Part One: Multiple-Choice Questions (45 points)

Question 1
Assume that capital markets are perfect. Which of the following statements is false?

A. As long as a firm’s choice of securities does not change the cash flows generated by its assets, the capital structure decision will not change the total value of the firm or the amount of capital it can raise.

B. With perfect capital markets, leverage merely changes the allocation of cash flows between debt and equity, without altering the total cash flows of the firm.

C. In a perfect capital market, the total value of a firm is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure.

D. Under perfect capital market conditions, the Law of One Price implies that a firm’s leverage does not affect its cost of debt capital.

E. If securities are fairly priced, then buying or selling securities has an NPV of zero and, therefore, should not change the value of a firm.

Question 2
Assume that capital markets are perfect. You have the following information concerning the equity and debt betas, as well as the debt to equity ratio in your firm.

<table>
<thead>
<tr>
<th>Equity Beta</th>
<th>Debt Beta</th>
<th>Debt to Equity Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.25</td>
<td>0.00</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Based on this information you can conclude that the unlevered beta in your firm is closest to:

A. 0.90.
B. 0.95.
C. 1.00.
D. 1.05.
E. 1.10.

Question 3
Google Corporation has no debt on its balance sheet in 2008, but paid $1.6 billion in taxes. Assume that Google’s marginal tax rate is 35% and Google’s borrowing cost is 7%. Assume that investors in Google pay a 15% tax rate on income from equity and a 25% tax rate on interest income. Taxes are the only imperfection in capital markets. If Google were to issue sufficient debt to reduce its taxes by $600 million per year permanently, then the effective tax advantage of this debt would be closest to:

A. 10%.
B. 15%.
C. 20%.
Question 4
Which of the following statements concerning the use of debt and equity financing in the presence of taxes and financial distress costs is false?

A. Aside from taxes, another important difference between debt and equity financing is that debt payments must be made to avoid bankruptcy, whereas firms have no similar obligation to pay dividends or realize capital gains.
B. Everything else equal, increasing the level of debt does not decrease the probability of bankruptcy.
C. A firm can receive a tax benefit from the use of debt financing only if it is paying taxes in the first place.
D. To the extent that a firm has other tax shields, its taxable earnings will be decreased and it will rely less heavily on the interest tax shield.
E. In general, as a firm's interest expense approaches its expected taxable earnings, the marginal tax advantage of debt increases, limiting the amount of equity the firm should use.

Question 5
Assume that capital markets are perfect. Omicron Technologies has $50 million in excess cash and no debt. Moreover, the firm expects to generate free cash flows of $40 million per year in subsequent years and will pay out these future free cash flows as regular dividends. Omicron's unlevered cost of capital is 10% and there are 10 million shares outstanding. Assume that Omicron uses the entire $50 million in excess cash to pay a special dividend. Omicron's ex-dividend price is closest to:

A. $40.00.
B. $5.00.
C. $50.00.
D. $45.00.
E. $10.00.

Question 6
Luther Industries currently has 5 million shares outstanding and its stock is currently trading at $40 per share. Assume Luther issues a 5:2 stock split. The number of shares Luther will have outstanding following the stock split is closest to

A. 25.0 million.
B. 12.5 million.
C. 2.0 million.
D. 2.5 million.
E. 10.0 million.

Question 7
Which of the following statements concerning capital budgeting with leverage is false?

A. As a general rule, the WACC method is the easiest to use when the firm will maintain a fixed debt-to-value ratio over the life of the investment.
B. The FTE method is typically used only in complicated settings for which the values of other securities in the firm’s capital structure or the interest tax shield are themselves difficult to determine.

C. For alternative leverage policies, the FTE method is usually the most straightforward approach.

D. When used consistently, the WACC, APV, and FTE methods produce the same valuation for any given investment.

E. When the firm keeps its interest payments to a target fraction of its FCF, we say it has a constant interest coverage ratio.

