Second Midterm Exam
Fall 2017          Econ 180-367

Closed Book.
Formula Sheet Provided.  Calculators OK.
Time Allowed: 1 Hour 15 minutes
All Questions Carry Equal Marks

1. (10 pts). Can the following scenario be consistent with the CAPM?  If not, please say exactly why not.

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Expected Return</th>
<th>Standard Deviation</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13.4%</td>
<td>40%</td>
<td>1.2</td>
</tr>
<tr>
<td>B</td>
<td>15.5%</td>
<td>50%</td>
<td>1.5</td>
</tr>
<tr>
<td>Market</td>
<td>12.0%</td>
<td>34%</td>
<td>1.0</td>
</tr>
</tbody>
</table>

2. (15 pts) A ten-year bond has a 4% coupon rate (paid semiannually).  The face value is $100, but it trades for $105. The zero-coupon ten-year bond has an interest rate of 3.8% (with semiannual compounding).  Assuming no arbitrage, what is the price of a ten-year bond with an 8% coupon rate?

3. (10 pts). Suppose that a firm has an equity beta of 0.9.  It has $200 million in debt and $100 million in equity.  There are no taxes.  What is the unlevered beta of the firm?

4. (15 pts) Consider a bond with two years to maturity, semiannual coupons and a coupon rate of 8% per year. So the holder of the bond receives four coupons: in 6 months, 12 months, 18 months and 24 months (along with the principal value in 24 months’ time). The bond trades at par.  Find the duration of the bond, in years.

5. (20 pts). Consider the following data for a one-factor economy.  All portfolios are well diversified.

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Expected Return</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12%</td>
<td>1.2</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>F</td>
<td>6%</td>
<td>0</td>
</tr>
</tbody>
</table>

(a) According to APT, what is the expected return on portfolio B?
(b) Suppose that another portfolio, portfolio E, is well diversified with a beta of 2 and an expected return of 15%. An arbitrage opportunity exists. What is it?  Be very clear about what assets you would go long/short and in what amounts.  No credit for vague or ambiguous answers.
6. (30 points) Multiple choice questions. Only one option is correct. Please indicate which one it is.
(i) A firm pays constant dividends of $5 per share per year. The CAPM required return is 5 percent per year. According to the dividend discount model, what is the price of a share in this firm?
A. $1  
B. $5  
C. $50  
D. $100  
E. $500  

(ii) Which of the following best describes the US Treasury yield curve over the last 50 years?  
A. The yield curve has typically been upward sloping. The occasions when it was downward sloping came just before bursts of inflation.  
B. The yield curve has typically been upward sloping. The occasions when it was downward sloping came just before recessions.  
C. The yield curve has typically been downward sloping. The occasions when it was upward sloping were associated with poor bank profitability.  
D. The yield curve has typically been downward sloping. The occasions when it was upward sloping came just before recessions.  
E. The yield curve has typically been downward sloping. The occasions when it was upward sloping came when the federal funds rate was unusually high. 

(iii) In March 2000, 3 Com announced that at the end of the year, they would give their shareholders 1.5 shares in Palm for every 3 Com share that they owned. At the time a share in Palm traded for $95.06, and a share in 3 Com traded for $81.11. Assume that an investor can go long or short shares in Palm or 3 Com at these prices without limit. Which of the following statements is true?  
A. There is no arbitrage in this environment.  
B. An arbitrage can be created by going long 1.5 shares in Palm and short 1 share in 3 Com.  
C. An arbitrage can be created by going long 1 share in Palm and short 1.5 shares in 3 Com.  
D. An arbitrage can be created by going short 1.5 shares in Palm and long 1 share in 3 Com.  
E. An arbitrage can be created by going short 1 share in Palm and long 1.5 shares in 3 Com.  

(iv) Which of the following is closest to the current level of the ten-year yield?  
A. 0.5%.  
B. 1.25%  
C. 2.4%  
D. 3.3%  
E. 5.0%  

(v) Stock with fixed dividend payments where failure to make payments does not lead to bankruptcy are known as:  
A. Common stock.  
B. Ordinary stock.  
C. Dividend debentures.  
D. Bonds equity.  
E. Preferred stock.
(vi) The clean price for a U.S. Treasury bond is $102. The settlement date is 91 days since the last coupon date and 91 days before the next coupon date. The coupon rate is 4 percent per annum. Which of the following is the dirty price of the bond?
A. $101  
B. $102  
C. $103  
D. $104  
E. $106  

(vii) The two-year zero coupon bond yield is 7% annum and the three-year zero coupon bond yield is 8% per annum. Bond yields are quoted with annual compounding. What is the forward rate from two to three years hence?
A. 6%.  
B. 7%.  
C. 8%.  
D. 9%.  
E. 10%.  

