Name

Finance II (441) Professor Eisfeldt/Pulvino/Sapienza

Corporate Finance Final: Spring 2003

1) Time limit: you have two hours to complete the exam.

2) The exam is closed book/closed note. Scratch paper and a formula sheet are provided and you may not use any outside materials except for a calculator.

3) Point totals for each question are specified in parentheses. There are 240 total points.

4) Circle your numerical answers. This makes it easier for me to find them. If you get stuck on the math, tell me what the correct answer should be based on your intuition.

5) Unless the question specifies otherwise, there are no taxes or transaction costs.

6) **As always, I expect you to abide by the honor code**. I trust that no one will give or receive assistance which gives them an unfair advantage over other students.

7) Concise answers will be rewarded.

Good Luck!

Question	Points
1 (70)	
2 (50)	
3 (60)	
4 (60)	

Final Exam

Question 1

3-Dimensional Pharmaceuticals, Inc. is a post-genomics drug discovery company that has developed a unique integration of proprietary technologies to provide an accelerated and improved methodology for "gene-to-clinic" small molecule drug discovery. The value of its current assets (investments it has already made) depends upon the feasibility of competing technologies. The assets in place are worth either $1200M or $600M. In addition the firm has an investment project that requires an initial investment of $1,000M and has a future cash flow of $1,100M, $1,200M, or $,1300M. The payoffs are shown in the following table. The probability of each state occurring is 1/3. You should assume that the manager acts in the interest of the **old** shareholders. The discount rate is zero.

	State 1	State 2	State 3	Expected
Probabilities	1/3	1/3	1/3	
Assets in Place	1200	600	600	
Investment Cost	1000	1000	1000	
CF from the investment	1100	1300	1200	
Pre-Issue Value of the firm				
Post-Issue Value of the firm				

A) The firm is currently all equity financed and there are 100 shares outstanding. Under the Modigliani and Miller assumptions, what is the stock price before the market knows the state of the world? Explain briefly (10)

B) The investment project requires an investment of $1000. Suppose that there is no asymmetry of information and the market knows that there is no asymmetry of information. If the manager decides to invest, she has to raise 1000 in equity. What is the price at which the new stock will be issued in order to raise the money to invest? Show your work. (15)

C) Based on your answer in B) what is the NPV of the equity issue in each state? (15)

D) Based on the price you found in B) is the market for 3-Dimensional Pharmaceuticals, Inc equity efficient? (15)

E) Suppose the manager knows the state before issuing and invest. What would be the optimal investment decision, under these circumstances? Explain completely. (15)

Question 2

Jackson Cleaning Services, Inc. is a small company owned by Mr. Ronald R. Reif. The only asset owned by the corporation is a signed contract to provide cleaning services for a period of one year for a large office building. After one year, the contract will be terminated, all cashflows will be zero, and all equipment will be worthless. Financial estimates are shown below. Based on similarly risky projects, the asset beta associated with the project is 0.95.

To receive the cashflows associated with the estimates below, Mr. Reif must immediately invest $100,000 in equipment and supplies. Of this $100,000, $40,000 will be borrowed from a local bank. The bank loan has an interest rate of 10% and a debt beta of 0.30. The risk-free rate is 5%, the market risk premium is 8.5%, and the corporate tax rate is 40%. There are no personal taxes. Assume that the $100,000 initial investment occurs immediately and that all other cashflows occur in one year.