Question 8
Consider the following two statements regarding basic aspects of financial options.

I. A call option whose strike price is above the current price of the underlying stock is *in-the-money*, as is a put option whose strike price is below the current price of the underlying stock.

II. If the payoff from exercising an option immediately is positive, the option is said to be *at-the-money*.

A. Statement I is correct, statement II is false.
B. Statement I is false, statement II is correct.
C. Statement I is false, statement II is false.
D. Statement I is correct, statement II is correct.

Question 9
Galt Industries is trading for $20 per share and has 25 million shares outstanding. Galt Industries has a debt-to-equity ratio of 0.4 and its debt is zero coupon debt with a ten year maturity and a yield to maturity of 8%. From the point of view of Galt’s debt holders, which of the following portfolios containing a put option on Galt’s assets best describes Galt’s debt?

A. Long $200 million in risk free debt and Short a put option with a $200 strike price.
B. Short $200 million in risk free debt and Long a put option with a $200 strike price.
C. Long $200 million in risk free debt and Short a put option with a $700 strike price.
D. Short $200 million in risk free debt and Long a put option with a $700 strike price.
E. Long $200 million in risk free debt and Long a put option with a $200 strike price.

Question 10
Which of the following statements regarding the Black-Scholes option pricing formula is false?

A. If you take the option price quoted in the market as an input and solve the Black-Scholes option pricing formula for the volatility, you will have an estimate of a stock’s volatility known as the implied volatility.
B. The Black-Scholes formula can be used to price American or European call options on non-dividend-paying stocks.
C. We need to know the expected return on the stock to calculate the option price in the Black-Scholes Option Pricing Model.
D. We can use the Black-Scholes formula to compute the price of a European put option on a non-dividend-paying stock by using the put-call parity formula.
E. The Black-Scholes formula for a call option is derived assuming that the call is a European option.

Question 11
The current price of KD Industries stock is $20. In the next year the stock price will either go up by 20% or go down by 20%. KD pays no dividends. The one year risk-free rate is 5% and will remain constant. Using risk neutral probabilities, the calculated price of a one-year put option on KD stock with a strike price of $20 is closest to:

A. $2.00.
B. $2.15.
C. $1.45.
D. $2.40.
E. $0.70.

Question 12
Which of the following statements regarding real options is false?

A. Abandonment options can add value to a project because a firm can drop a project if it turns out to be unsuccessful.
B. A real option to invest in the future is known as a growth option.
C. Because growth options have value, they contribute to the value of any firm that has future possible investment opportunities.
D. Options are riskier when they are out-of-the-money than in-the-money, and because most growth options are likely to be out-of-the-money, the growth component of firm value is likely to be riskier than the ongoing assets of the firm.
E. Future growth opportunities can be thought of as a collection of real put options on potential projects.

Question 13
Which of the following is not one of the four characteristics of IPOs that puzzle financial economists?

A. On average, IPOs appear to be underpriced.
B. The long-run performance of a newly public company (three to five years from the date of the IPO) is superior to the overall market return.
C. The number of issues is highly cyclical.
D. The costs of the IPO are very high, and it is unclear why firms willingly incur such high costs.
E. The price at the end of the first day of trading after the IPO is often substantially higher than the IPO price.

Question 14
Which of the following statements regarding leasing contracts is false?

A. In a leveraged lease the lessor borrows from a bank or another lender to obtain the initial capital for the purchase of the leased asset, using the lease payments to pay interest and principal on the loan.
B. In some circumstances, the lessor is not an independent company but rather a separate business partnership, called a special-purpose entity (SPE), which is created by the lessee for the sole purpose of obtaining the lease.
C. In a direct lease, the lessor is not the manufacturer, but is often an independent company that specializes in purchasing assets and leasing them to customers.

D. SPEs are commonly used in synthetic leases, which are designed to obtain specific accounting and tax treatment.

E. In a sale and lease back transaction the lessor obtains cash from the sale of the asset and additionally receives lease payments from the lessee.