(viii) How many US corporations currently have a AAA credit rating from Standard and Poors?
A. None.  
B. Two.  
C. 23.  
D. All 500 firms in the S&P 500.  
E. Over 2,000.  

(ix) Consider a U.S. Treasury note maturing on September 30, 2020 with a 2 percent per annum coupon. Suppose that you buy it on September 30, 2016 for $105 and sell it on September 30, 2017 for $104. What is your holding period return?
A. -0.95 percent.  
B. 0 percent.  
C. 0.95 percent.  
D. 2 percent.  
E. 2.88 percent.  

(x) An efficient markets hypothesis stating that all public information is reflected in current share prices is classified as:
A. Weak form efficiency.  
B. Strong form efficiency.  
C. Market efficiency.  
D. Private efficiency.  
E. Semi-strong efficiency.
Solutions and Grading Rubric.

1. Impossible. The standard deviation of portfolio A must be at least $34 \times 1.2 = 40.8$ percent. The standard deviation of portfolio B must be at least $34 \times 1.5 = 51$ percent. OK to say either one of these. It is also OK to say that the market Sharpe ratio is below the Sharpe ratios of other assets. No credit for just saying impossible without explanation. No partial credit on this question.

2. The price of the zero-coupon ten-year bond with a face value of $100$ is $\frac{100}{1.019^{20}} = 68.63$. The ten-year bond with an 8% coupon rate is equivalent to two units of the bond with a 4% coupon rate minus a ten-year zero coupon bond. So the price of the ten-year bond with an 8% coupon rate has to be $2 \times 105 - 68.63 = 141.37$. 9 points for getting that the price of the bond was twice the bond with the 4% coupon minus the price of the zero-coupon bond. 3 points off for an algebra mistake. 3 points off for treating 3.8 percent as the interest rate per 6 months.

3. Unlevered Beta = $\frac{1}{1 + (D/E)}$ * Levered Beta = $\frac{1}{1 + 2} \times 0.9 = 0.3$. 2 points off for a clear algebra mistake (including writing down the formula correctly). Otherwise no partial credit.

4. Suppose that the face value is $100$ (doesn’t affect the answer). Because the bond trades at par, it must trade for the face value and the yield to maturity is equal to the coupon. So the duration (in years) is:

$$\frac{4}{1.04} \times 0.5 + \frac{4}{1.04^2} \times 1 + \frac{4}{1.04^3} \times 1.5 + \frac{104}{1.04^4} \times 2 = 1.89$$

10 points for getting the duration in number of 6 month periods but writing that this is the number of years, or not stating units.
10 points for either incorrectly treating the yield per 6 months as 8% or the coupon per 6 months as 8% (doing the conversion between semi-annual and annual incorrectly).
No credit for a formula with the right form but with inexplicable coupons (examples $40$ with a price of $100; \$3 with a price of $100$) or discounting.

5. (a) Since the beta for portfolio F is zero, its expected return must equal the risk-free rate. From the APT from portfolio A

$$0.12 = 0.06 + 1.2\lambda$$

which means that $\lambda = 0.05$. Now for portfolio B, the expected return must be $0.06 + \lambda = 0.06 + 0.05$, which is 11%. 8 points for part (a) with no partial credit.

(b) The expected return on portfolio E must be $0.06 + 2\lambda = 0.06 + 0.1 = 0.16$. Since we are told that the expected return is 15%, an arbitrage opportunity exists. Here is an arbitrage strategy.
1. Invest -$100$ in E. Payoff is -$100*(1.15+2F)$
2. Invest +$200$ in B. Payoff is $200*(1.11+F)$
3. Invest -$100$ in the risk-free asset. Payoff is -$106$.
The up-front cost is zero. The payoff is $-115 - 200F + 222 + 200F - 106 = 1$
and so the investor makes $1 for sure. That’s an arbitrage. A similar arbitrage strategy could be executed using well-diversified portfolio A instead of well-diversified portfolio B. Any such arbitrage is fine for 12 points. No credit if you got the payoff of B wrong in part (a) and this led you to get the arbitrage backwards. No credit if you construct a proposed strategy where the returns depend on the factor.

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