NEW YORK UNIVERSITY
Stern School of Business

B40.3331 Instructor: John Teall
Equity Instruments and Markets Summer Term 2007

Mid-Term Exam, Sample Version 1
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1. Describe why an individual might argue that the specialist system used by national exchanges (NYSE, ASE) puts the specialist in a position involving a conflict of interest?

2. One theory explaining IPO returns is that the underwriter obtains information on the issuing company from prospective stock purchasers. Elaborate on this theory, explaining how and what type of information might be obtained and why this might justify abnormal returns to IPO investors. How do issuing firms benefit from the process that grants IPO investors abnormal returns if this theory is correct?

3. What is the function of the Depository Trust Corporation?

4. a. Describe differences between a call market system and a continuous market.
   b. Under what circumstances might you expect a call system to be more practical than a continuous market?

5. What were the provisions of the so-called Buttonwood Agreement?

6. In a perfectly efficient capital market, is it possible for a high-risk security to have a higher NPV (Net Present Value: Present value less initial cash investment) than a low risk security? Why or why not?

7. Shiv et al [2005] studied the relative abilities of brain-damaged study participants to make gambling decisions. Describe the methodology and results of their study, along with potential implications for investing.

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8. In our discussion of Prospect Theory, we considered the following choice of gambles:

Gamble A: .33 probability of receiving 2,500, .66 of receiving 2400 and .01 of receiving 0
Gamble B: 100% probability of receiving 2,400

and

Gamble A*: .33 probability of receiving 2,500, .67 of receiving 0
Gamble B*: .34 probability of receiving 2,400 and .66 of receiving 0

Demonstrate that if an investor is indifferent between Gambles A and B, he must be indifferent to A* and B* in order to fulfill the *Strong Independence axiom* identified by von Neumann and Morgenstern.

9. Estimate the implied volatility (standard deviation) for the following call: $c_0 = 10$, $S_0 = 25$, $T = .5$, $X = 35$ and $r_f = .10$. Your answer should be within .03.

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1. The specialist is responsible for maintaining an orderly, liquid, continuous market for the securities in which he specializes. He is "in charge" of the auction for these securities. At the same time, he is expected to purchase and sell securities on his own account, keeping any profits his trades earn. The specialist might be able to profit by neglecting his duty to maintain an orderly, liquid and continuous market.

2. Neither issuing firms nor underwriters know the true value for an IPO. However, all participants, including prospective purchasers of the IPO bring to the market information that might be useful in the price-setting process. Prospective purchasers of the IPO provide useful information in the price-setting process through the sizes of the purchase orders that they submit.

3. The primary function of the Depository Trust Corporation is to simplify the paperwork and record keeping associated with stock ownership and transfer. It holds stock certificates of member firms, registering them in member names and maintaining computerized records of ownership. Ownership transfers are accomplished with book entries.

4. a. A call system exists where a security is traded only once or a few times a day based on orders for a security being accumulated until the market is called for execution of transactions. Trades executed in the same market are at the same price. Either a written or verbal call trading system may be used. Exchanges may allow for continuous trading for after call market trading. If there is an imbalance in a verbal call system, the clerk continues to cry out prices until it appears that the market will clear. A continuous market allows securities to trade continuously throughout the day. The purpose of the continuous market is to provide for continuous liquidity for the security.
b. The call market may provide for better price discovery when markets are illiquid, when there are few participants in the market or when securities are traded infrequently.

5. The Buttonwood Agreement provided for the formation of what was to become the New York Stock Exchange. It fixed brokerage commissions among its signatories and prohibited off-board trading (i.e., traders and brokers were to trade only with each other).

6. No - In a perfectly efficient market, all securities have zero NPV (by definition of a perfectly efficient market).

7. This study gathered 19 subjects that had incurred damage (stable focal lesions) to parts of their brains impairing their abilities to process emotions. The subjects were asked to participate in a series of gambles along with two control groups, one that had experienced no brain damage and a second group that had experienced some other type of brain damage. Each study participant was asked to participate in a sequential series of 20 gambles, betting $1 against a 50/50 chance at either

0 or $2.50. The expected value of each gamble was $1.25, $.25 higher than its cost. The subjects experiencing damage to their emotional circuitry bet more consistently than their "normal" counterparts and earned more money. The performance differences were more pronounced after non-impaired subjects experienced losses, making them even more reluctant to take advantage of expected wealth-increasing gambles. The performance of the emotionally damaged group compared favorably to the control group of participants who had experienced no brain damage and to the second control group who had experienced unrelated types of brain damage. A potential implication of this study is that emotions may impair investors' abilities to respond rationally to situations involving risk, particularly after experiencing series of losses.