Question 15

Rearden Metal has earnings per share of $2 and no debt. It has 10 million shares outstanding and is trading at $20 per share. Rearden Metal is thinking of buying Associated Steel, which has earnings per share of $1.25, 4 million shares outstanding, and a price per share of $15. As Rearden Metal, also Associated Steel is fully financed with equity. Rearden Metal will pay for Associated Steel by issuing new shares. There are no expected synergies from the transaction. Assume that capital markets are perfect and react immediately to new information. If Rearden offers an exchange ratio such that, at current pre-announcement share prices for both firms, the offer represents a 20% premium to buy Associated Steel, then the price per share of Rearden immediately after the announcement will be closest to:

A. $15.00.
B. $17.20.
C. $18.60.
D. $19.10.
E. $20.00.

Part Two: Open Questions (55 points)

Question 1

Assume that corporate taxes are the only imperfections in capital markets. MJ Enterprises has 50 million shares outstanding with a market price of $25 per share and no debt. MJ has had consistently stable earnings, and pays a 35% tax rate. On the other hand, individual investors face no personal taxation. Management plans to borrow $500 million on a permanent basis through a leveraged recapitalization in which they would use the borrowed funds to repurchase outstanding shares.

a) Calculate MJ’s share price following the announcement of the recapitalization plan. (5 points)

b) Would your answer to point a) change if the management of MJ Enterprises were to use the borrowed $500 million to pay a special dividend to existing shareholders instead of repurchasing outstanding shares? Explain. (5 points)

Question 2

Zymase is a biotechnology start-up firm. Researchers at Zymase must choose one of three different research strategies. The payoffs (after-tax) and their likelihood for each strategy are shown below. The risk of each project is diversifiable.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Payoff ($ million)</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>120</td>
<td>100%</td>
</tr>
<tr>
<td>B</td>
<td>200</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>50%</td>
</tr>
</tbody>
</table>
a) Which project has the highest expected payoff? (5 points)

b) Suppose Zymase has debt of $50 million due at the time of the project’s payoff. Which project has the highest expected payoff for equity holders? (5 points)

c) Suppose Zymase has debt of $30 million due at the time of the project’s payoff. Which project has the highest expected payoff for equity holders? (5 points)

d) If management chooses the strategy that maximizes the payoff to equity holders, what is the expected agency cost to the firm from having $50 million in debt due? What is the expected agency cost to the firm from having $30 million in debt due? (5 points)

Question 3
Rearden Metal is considering the purchase of a new blast furnace costing a total of $5 million dollars. This furnace will qualify for accelerated depreciation: 20% can be expensed immediately, followed by 32%, 19.2%, 11.52%, 11.52% and 5.76% over the next five years. Rearden has substantial tax loss carry forwards and estimates that its marginal tax rate will be only 10% over the next five years. Since Rearden will get very little tax benefit from the depreciation expense, it considers leasing the furnace instead. Suppose that Rearden and the lessor face the same 8% borrowing rate, but the lessor has a 40% marginal tax rate. Assume that the furnace is worthless after five years, the lease term is five years, and a lease would qualify as a true tax lease. What is the minimum acceptable upfront lease payment for the lessor? [Hint: you must compute the upfront lease payment for which the NPV of “Buy and Lease” is zero for the lessor]. (10 points)

Question 4
Wyatt Oil has 8 million shares outstanding and is about to issue 10 million new shares in an IPO. The IPO price has been set at $15 per share, and the underwriting spread is 6%. The IPO is a big success with investors, and the share price rises to $35 at the end of the first day of trading.

a) What is the amount of money raised by Wyatt Oil with the IPO? (5 points)

b) Compute the post-IPO market value of Wyatt Oil, that is, its market value at the end of the first day of trading after the IPO. (5 points)

c) Suppose now that the post-IPO market value of Wyatt Oil represents a fair valuation of the firm. Based on this assumption, what would have been a fair valuation of each of its shares of stock before the IPO? (5 points)
SOLUTIONS