	End of Year Estimates
Sales	$400,000
EBIT	$275,000
Expected Interest Expense	$3,020
Taxable Income	$271,980
Taxes (0.40 x Taxable Income)	$108,792
Net Income	$163,188
Depreciation	$60,000
Capital Expenditures	$10,000
Change in Net Working Capital	0

A. There are two possible states one year from now. In the bad state, Mr. Reif defaults on the bank loan and pays neither principal nor interest. In the good state, both principal and interest are paid in full. What is the probability that Jackson Cleaning Services will default on the bank loan at the end of one year? (10)

B. Assuming that the debt is fairly priced, what is the NPV of the project? (15)

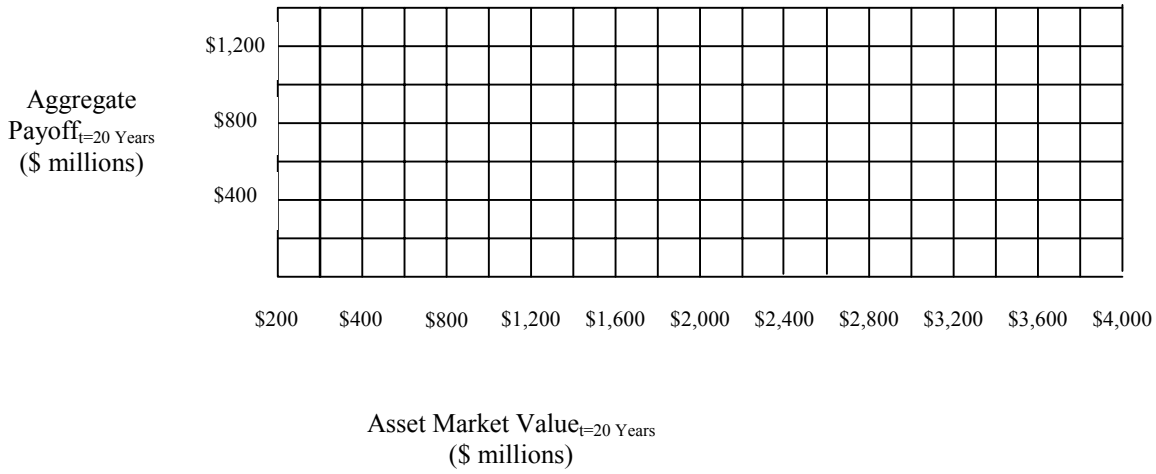
C. Suppose that instead of borrowing $40,000 to undertake the project, Mr. Reif instead decides to finance the project with 40% debt and 60% equity. What is the value of the project using this new financial structure? Assume that the debt beta remains constant at 0.30. Hint: Using WACC will be easier than using APV here.(15)

D. Theoretically, APV and WACC should give identical estimates of firm or project value. WACC was easier to use than APV for part c. If WACC were always easier to compute, why would you ever want to use APV?(10)

Question 3

On May 1, 2003, Comverse Technology, a manufacturer of telecommunication systems and software for multimedia communications announced that they were offering 350,000 Zero Coupon Putable Securities (ZYPS) for a price of $1,000 each. As implied by the name, the ZYPS pay no coupons. The securities mature in 20 years at which time the ZYPS owner has the option of receiving face value ($1000) or 55.635 shares of Comverse common stock. There are currently 188 million shares of Comverse common stock outstanding and the share price is $13.12. Assume that common stock and ZYPS are the only securities in Comverse Technology's capital structure. Comverse pays zero dividends.

A. As a function of the value of Comverse's assets 20 years from now, draw the payoff diagram for ZYPS holders. Make sure that the diagram is clearly labeled (15)



B. Rather than issuing ZYPS, Comverse could have issued zero-coupon straight debt without a conversion feature (straight bonds promise to pay $1000 in 20 years and cannot be converted into shares of common stock). Had Comverse issued straight bonds, it would have had to promise a return of 11% per year.

(i) What is the "bond portion" of the convertible bond worth? (15)

(ii) What is the "option portion" worth when issued? (10)

C. Now assume that the ZYPS that Comverse issued are both callable and putable in 5 years for $1000 per $1000 face value bond. That is, Comverse has the right but not the obligation to buy the bonds for $1000 in five years. ZYPS owners have the right but not the obligation to sell the bonds back to Comverse for $1000 in five years. How would the inclusion of put and call features affect your answers to Parts B (i) and B (ii)? Why? Hint: think about what happens to the value of the "bond portion" and the "option portion" (you may want to use both qualitative and quantitative arguments). (20)

Question 4

Ugrillit is a small firm which sells premium frozen beef. Ugrillit buys beef from competitive wholesalers and produces frozen hamburgers and steaks to sell to its customers. Currently, futures contracts on live cattle expiring one year from today have a settlement price of $75 per pound. Economists predict that live cattle will sell for $82.89 per pound in one year. For this question, assume the risk free rate is 5% and the market risk premium is 8.5%.

