

**First Midterm Exam**

Fall 2019

Econ 180-367

Closed Book.

Formula Sheet Provided. Calculators OK.

Time Allowed: 1 Hour 15 minutes

All Questions Carry Equal Marks

1. (20 points) Suppose that there are two stocks, A and B with the following characteristics:

| Asset   | Expected Return | Standard Deviation |
|---------|-----------------|--------------------|
| Stock A | 0.08            | 0.20               |
| Stock B | 0.12            | 0.40               |

The correlation between returns on stocks A and B is negative. It is -0.25. You form a portfolio that places equal weight on stocks A and B.

(a) What is the standard deviation of the return on this portfolio?

(b) If the risk-free rate is 2 percent, what is the Sharpe ratio on this portfolio?

2. (10 points) Consider an investor with a utility function  $u(W) = \exp(-W)$  where  $W$  is her wealth. What is this investor's coefficient of absolute risk aversion?

3. (20 points) Suppose that there are three assets: stock A, stock B and the risk-free asset with the following characteristics.

| Asset           | Expected Return | Variance |
|-----------------|-----------------|----------|
| Stock A         | 0.10            | 0.16     |
| Stock B         | 0.04            | 0.04     |
| Risk-free Asset | 0.02            |          |

Stocks A and B are uncorrelated. Investors are allowed to borrow and lend at the riskfree rate as much as they would like. They can also go long or short in any stock as much as they would like.

John has \$100 to invest and has a utility function  $E(r) - \frac{A}{2}\sigma^2$  where  $E(r)$  is his expected return,  $\sigma^2$  is the variance of returns and his risk aversion is  $A=2$ . How will he split his wealth among these three assets?

4. (10 points) A project will pay of \$100 in one year, \$100 in two years and \$200 in three years. Interest rates are 5 percent per annum. What is the net present value of this project?

5. (10 points) Returns on an asset will either be 11 percent or 5 percent, each with equal probability. What is the variance of returns on this asset?

6. (30 points) Multiple choice questions. Only one option is correct. Please indicate which one it is.

(i) Which of the following is closest to the annual average return on Treasury bills over the last 90 years?

- A. 1 percent.
- B. 2 percent.
- C. 3.5 percent.
- D. 5.5 percent.
- E. 10 percent.

(ii) Which of the following stocks has the highest book-to-market ratio?

- A. Goldman Sachs.
- B. Microsoft.
- C. Deutsche Bank.
- D. Amazon.
- E. Bank of America.

(iii) Suppose that there are 25 stocks, each of which has returns with standard deviation 25 percent. The stocks are all mutually uncorrelated. You form an equal weighted portfolio of these stocks. What is the standard deviation of this portfolio?

- A. 1 percent.
- B. 5 percent.
- C. 6.25 percent.
- D. 10 percent.
- E. 25 percent.

(iv) When buying stocks on margin, which of the following is the initial margin set by Federal Reserve Regulation T?

- A. 5 percent.
- B. 10 percent.
- C. 25 percent.
- D. 50 percent.
- E. 100 percent.

(v) The effective annual rate on an investment is 6.8 percent. What is the annual percentage return with quarterly compounding (four times a year)?

- A. 2.86 percent
- B. 6.63 percent
- C. 6.58 percent
- D. 6.92 percent
- E. 7.45 percent

(vi) Which of the following statements is most accurate for historical daily stock returns?

- A. They are normally distributed.
- B. They have negative skewness and fat tails.
- C. They have positive skewness and fat tails.
- D. They have negative skewness but do not have fat tails.
- E. They have positive skewness but do not have fat tails.

(vii) A firm has an equity (levered) beta of 0.5. It's assets are \$100 million and it's debt is \$80. What is it's asset (unlevered) beta?

- A. 0.1
- B. 0.4.
- C. 0.6.
- D. 1.
- E. 2.5.

(viii) Which of the following is the annual Sharpe ratio on the S&P 500?

- A. 5
- B. 4
- C. 1
- D. 0.6
- E. 0.4

(ix) The expected stock market return is 6 percent. The riskfree rate is 2 percent. Pfizer has an expected return of 8 percent. According to the CAPM, what must the beta of Pfizer stock be?

- A. 1.
- B. 1.5.
- C. 2.
- D. 2.5.
- E. 4.

(x) Financial instruments with a maturity of one year or less are traded in which of the following markets?

- A. The money market.
- B. The capital market.
- C. The equity market.
- D. Derivatives markets.
- E. The foreign exchange market.

### Solutions and Grading Rubric

1. (a) The variances of stocks A and B are 0.04 and 0.16. The covariance between stocks A and B is  $-0.25 * 0.2 * 0.4 = -0.02$

So the variance of the portfolio return is

$$0.5^2 * 0.04 + 0.5^2 * 0.16 - 2 * 0.5^2 * 0.02 = 0.04$$

The standard deviation is therefore 0.2.

15 points for part (a). 5 points off for getting mixed up between covariance and correlation, or between standard deviation and variance, or failing to square weights. 3 points off for a purely algebraic mistake. No credit for just writing down the formula for variance without applying it.

- (b) The expected return on the portfolio is 0.1, or 10 percent. So the Sharpe ratio is  $\frac{0.1 - 0.02}{0.2} = 0.4$ .

5 points for part (b). Whatever standard deviation you got in part (a) can be used in the denominator of part (b) for full credit on this part. No credit if the wrong formula for the Sharpe ratio is used, or if percent and decimal are mixed up. 1 point off for a purely algebraic mistake. 2 points off for getting the portfolio mean wrong.

2. The coefficient of absolute risk aversion is  $-\frac{U''(W)}{U'(W)} = -\frac{\exp(-W)}{-\exp(-W)} = 1$ . Full credit if you just write

down the answer without derivation. 5 points if you write out the formula but cannot do the differentiation correctly. 8 points if you do it correctly up to getting the sign wrong.

3. Between stocks A and stock B, the share that he will allocate to A is

$$\frac{0.08 * 0.04}{0.08 * 0.04 + 0.02 * 0.16} = 0.5$$

Thus the risky portfolio has a mean return of 0.07 and a variance of 0.05. The fraction allocated to the risky portfolio should be

$$\frac{0.07 - 0.02}{2 * 0.05} = \frac{1}{2}$$

So, of the \$100, \$50 goes to the risk-free asset and \$25 goes to each of the two risky assets.

10 points for getting the allocation among the two stocks, 2 points for the mean of the risky portfolio and 3 points for the variance, and 5 points for the fraction allocated to the risky portfolio. Anyone who gets this far gets full credit--no need to explicitly say that \$25 is in each risky asset. 3 points off for any algebraic mistake. 5 points off for putting the wrong thing in one of the formulas, like return instead of excess return.

4.  $\frac{100}{1.05} + \frac{100}{1.05^2} + \frac{200}{1.05^3} = 358.71$ . 2 points off for algebra mistake.

5. The expected return is 8 percent. The variance is  $\frac{1}{2}(5-8)^2 + \frac{1}{2}(11-8)^2 = \frac{1}{2}9 + \frac{1}{2}9 = 9$ . So 9

percent is the variance. 5 points off if you did it correctly except got the wrong expected return. 2 points off for algebra mistake.

- 6. (i) C.
- (ii) C.
- (iii) B.
- (iv) D.
- (v) B.
- (vi) B.
- (vii) A.
- (viii) E.
- (ix) B.
- (x) A.

3 points per question, with no partial credit.