8.++ First, since a .66 probability of a $2,400 payout is being shifted to 0 from A and B to A* and B*, we will rewrite the statement of gamble payoffs as follows:

Gamble A: .33 probability of receiving 2,500, .66 of receiving $2,400 and .01 of receiving 0
Gamble B: .34 probability of receiving 2,400 and .66 of receiving $2,400

and

Gamble A*: .33 probability of receiving 2,500, .01 of receiving 0 and .66 of receiving 0
Gamble B*: .34 probability of receiving 2,400 and .66 of receiving 0

The investor is indifferent between Gambles A and B. Recall that the Strong Independence axiom states that if $x_j \succ x_k$, then for any $\alpha \in [0,1]$, $\alpha x_i + (1-\alpha)x_k \sim \alpha x_j + (1-\alpha)x_k$. This Strong Independence axiom implies that for any $\alpha \in [0,1]$:

α(.33 prob. of receiving 2,500 and .01 of receiving 0) + (1-α)(.66 prob. of receiving 2,400)
$\sim \alpha$(.34 prob. of receiving 2,400) + (1-α)(.66 prob. of receiving 2,400),

which implies that:

(.33 prob. of receiving 2,500 and .01 of receiving 0) ~ (.34 prob. of receiving 2,400)

The same decomposition for Gambles A* and B* results in:

Gamble A*: α(.33 prob. of receiving 2,500, .01 of receiving 0) + (1-α)(.66 prob. of receiving 0)
Gamble B*: α(.34 prob. of receiving 2,400) + (1-α)(.66 prob. of receiving 0),

Which, by the same strong independence axiom, reduces to a comparison between:

Gamble A*: (.33 prob. of receiving 2,500 and .01 of receiving 0)
Gamble B*: (.34 prob. of receiving 2,400)

9. Try an initial guess for standard deviation, say, equal to .5 to plug into the Black-Scholes formula. This results in a Black-Scholes call value equal to 1.93, smaller than the $10 we want. Try a much larger estimate for standard deviation, say 1.15, or 115%. This produces a call value

estimate that is too large, but closer to $10. We interpolate, attempting a solution closer to 1.15. For example, we try an estimate, say, 1.067, and determine that this seems quite close. We verify that it is sufficiently close by determining that 1.097 is too large and 1.037 is too small. Note that the difference between the high and low ends of our range is .06, twice our margin of error.

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1. Is it possible for a market to be weak form efficient and not semi-strong form efficient? If so, when? If not, why?

2. What are the three models of normal returns discussed by Brown and Warner in their analysis of event study methodologies? Describe them.

3. Answer each of the following with one word only: True or false:
   a. The two-stage model cannot be used when the discount rate for the first stage cash flows is lower than the growth rate for the first stage cash flows.
   b. The two-stage model cannot be used when the discount rate for the second stage cash flows is lower than the growth rate for the second stage cash flows.
   c. Negative EPS for peer group firms will tend to bias downward their P/E multiples, causing a downward bias in the value estimate for the subject firm unless appropriate adjustments are made.

4. Your analysis reveals that a particular company's stock realizes 285 runs in each series of 900 closing prices. When price declines occur, they tend to be no larger or smaller than price increases when they occur. You believe that this runs test on historical data is statistically significant. Furthermore, you believe that this same relationship between closing prices and prior day closing prices will prevail in the future. Assume that you will trade for short-term profits if you are able to forecast one-day returns. What transaction (buy or sell) should you execute on the day following a price decline?

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5. Suppose an investor has the opportunity to invest in a stock currently selling for $85 per share. The stock is expected to pay a $3 dividend next year (at the end of year 1). In each subsequent year until the start of the fifth year, the annual dividend is expected to grow at an annual rate of 20%. Starting at the end of the fifth year, the annual dividend is anticipated grow at an annual rate of 10% through the eighth year. Starting at the end of the ninth year, dividends are anticipated to grow at an annual rate of 1%. All cash flows are to be discounted at an annual rate of 7%. Should the stock be purchased at its current price?

6. The Berger Publishing Company in its last fiscal year realized revenues equal to $1,000,000 and operating costs equal to $1,400,000. However, a takeover of Berger by another publishing or printing company should result in labor efficiencies that would reduce Berger Company's operating costs to $1,200,000 per year. Furthermore, projects in development should result in Berger's revenues growing at an annual rate of 10% indefinitely. Assume that target and prospective acquiring companies operate in a 40% tax bracket and discount all of their cash flows at an annual rate of 12%. What is the present value of Berger as a takeover candidate?

