6-5 = 1: \( E_A = 1 + 2 \times 1 = 3\%, E_B = 2 + 1 \times 1 = 3\%. \)

17. (c) the riskless rate is that of the T-note: \( r_f = 5\%. \) Given TRM, \( E_C = 3 + 3 \times 1 = 6\%. \)
    Mrs. R wants to choose a portfolio that lies on the positive-sloped portion of the portfolio possibility curve. Since, given TRM, \( E_A < r_f, \) but \( E_C > r_f, \) regardless of the (non-zero) standard deviation of \( A \) and \( C \) returns and the degree of risk aversion, in case (i) will short \( A \) but in case (ii) will long \( C. \)

18. (d) from BKM p.244 problem 21

19. (c) from BKM p.244 problem 26

20. (b) \( \sigma_p^2 / \sigma_i^2 = \beta_i^2. \) So \( \beta_i^2 = (0.2)^2 / (0.16)^2 = 1.56, \) and \( \beta = 1.25. \)

21. (c) \( 0.05 + 0.5 (0.13 - 0.05) = 0.05 + 0.04 = 0.09 \) for \( Q \) and \( R \)

22. (a) \( 0.05 + [(0.13 - 0.05) / 0.1] \times 0.05 = 0.09, \) so \( Q \) lies on the CML and the SML
    \( 0.05 + [(0.13 - 0.05) / 0.1] \times 0.08 = 0.114 > 0.09, \) so \( R \) does not lie on the CML.
    In other words, \( R \) is not mean-variance efficient.

23. (b) Recall, \( \rho_{p,M} = \beta_{p,M} \sigma_M / \sigma_p. \)
    So, \( \rho_{Q,M} = 0.5 \times 0.1 / 0.05 = 1, \) which is greater than \( \rho_{R,M} = 0.5 \times 0.1 / 0.08 = 0.625 \)

24. (d) The market model here assumes that \( R_j = \alpha_j + \beta_j R_M + e_j. \)
    That is \( r_j - r_f = \alpha_j + \beta_j (r_{M} - r_f) + e_j. \) So, \( E[r_j] = r_f + \alpha_j + \beta_j (E[r_M] - r_f). \)
    On the other hand, the CAPM states that \( E[r_j] = r_f + \beta_j (E[r_M] - r_f). \)
    Hence for both to be consistent, must have \( \alpha_j = 0. \)

25. (a) Since \( Z \) is held by an investor as a total (complete) portfolio, \( Z \) must lie on the CML. So \( 12 = 6 + (15 - 6) \times 8 / \sigma_M. \) That is, \( \sigma_M = 12\%. \)
    \( \rho_{YM} = \beta_{YM} \sigma_M / \sigma_Y = 0.5 \times 12 / 8 = 0.75. \)