A. What is the β on Live Cattle? (10)

B. Prior to the Canadian government's announcement that a cow had been found to have mad cow disease on May 20th, the one year futures price on live cattle had been $80 per pound. How do you think that this $5 drop in the futures price compares to the change in the market's expectation of live cattle prices in one year? Why?(15)

C. Ugrillit's 2003/2004 fiscal year begins today. Ugrillit will buy its beef for its fiscal year 2004/2005 beef orders one year from today. For the 2004/2005 fiscal year, Ugrillit has fixed costs of $150,000 and orders for 100,000 pounds of beef. Ugrillit is not taking additional orders due to capacity constraints. Assume that the per-pound price at which wholesalers sell beef to Ugrillit is equal to one tenth of the prevailing per pound price of live cattle. Ugrillit charges its customers 20% more than the price it pays wholesalers. How many futures contracts on live cattle would you need to buy to replicate Ugrillit's profits for fiscal year 2004/2005? Show your work. (25)

D. Ugrillit will not be able to pay its fixed costs if beef prices fall too low. How could Ugrillit hedge to eliminate any chance of negative gross profits without giving up any of its upside potential for positive gross profits? Here "gross" refers to profits ignoring the cost of the hedging securities. (How many contracts, of what type, with what expiration should Ugrillit buy or sell? If you can't figure out what the exact contract is, tell me as much as you can about what you think it should be.) (10)

Facts and Formulas

Value of a perpetuity: $V_{cashflows} = \sum_{t=1}^{infinity} \frac{C}{(1+r)^t} = \frac{C}{r}$

Value of a growth perpetuity: $V_{cashflows} = \frac{C}{r - g}$

Value of a T year annuity: $V_{cashflows} = \sum_{t=1}^{T} \frac{C}{(1+r)^T} = \frac{C}{r} - \frac{C}{r(1+r)^T}$

These formulas hold for retuns as well as for betas.

Asset β: Since A=D+E $\beta_{Assets} = \beta_{Debt} \frac{Debt}{Debt + Equity} + \beta_{Equity} \frac{Equity}{Debt + Equity}$

If there are two types of assets: $\beta_{Assets} = \beta_{Asset1} \frac{Asset1}{TotalAssets} + \beta_{Asset2} \frac{Asset2}{TotalAssets}$

Equity β: $\beta_{Equity} = \beta_{Asset} + \frac{Debt}{Equity} (\beta_{Asset} - \beta_{Debt})$

Expected rate of return on equity: $r_{equity} = r_{assets} + \frac{D}{E} (r_{asset} - r_{debt})$

Capital Asset Pricing Model: $E[r_{project}] = r_{risk\ free} + \beta_{project} E[r_{market\ return} - r_{risk\ free}]$

Equations and Facts, continued

Payoff to a call option:

$$\text{Payoff} = \text{Max}\{0, \text{Price of Stock} - \text{Strike Price}\} = \text{Max}\{0, S_t - X\}$$

Payoff to a put option:

$$\text{Payoff} = \text{Max}\{0, \text{Strike Price} - \text{Price of Stock}\} = \text{Max}\{0, X - S_t\}$$

Payoff of a Forward or Futures Contract:

Long: $(CV_t - X)$

Short: $(X - CV_t)$

where X is the futures price and CV_t is the commodity value at date t.