7. The Pamplin Company, which has $30,000,000 in assets, intends to take over Stern Corp., which has $10,000,000 in assets. Pamplin has $20,000,000 in zero coupon debt maturing in three years and Stern has $5,000,000 in zero coupon debt maturing in three years. The combination is expected to generate $2,000,000 in cost-reducing synergies. Assume that all Black-Scholes assumptions apply to each of the two firms and their securities. The standard deviations of asset returns for Pamplin and Stern's are, respectively, .5 and .7 and the synergies will have no impact on either the individual or combined firm standard deviations. The riskless return rate is currently .05. The correlation coefficient between asset returns for the two firms is .1. What will be the post merger debt and equity values of the combined firm? By how much will the merger change overall equity value? Is it possible for shareholders of both firms to benefit from the takeover?

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1. Yes: When prices cannot be forecast based on their historical sequences but prices do reflect other public announcements or public information of some other type.

2.a. *Mean Adjusted Returns*: The normal return for a security equals a constant K_i. Typically, the mean return for the security over a sampling of time periods outside of the testing period serves as the constant K_i. The expected return for the security is assumed to be constant over time, though ex-ante returns will vary among securities. Thus, the abnormal return for the security is found: $\varepsilon_{i,t} = R_{i,t} - K_i$.

b. *Market Adjusted Returns*: The normal return for a security at a given point in time equals the market return for that period. The expected returns for all securities are assumed to be the same during a given period, though they vary over time. Abnormal returns are found: $\varepsilon_{i,t} = R_{i,t} - R_{m,t}$.

c. *Market and Risk Adjusted Returns*: Here, normal returns are assumed to be generated by a single index model. Typically, security returns are linearly related to market returns through stock betas. These risk-adjusted returns vary across securities and over time. Abnormal returns may be determined: $\varepsilon_{i,t} = R_{i,t} - \beta_i(R_{m,t}-r_{f,t})$.

3.a. False
b. True
c. True

4. The number of runs associated with a set of 900 uncorrelated prices equals (899+1)/2 = 450. 285 runs is significantly less, implying that there exists a positive intertemporal correlation in stock prices. Hence, I should expect a price decrease on the day following a price decline. Hence, I should sell stock at the open on the day following a price decline.

5.The following Three Stage Growth Model can be used to evaluate this stock:

$$P_0 = DIV_1\left[\frac{1}{k-g_1} - \frac{(1+g_1)^{n(1)}}{(k-g_1)(1+k)^{n(1)}}\right] + DIV_1\left[\frac{(1+g_1)^{n(1)-1}(1+g_2)}{(1+k)^{n(1)}(k-g_2)} - \frac{(1+g_1)^{n(1)-1}(1+g_2)^{n(2)-n(1)+1}}{(k-g_2)(1+k)^{n(2)}}\right]$$

$$+ \frac{DIV_1(1+g_1)^{n(1)-1}(1+g_2)^{n(2)-n(1)}(1+g_3)}{(k-g_3)(1+k)^{n(2)}}$$

$$P_0 = \$3\left[\frac{1}{.07-.20} - \frac{(1+.20)^4}{(.07-.20)(1+.07)^4}\right] + \$3\left[\frac{(1+.20)^{4-1}(1+.10)}{(1+.07)^4(.07-.10)} - \frac{(1+.20)^{4-1}(1+.10)^{8-4+1}}{(.07-.10)(1+.07)^8}\right]$$

$$+ \frac{\$3(1+.20)^{4-1}(1+.10)^{8-4}(1+.01)^1}{(.07-.01)(1+.07)^8} = 104.748$$

Note that the definition for n(2) is a little different from before in the formula; the numbers should work out to b the same. Since the $85 purchase price of the stock is less than its $104.748 value, the stock should be purchased.

6. [(-1,200,000)(1-.4)/(.12)] + [1,000,000(1-.4)*(1 + .10)]/[.12-.10]
= - 6,000,000 + 33,000,000 = 27,000,000

7. Inputs are as follows:

Pamplin:
t = 3 r_f = .05
X =20,000,000 S_0 = 30,000,000
σ = .5 σ^2 = .25

Stern:
t = 3 rf = .05
X =5,000,000 S_0 = 10,000,000
σ = .7 σ^2 = .49

Computations are as follows:

Pamplin:
d_1 = 1.074 $N(d_1)$ = .859
d_2 = .208 $N(d_2)$ = .583
c_0 = $15,732,553 = equity value
p_0 = $2,946,713
D = $17,214,161 - $2,946,713 = $14,267,447

Stern:
d_1 = 1.3016 $N(d_1)$ = .903
d_2 = .089 $N(d_2)$ = .536
c_0 = $6,730,083 = equity value
p_0 = $1,033,623
D = $4,303,541 - $1,033,623 = $3,269,917.

