PART TWO

Exercise 1 (25 points)
The expected return of the S&P 500 (which you can assume is the tangency portfolio) is 16% and has a Standard Deviation of 25% per year. Microsoft has a Standard Deviation of 20% per year and a covariance with the S&P500 of 0.1. If the risk-free is 6% per year and CAPM holds:

a) **(9 points)** Calculate the expected return of Microsoft.

b) **(8 points)** If Intel has half of the expected return of Microsoft then, what is Intel's beta?

c) **(8 points)** Calculate the beta and expected return of a portfolio that invests in the following five assets in the following proportions: 25% in Microsoft; 10% in Intel; 75% in the S&P 500; -20% in GM (where $\beta_{GM}=0.8$) and 10% in the risk-free asset.

Exercise 2 (25 points)
An oil well will produce 100,000 barrels of oil next year and 250,000 barrels in two years (assume for simplicity that the oil will be available at the end of the year). After that the oil well will be closed forever. Suppose that the operating expenses $48/barrel. Suppose that the forward price of oil delivered one year from now is $100/barrel and that *no forward market is available in two years*. Suppose that the risk free rate is 5%, that the beta of oil-well is 0.9, and that the market expected risk premium is 6%. Suppose that, in the second year, the oil price fluctuates so it can be: $130/barrel, $100/barrel, or $90/barrel with equal probabilities.

a) **(8 points)** Find the value of the oil well.

b) **(10 points)** Suppose that the oil well would be only operative for one year (i.e., ignore any information about year two). Form a perfect tracking portfolio for the oil well and value the oil well in such a case.

c) (7 points) Suppose that the oil well is only operative for one year (again, please ignore any information about year two) and that the one-year oil forward price is $40/barrel. What is the value of the oil well? Explain.

Exercise 3 (25 points)
Make the usual assumptions of risk neutrality, a zero risk-free rate, and no taxes.

Firm X needs to spend $3.2 million at year 0 to develop a new computer. Demand is uncertain at year t=0. Demand at t=1 will be either high (probability 70%) or low (probability 30%). At year 1, Firm X will learn whether the demand for the computer is indeed high or low. To continue the project, Firm X must decide whether to spend an additional $3.6 million at year t=1. If X decides to continue the project, the computer will produce at year t=2 a cash flow of $18 million if demand is high, and of $4.8 million if demand is low. If X does not make the investment at year 1, there will be no cash flows at year 2.

a. (15 points) Assume that X intends to finance the original investment ($3.2 million) with senior debt held by a diffuse group of bondholders. Will X be able to finance the project? If so, find the face value of the debt that X must issue at year 0 to obtain the $3.2 million, and the value of the project for X.

b. (10 points) Suppose that instead of two possible scenarios (i.e., high and low demand) demand can be high, medium or low with the following probabilities and cash flows.

Demand	Probability	Cash Flow in year 2
High	20%	$18 million
Medium	50%	$7.5 million
Low	30%	$4.8 million

Will Firm X be able to issue the bond to raise $3.2 million? If it can, find the face value of the bond. If it cannot, justify your answer with calculations.

Exercise 4: (25 points)

Hermes Inc., a producer of luxury goods, needs to spend $40,000 at year 0 to develop a new product. The demand for product is uncertain at year 0. At year 1, however, Hermes will learn whether the demand for the product is high (probability 5/11) or low (probability 6/11). To continue operations, and after learning the demand, Hermes must decide whether to spend an additional $20,000 at year 1. If Hermes decides to continue operations, the product will generate at year 2 a CF of $110,000 if demand is high and of $50,000 if demand is low. There are no taxes, investors are risk-neutral and that the risk-free rate of zero. Assume that Hermes can only raise finance at t=1 by issuing new equity.

a) **(7 points)** Assume that Hermes intends to finance the original $40,000 of year 0 by issuing senior debt that matures in year 2. Will Hermes be able to do so? If it can, calculate the face value of the senior debt, and the value of equity at t = 0 (right after raising the $40,000 in senior debt).

b) **(5 points)** Assume that in the case of low demand, debt-holders could get together and renegotiate the face value of the debt. By how much should they reduce the face value of debt?

c) **(7 points)** If debt-holders anticipate that they can renegotiate the face value of debt in the case of low demand: (i) Calculate the face value of the debt that Hermes must issue at t=0 in order to raise $40,000; (ii) Calculate the value of equity at t = 0 (right after raising the $40,000 in senior debt). Very briefly explain why the value of equity is lower or higher than in part (a)?

d) **(6 points)** Now assume that <u>in the case of high demand</u>, if Hermes spends the additional $20,000 at year 1, the shareholders can take one of two alternative projects:

- A safe project, that as before, yields a CF of $110,000 at t =2.
- A risky project that yields a CF of $140,000 or $0 at t = 2 with equal probability (i.e., 0.5)

Hermes plans to finance as much as possible of the initial investment by issuing senior debt and the rest by issuing equity. Up to how much of the initial $40,000 can Hermes finance with senior debt? (Note: *In part (d) assume that in the case of low demand renegotiation does* NOT *take place*).

Question 5: (25 points)
A firm would like to finance an investment project. The project yields a cash flow of $30 with probability p (in the "up" state) and $10 with probability (1-p) (in the "down" state). The project costs $11 and the firm's only asset is the idea for this project. Thus, the $11 must be raised from the external capital markets. Investors are risk-neutral and the risk-free interest rate is 0. Ignore taxes.

In other words, the situation can be represented as follows:

t=0	t=1	
-11	Either Up state (with probability p)	$30
	Or Down state (with probability 1-p)	$10

There is asymmetric information in the sense that the firm can be an overvalued firm (i.e., a "low" type firm), in which case p =0.5, or it can be an undervalued firm (i.e., a "high" type firm) in which case p=0.7. The firm's manager knows the firm's type (i.e., the true p), but the capital markets do not. Before observing any financing announcement, the market believes the firm has a 50% chance of being undervalued and a 50% chance of being overvalued.

a) (8 points) Suppose that the only financing vehicles are debt or equity, and suppose that the financial distress costs of debt are $2 (i.e., in case that the firm defaults the firm cash flows will be reduced by $2).

Suppose that the market prices debt issuances as stemming from a "high type" firm and equity issuances as stemming from a "low" type firm. Find out which security each type of firm will issue and explain why (i.e., this explanation needs to be supported numerically.)

b) (5 points) Describe (i.e., calculate) the stock market reaction after a firm decides to issue equity or debt. Explain.

c) (8 points) Suppose now that the financing vehicles available to these firms are equity and convertible bond with face value $11 (straight debt is now impossible to issue). In addition, assume that financial distress costs are $5 (rather than $2 as in part a)).

Suppose that the market prices debt issuances as stemming from a "high type" firm and equity issuances as stemming from a "low" type firm. Find out which security each type of firm will issue and explain why (i.e., this explanation needs to be supported numerically.)

Note 1: After the cash flows are realized, the convertible bondholders will have a chance to convert. If they do so, the firm does not incur any financial distress costs. (This means that the convertibles are not callable but that the bondholders may voluntarily decide to convert.)

Note 2: The rest of terms of the convertible bond must be derived by you to be sure that the investors get a fair compensation for investing in the issuing firm.

d) (4 points) Describe (i.e., calculate) the stock market reaction after a firm decides to issue equity or debt. Explain.