Forward or Futures Price:

$$\text{Futures Price}_0 = E_0[\text{Commodity Value}_1]\left(\frac{1 + r_{\text{riskfree}}}{1 + r_{\text{commodity value}}}\right)$$

NPV of a project:

$$\text{NPV}[\text{Project} \mid \text{Capital Structure is Irrelevant}] + \text{NPV}[\text{Financing}]$$

Weighted Average Cost of Capital:

$$r_{WACC} = r_E \frac{E}{D + E} + r_D (1 - \tau) \frac{D}{D + E}$$

Tax Shield (Upper Bound): τD

Tax Shield (Lower Bound):

$$\frac{\tau r_D D}{r_D + p}$$

Scratch Sheet #1

Scratch Sheet #2

Solution Sketch:

Question 1

A) The value of the firm is the assets in place plus the NPV of the project. The value of the firm is 1300, 900, or 800 with equal probability. The expected value of the firm is therefore 1000. There are 100 shares outstanding; the stock price is $10.

	State 1	State 2	State 3	Expected
Probabilities	1/3	1/3	1/3	
Assets in Place	1200	600	600	800
NPV[Expansion]	100	300	200	200
Pre-Issue Value of the firm	1300	900	800	1000
Post-Issue Value of the firm	2300	1900	1800	2000

B) In order to answer to this question, you have to consider that the new shareholders will get a fraction of the firm after the capital infusion. The expected value of the firm after the equity infusion is 2000 (see table above). They should receive half of the value of the firm.
$1000=k*(2000)
k=1/2
So the number of shares than need to be issued is equal to 100. The stock price is worth $10.

C) The NPV of the equity issue is what the old shareholders receive ($1000) minus what the old shareholders give away (½ the firm). Thus the NPV is

NPV(financing in state 1)=1000-.5*(2300)=-150
NPV(financing in state 1)=1000-.5*(2300)=50
NPV(financing in state 1)=1000-.5*(2300)=100

D) The expected NPV of financing is zero.
E(NPV(financing))=(-15+5+10)/3=0.
Remember, the NPV of financing is the amount by which the equity is mispriced. Since the expected mispricing is zero, the market for 3-Dimensional Pharmaceuticals, Inc. equity is efficient. The equity is priced as the discounted value of future cashflows. The new shareholders pay $1000 for a claim that has an expected value of $1000.

E) The managers are acting in the interest of old shareholders. Thus they will invest in a project only if the NPV is positive when the effect of financing (from the old shareholder's perspective) is included. The NPV of the project plus the financing is positive in states 2 and 3, but is negative in state 1. Thus the firm will issue equity and take the project only in states 2 and 3. In state 1, the firm will forego a positive NPV project. Financing is relevant in this example.

Question 2

A. The current value of the debt is equal to the probability weighted bank payments at the end of the year discounted by the expected return on debt:

$$\$40,000 = \frac{p(0) + (1-p)(\$40,000 + \$4,000)}{(1 + r_D)}$$

The expected return on debt can be obtained from CAPM:

$$r_D = 0.05 + (.3)(0.085) = 0.0755$$

Substituting into the first equation and solving for p results in a default probability of 2.23%.

B. Using Adjusted Present Value, the value of the project is equal to the "All Equity" value plus the value of the tax shield. To calculate the "All Equity" value, we need the cashflows as if the firm is 100% equity financed. The table below shows that relevant calculation. Note that taxes have been adjusted such that the interest expense tax shield is not subtracted before calculating taxes.

	End of Year 1 Estimates
Sales	$400,000
EBIT	$275,000
Adjusted Taxes (EBIT x 0.40)	$110,000
EBIAT	$165,000
Depreciation	$60,000
Capital Expenditures	$10,000
Change in Net Working Capital	0
Free Cash Flow (Net Income + Depr. – CAPX – Increase in NWC)	$215,000

The discount rate for an all equity firm is equal to the rate of return on assets. Using CAPM, this is equal to:

$$r_A = 0.05 + (.95)(0.085) = 0.1308$$

Therefore, the NPV[All Equity] is:

$$NPV\,[\,All\ Equity\,] = \frac{215{,}000}{(1 + .1308)} - 100{,}000 = \$90{,}131$$