Using the simple two-security risk equation, we find that the combined firm standard deviation of returns equals .429 because the correlation coefficient is .1 and the weights are ¼ and ¾:

$$.429 = (.75^2 * .5^2) + (.25^2 * .7^2) + 2(.75 * .25 * .5 * .7 * .1)$$

Combined firm:

X =25,000,000 S_0 = 42,000,000 (Including synergies)

d_1 = 1.271 $N(d_1)$ = .898

d_2 = .527 $N(d_2)$ = .701

c_0 = $22,637,807 = equity value

p_0 = $2,155,506

D = $21,517,702 - $2,155,506 = $19,362,193

Note that the combined firm equity has been increased by $175,171 and creditor wealth has increased by $1,824,829. Note that the sum of the wealth increases equals $2,000,000, the value of the synergies.

Questions to Skip: Material not covered this term

8. The following table presents various data from a table of daily stock prices over time. Time periods, prices, returns, prior day returns, regression errors and squared regression errors are presented in the columns. The covariance between returns and prior day returns, the variance of prior day returns, the regression beta, the regression vertical intercept, the standard error of beta and the t-statistic are presented to the right of the table. The average of prior day returns and the sum of squared errors is presented below the table. Some data points are missing.

t	$Price_t$	$Return_t$	$Return_{t-1}$	$,_i$	$,_i^2$	
1	85	NA	NA	NA	NA	
2	84	-0.01176	NA	NA	NA	
3	85	0.01190	-0.01176	???	???	-0.00151= COV(rt, rt-1)
4	81	-0.04706	0.01190	-0.05114	0.00262	0.00243= VAR(rt-1)
5	82	0.01235	-0.04706	-0.02836	0.00080	**???**= b
6	77	-0.06098	0.01235	-0.06478	0.00420	
7	85	0.10390	-0.06098	0.05454	0.00297	0.01148= a
8	82	-0.03529	0.10390	0.01777	0.00032	
9	87	0.06098	-0.03529	0.02757	0.00076	**???**= SE(b)
10	90	0.03448	0.06098	0.06088	0.00371	**???**= t
11	87	-0.03333	0.03448	-0.02339	0.00055	
12	91	0.04598	-0.03333	0.01379	0.00019	
		Avg.R(t-1)=	0.00352	SSE=	???	

a. What is the regression beta?
b. What is the value of the missing error term and the missing error term squared?
c. What is the standard error of the beta estimate?
d. Is the beta coefficient statistically significant?
e. Evaluate the evidence for momentum/mean reversion.

8. Missing data is provided below:

$,_i$	$,_i^2$	
NA	NA	
NA	NA	
-0.00688	0.00005	-0.00151= COV(rt, rt-1)
-0.05114	0.00262	0.00243= VAR(rt-1)
-0.02836	0.00080	-0.62118= b
-0.06478	0.00420	

0.05454	0.00297	0.01148= a
0.01777	0.00032	
0.02757	0.00076	0.28831= SE(b)
0.06088	0.00371	-2.15453= t
-0.02339	0.00055	
0.01379	0.00019	
SSE=	0.01616	

a. beta is COV/VAR = -.00151/.00243 = -.62118.
b. The missing error term is R3 – a – bR2 = .01190 - .01148 –(-.62118)(-.01176) = .00688. Its squared value is .00005.
c. The SSE is .01616. Thus, se(b) is [(.01616/8)/(10*.00243)]^.5 = .28831.
d.,e.Yes. The t-statistic for b is –2.15453, statistically significant at the .05 level. Thus, there appears to be at least a 95% probability that this series of prices exhibits mean reversion. However, this particular test is its small and unrepresentative sample set. First, only one stock was used. Second, the test was based on only 10 data points, all from a single year.

10. An investor needs to invest $10,000 into a portfolio of three securities, which enables him to minimize risk while maintaining an expected return of at least 15%. The following table represents the expected returns, standard deviations and covariances for the securities:

i	$E[R_i]$	σ_i	$\sigma_{i,j}$
1	.06	0	$\sigma_{1,2}=0$
2	.11	.3	$\sigma_{1,3}=0$
3	.25	.6	$\sigma_{2,3}=0$

How much money should the investor put into each of the stocks?

10. Note that Security 1 is riskless. Solve for z2 and z3 and w2 and w3 as follows:
0.11-.06 = 0.09z2 + 0z3
0.25-.06 = 0z2 + 0.36z3
z2 = .556, z3 = .528; w2 = .513 w3 = .487
The stock portfolio return will be .513*.11 + .483*.25 = .1782. The target portfolio return is 15%. Since the target portfolio return is less than the stock portfolio return, the stock portfolio will be combined with the riskless asset with a return of 6% for this investor. Thus, we will solve the following:
.15 = wm * .1782 + (1-wm) * .06
Thus, wm = .761389 and wf = w_1 = .238611. The portfolio breaks down as follows:
w_1 = .238611 w_2 = .390455 w_3 = .370932
Thus, one should invest $2386 into security 1, $3905 into 2, and $3709 into 3 to meet the expected 15% return target.