Part 1: Multiple-Choice Questions

1. D
2. C

<table>
<thead>
<tr>
<th>Equity Beta (β_E)</th>
<th>Debt Beta (β_D)</th>
<th>Debt to Equity Ratio</th>
<th>Percent Equity</th>
<th>Percent Debt</th>
<th>Unlevered Beta (β_U)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.25</td>
<td>0.00</td>
<td>0.25</td>
<td>0.80</td>
<td>0.20</td>
<td>1.00</td>
</tr>
</tbody>
</table>

The percentage of equity is given by E/(E+D) which can be computed easily from the debt to equity ratio (D/E) as

\[
\text{Percentage of equity} = \frac{E}{E+D} = \frac{β_E}{1-β_D/(E+D)}
\]

The percentage of debt is given by D/(E+D), which can be simply computed as

\[
\text{Percentage of debt} = \frac{D}{E+D} = 1 - \frac{E}{E+D}
\]

Finally, the unlevered beta is calculated as

\[
β_U = \% \text{ equity} \cdot β_E + \% \text{ debt} \cdot β_D
\]

3. D

4. E
5. A

Enterprise Value - PV(Future FCF) $400 million

Market value = Enterprise Value + cash = $400 + $50 = $450 million.

However, once the $50 million in cash is used to pay the dividend, the new market value becomes $450 - $50 = $400 Million. Hence, on the ex-dividend date we have that

6. B

shares outstanding following split = current shares outstanding × split : 5 million × 2 = 10 million

7. C
8. C
9. A

The market value of equity(E) = $20 share x 25 million shares = $500 million. Since the D/E ratio = 0.4 we find that Debt/$500 = 0.4 => Debt = 0.4($500) = $200 million in debt.

The shareholders are entitled to any residual value after the debt of $200 million is fully repaid. Therefore the strike price is $200 million. Since risky debt = risk-free debt - put option on firm assets we know that we need to be long the risk free debt and short the put.

10. C
11. C

The risk neutral probability of a price increase is ρ obtained from

\[
ρ \times 0.20 + (1 - ρ) \times (-0.20) = 0.05,
\]

which can be solved to find ρ = 0.625. The put option is worth $4 if the price goes down and nothing if the price goes up. The calculated price of the put is therefore

\[
P = ((1 - ρ) \times $4)/1.05 = $1.43.
\]
Value of Associated Steel = $15 \times 1.2\text{ per share} \times 4\text{ million shares} = $72\text{ million. Therefore Rearden will have to issue $72\text{ million}/$20\text{ per share} = 3.6\text{ million new shares to fund the deal. This will give Rearden 10 + 3.6 = 13.6\text{ million shares post merger. The total value of Rearden pre-merger is $20\text{ per share} \times 10\text{ million shares} = $200\text{ million and the value of Associated pre-merger is $15\text{ per share} \times 4\text{ million shares} = $60\text{ million, for a combined value of $260\text{ million. The share price after the merger is }$260\text{ million}/13.6\text{ million shares} = $19.12\text{ and this will be immediately felt in Rearden’s stock price at the announcement.}}$

**Part 2: Open Questions**

**Question 1**

a) 

\[ V^U = (50\text{ million shares}) \times $25\text{ per share} = $1,250\text{ million.} \]

Tax Shield = Debt \times \tau_c = $500\text{ million} \times .35 = $175\text{ million.} \]

\[ V^L = V^U + \text{Interest Tax shield} = $1250\text{M} + $175\text{M} = $1425\text{M}. \]

When the recapitalization plan is announced the price immediately reacts and jumps to:

\[ \left( \frac{V^L}{\text{shares outstanding}} \right) = \frac{1425\text{M}}{50\text{M shares}} = $28.50\text{ per share}. \]

b) 

Nothing changes in this case as the payment of a special dividend is equivalent to a share repurchase when investors face no personal taxation. The only source of value is the tax shield created by the borrowed money.