The value of the tax shield is equal to the expected tax shield cashflow discounted at the rate of return that reflects the systematic risk of the cashflow. Assuming that the appropriate discount rate is r_D, the value of the tax shield is:

$$NPV\,[\,Tax\ Shield\,] = \frac{(0.40)(0.0755)(\$40{,}000)}{(1 + 0.0755)} = \$1{,}123$$

The Adjusted Present Value of the project is:

$$APV = \$90{,}131 + \$1{,}123 = \$91{,}254$$

C. Calculating the value of a firm when the D/V ratio, rather than debt level, is specified is easiest using WACC:

$$WACC = \frac{E}{(E+D)} r_E + \frac{D}{(E+D)}(1-\tau) r_D$$

$$r_E = r_A + \frac{D}{E}(r_A - r_D) = 0.1308 + \left(\frac{.4}{.6}\right)(0.1308 - 0.0755) = 0.1677$$

$$\Rightarrow WACC = (0.6)(.1677) + (0.4)(1-0.4)(0.0755) = 0.1187$$

The NPV of the project is obtained by discounting the all-equity cashflows at WACC:

$$NPV = \frac{\$215{,}000}{(1+0.1187)} - \$100{,}000 = \$92{,}187$$

D. WACC ignores all (non-tax) violations of the MM assumptions (including mispricing and costs of financial distress,) and assumes a constant capital structure (if the project starts out 40% debt, it must continue to be 40% debt for the life of the project). Also, the sources of value are "hidden"—with APV you see how much value comes from the project and how much comes from the financing.

Question 3

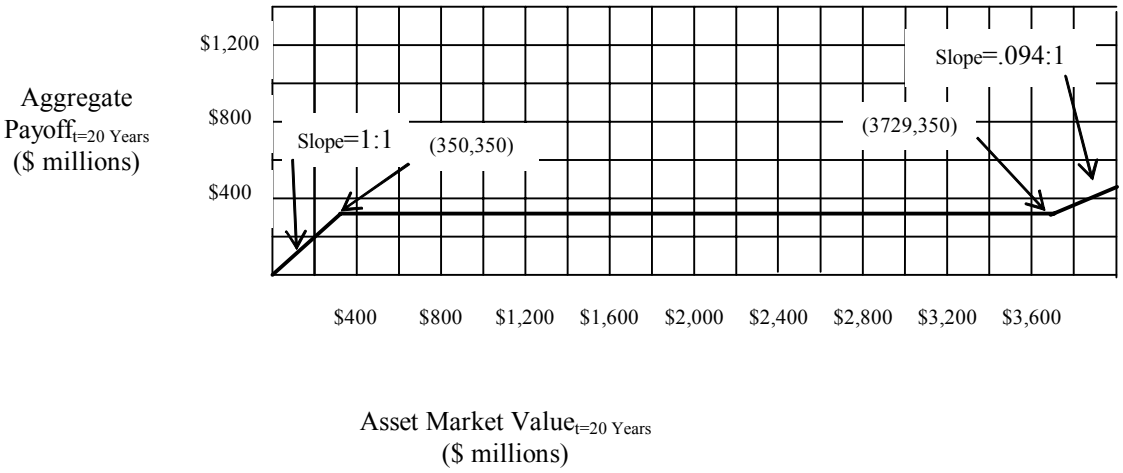
A. ZYPS holders will find it optimal to convert their ZYPS into common shares when the value of 55.635 shares exceeds the value of receiving the promised $1,000 payment:

$$P_{AC} * 55.635 > \$1000 \Rightarrow P_{AC} > \$17.97$$

At this stock price, all debt will be converted into equity and the total value of the firm's assets will equal the total shares outstanding multiplied by the stock price. The ZYPS will convert into 350,000*55.635 shares and there are 188 million shares outstanding:

$$(350{,}000 * 55.635 + 188\,million)(17.97) = \$3.729\,Billion$$

Above $3.729 Billion, ZYPS holders will get $0.094 of every $1 increase in the value of the firm's assets. Original shareholders will receive the remaining $0.906 of each $1 increase in value. Therefore, the slope in the far right of the graph is .094:1. Below $350 Million, the ZYPS holders are impaired – Converse will default on its promised payment. In this region, ZYPS holders get $1 of every $1 increase in firm value. Between firm values of $350 million and $3.729 billion, ZYPS holders are paid the face value of $1,000 per bond, or $350 million in aggregate. The resulting graph is shown below.



