

**Instructions:** This exam is open book and notes, but it should involve your work only, you will need a calculator and can use a computer. For each question where a computation is needed your answer must consist of the derivation of the formulas you need to arrive at your answer and the actual numerical solution, two digit precision is good (on interest rates, that is in 100<sup>th</sup> of percents). This exam should take you about three and half hour but you may use as much as six hours.

**Short questions** answer each in about 50 words

- A.(3pts). On Dec 5, the Federal government announced that economic growth was accelerating and that first time unemployment claims were down below 300,000. The stock market and bond prices fell, what expected Federal Reserve policy change might explain why good news leads to price falls? Why?
- B.(3pts). Why might the value of a firm depend on its financial structure (why might Modigliani Miller fail)?
- C.(3pts). The Dodd-Frank Financial reform bill requires firms that issue collateralized securities to hold onto a fraction of these securities. What problem is that design to avoid?
- D.(3pts). Why might large (old/well established) firms prefer to fund new ventures with debt rather than equity?

### Problems

#### 1. Modigliani Miller

Mr Cool has invented a new sunscreen. In warm years demand is high and profits are 1 million dollars, in cool years profits are 500,000 dollars. Temperature is IID and the likelihood of a warm year is 0.5. Everyone knows that after 10 years, a competitor will come into the market and profits will be zero. The riskless interest rate is 3% per year.

**1A. 1pt.** What is the NPV of the sunscreen invention?

**1.B 2pts.** Suppose Mr Cool decides to set up the l'Oree cosmetic firm to produce the sunscreen and to do so he needs to raise three million dollars from a risk neutral investor (whose alternative investment in a riskless bond). If he issues stock what share of the firm does he have to give to the investor?

**1.C 2pts.** Suppose Mr Cool issues bonds at an interest rate of 4% to the investor instead, what is the price of those bonds so how many does he issue to raise \$3,000,000.

**1.D 2pts** Show that Mr Cool's wealth is the same whether he issues stock or bonds.

## 2. Collateralized debt

Countrybank is a mortgage lender on the frontier. It makes simple 5 year balloon payment mortgages at a fixed interest rate. The geography of the frontier is such that the most valuable use for land is growing apples. Apple trees grow faster in wet years than in dry ones and land with bigger trees is more valuable than land with small tree. The probability of wet and dry years is equal and IID. After a wet year the value of the land grows by 4% after a dry year it declines by 4%. Initially the value of the land is \$50 an acre. Income (net of all expenses except for land) is 5% of the land value. The riskless interest rate is 3%.

**2A. 1pt.** After five years what is the range (note not the distribution) of possible values of land?

**2.B 2pts.** If Countrybank decides to issue only riskless mortgages what is the Loan to Value ratio it must set?

**2.C 1pts.** If Countrybank chooses an LTV of 0.85 what is the probability of default? (hint if there is at least one wet year what is the value of the land?). When does default occur if it does happen?

**1.D 2pts** If Countrybank chooses an LTV of 0.85 what interest rate should it charge?

## 3. Efficient Frontier

The No-Short-Sale Island has only two securities and the market does not allow short sales.

	Stock A	Stock B
Expected Return	0.07	0.03
	Variance covariance matrix	
Stock A	0.08	0.01
Stock B	0.01	0.03

For each of the questions below a portfolio must report, its proportion of each asset, its expected return, and its expected variance.

**4.A. 2 pts** What are efficient portfolios by 0.5% increments from 3% to 7% target returns?

**4.B. 1 pt** Which of these portfolios are dominated?

**4.C. 2 pts.** Now consider the riskless bond that returns 2%, in a  $r\text{-}\sigma$  environment. What is the Sharpe ratio for each of the portfolios you found in 4A?

**4.C. 1 pts** What is the tangent portfolio (an approximation to the nearest 0.1% will do )?

#### 4 Future Rocks

You are a wholesale grocer. You have entered into a contract with the local school district to supply 50,000 gallons of milk for their lunch programs each month. The current price for milk is \$1.5 dollars per gallon. Your contract specifies a price of \$1.5 dollars per gallon, the future price of milk today is \$1.6 dollars per gallon (for delivery in any of the next 12 months). The cost of storage is 1% per month and the interest rate is 0.25% a month.

4.A. **2pts.** Write a formula for deciding whether to hedge your delivery contract by going long on a forward contract for milk or by holding milk inventory.

4.B.(2pts). For what months do you hedge?

4.C.(2pts)At what forward price would you then buy the contract for the next month?

#### 5 Computing Options

The OMG co has a project that pays out next period. Then the profit is distributed uniform between 1,700,000 and 2,300,000. It has issued a million shares for that project the interest rate is 1%. Investors are risk neutral (or  $\beta=0$ ).

5.A 1pt. What is the price of the stock today?

5.B 2pts. The firm issues 100,000 stock options to management at a strike price of \$2. What is the expected value of an option neglecting the impact of the exercise on share value?

5.C 2pts.What increase in expected profits from management effort would justify issuing the options?

5.D 2pts.Suppose management has the 100000 options at a strike price of \$2 and has access to two strategies one that move the profit range to uniform between [2000000 to 2300000] and the other has a uniform rang of [1,000,000; 3,000,000] which one does management chose? Would shareholders be happy with management's choice?

#### 6. Corporate finance:

The Slowfood Co has been underperforming the market and its stock price has fallen. The founding family (the Slows) hired you as a consultant to evaluate some final strategies to put Slowfood back on top of the industry. After some careful research you decide that more management effort and better focus can increase the profitability of the firm by 50%.

6.A.(2pts). Explain in about 100 words under what circumstances a leveraged buyout by management would make sense.

6.B.(2pts) Explain in about 100 words under what circumstances giving management options equal to 20% of would make sense.

6.3C.(2 pts) Why might the Slow family prefer the stock option plan over the leverage buyout?