**Question 2**

a) 

Expected playoff of project A = $120\text{ million;} 
Expected playoff of project B = 0.5 \times 200 + 0.5 \times 30 = $115\text{ million;} 
Expected playoff of project C = 0.1 \times 400 + 0.9 \times 80 = $112\text{ million;} 
Project A has the highest expected payoff.

b) 

Let \( E(X) \) denote the expected payoff to equity holders when researchers choose strategy X. With debt due equal to $50\text{ million we find:} 

\[ E(A) = 120 - 50 = $70\text{ million} \]

\[ E(B) = 0.5 \times (200 - 50) + 0.5 \times 0 = $75\text{ million} \]

\[ E(C) = 0.1 \times (400 - 50) + 0.9 \times (80 - 50) = $62\text{ million} \]

Project B has the highest expected payoff for equity holders.

c) 

With debt due equal to $30\text{ million we find:}
E(A) = 120 – 30 = $90 million  
E(B) = 0.5 \times (200 – 30) + 0.5 \times 0 = $85 million  
E(C) = 0.1 \times (400 – 30) + 0.9 \times (80 – 30) = $82 million  
Project A has the highest expected payoff for equity holders.

d)  
With $50 million in debt, management will choose project B, which has an expected payoff for the firm that is 120 – 115 = $5 million less than project A. Thus, the expected agency cost is $5 million.  
With $30 million in debt, management will choose project A, which maximizes total firm’s value. Hence, the resulting expected agency cost is zero.

Question 3

The FCF for the lessor of buying the furnace are summarized below.

<table>
<thead>
<tr>
<th>Buy</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Expenditures</td>
<td>(5,000,000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation Tax Shield @40%</td>
<td>400,000</td>
<td>640,000</td>
<td>384,00</td>
<td>230,400</td>
<td>230,400</td>
<td>115,200</td>
</tr>
<tr>
<td>FCF</td>
<td>(4,600,000)</td>
<td>640,000</td>
<td>384,00</td>
<td>230,400</td>
<td>230,400</td>
<td>115,200</td>
</tr>
</tbody>
</table>

We must find the lease payment such that from the point of view of the lessor the NPV of “Buy and Lease” = 0. Let L denote this unknown upfront lease payment. The FCF for the lessor of leasing the furnace are summarized below.

<table>
<thead>
<tr>
<th>Lease</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCF = After-tax lease payments</td>
<td>L(1 – 0.40)</td>
<td>L(1 – 0.40)</td>
<td>L(1 – 0.40)</td>
<td>L(1 – 0.40)</td>
<td>L(1 – 0.40)</td>
<td>0</td>
</tr>
</tbody>
</table>

We know that for the lessor NPV = PV(FCF Buy + Lease) at \( r_d(1 - \tau_c) = 8\%(1 - 0.40) = 4.8\% \), so we find

This expression in L simplifies to

\[ L \times 2.737492 - 3,157,385 = 0, \]

which can be easily solved yielding \( L = $1,153,386. \)

Question 4

a)

Wyatt is issuing 10 million shares at $15 per share for a total of $150 million. However the underwriter will take the 6% underwriting spread or 6% x $150 = $9 million leaving only $141 million for Wyatt Oil.

b)

Wyatt has a total of 10 + 8 = 18 million shares outstanding after the IPO. Each of these
shares is worth $35 per share for a total value of 18 million x $35 = $630 million.

c)

We know that Wyatt Oil is able to raise $141 million with the IPO. Its fair value after the IPO is $630 million, but this valuation includes the $141 million in cash raised with the share issue. The pre-IPO fair valuation was therefore 630 – 141 = $489 million which with 8 million shares outstanding implies a fair share price of 489/8 = $61.125 per share.