B.

(i) The bond portion of the bond can be obtained by discounting the promised payment at the promised rate of return for a straight bond:

$$Value_{Bond} = \frac{\$1{,}000}{(1+0.11)^{20}} = \$124.03$$

(ii) The option portion of the bond can be obtained by subtracting the value of the bond portion from the total value:

$$Value_{Option} = Value_{Total} - Value_{Bond} = \$1{,}000 - \$124.03 = \$876$$

C. If in five years, the ZYPS are worth less than $1,000, the ZYPS holders will "put" them back to the company in exchange for the $1,000 put price. If the ZYPS are worth more than $1000, the company will "call" the bonds and attempt to extinguish their option value. In response, ZYPS holders will either sell their bonds into the call for $1000 or convert their bonds into common stock. In either case, the ZYPS will cease to exist after five years.

Intuitively, decreasing the time until the $1,000 face value is paid will increase the value of the bond portion:

$$Value_{Bond} = \frac{\$1{,}000}{(1+0.11)^5} = \$593.45$$

Conversely, reducing the time until maturity for the option portion will decrease its value. Since we don't know the total effect, we cannot "back out" the value of the option portion by subtracting the value of the bond portion from the total price. All we know is that the option portion will be worth less than $876 and the ZYPS value will be less than $1,469.45 (= $876 + $593.45).

Question 4

A. Using the formula for the futures price:

$$\text{Futures Price}_0 = E_0[\text{Commodity Value}_1]\left(\frac{1+r_{\text{riskfree}}}{1+r_{\text{commodity value}}}\right)$$

and the CAPM,

$$E[r_{commodity}] = r_{\text{risk free}} + \beta_{commodity}\, E[r_{\text{market return}} - r_{\text{risk free}}]$$

we can find the beta on live cattle.

We have:

$$75 = 82.89\left(\frac{1+.05}{1+.05+\beta_{cattle}.085}\right)$$

so, $\beta_{\text{cattle}}=1.3$.

B. The drop in the expected live cattle spot price should have been about the same, or $5. The news about the mad cow doesn't change the systematic risk in live cattle prices, so the relationship between the futures price and the expected spot price should not have changed. From the formula for the futures price above, the only way the difference between the futures price and expected commodity price would change is if either the risk free rate, or the expected return on the commodity changed. First, there is nothing in the question to suggest that the risk free rate changed. Second, expected returns are determined by betas. Betas don't change unless fundamental systematic riskiness (covariance with the market) changes.

C. Profits are revenues minus costs.

Revenues = number of orders * 1+%markup * wholesale price
=100,000 orders * 1.2 markup * (.10 * live cattle price)

Costs =number of orders * wholesale price + fixed cost
=100,000 * (.10 *live cattle price) + 150,000

Revenues – Costs= $(100{,}000*1.2*.10*P_{\text{live cattle}}) - (100{,}000 * .10 * P_{\text{live cattle}}) - 150{,}000$
$=2{,}000 * P_{\text{live cattle}} - 150{,}000$
$=2{,}000*(P_{\text{live cattle}} - 75)$

Thus, you would have to buy 2,000 contracts.

D. To eliminate any downside, Ugrillit could by 2,000 puts on live cattle with a strike price of $75 expiring in one year. Ugrillit's profits from its assets plus the puts would be:

$2{,}000*(P_{\text{live cattle}} - 75) + 2{,}000*\max(75-P_{\text{live cattle}},0)$

Thus, if live cattle ever cost more than $75 per pound, the profits from the puts would offset the losses from Ugrillit's real assets.