Each question is worth 20 points. The maximum number of points for this assignment is 140. You may work in groups of up to four on homework assignments. Please submit one solution with the names of all group members on it.

Question 1

Two firms, U and L, generate exactly the same cash flows as each other every year. Each will earn $350 in a boom year and $100 in a slump year. In each year, there is a 50% chance of a boom and a 50% chance of a slump. U is entirely equity financed, and shareholders receive the entire income of the company as a dividend every year. Its shares are currently valued at $1,000. L has $800 of perpetual risk-free debt paying an interest rate of 10%, and therefore $80 of L's income is paid out as interest every year. There are no taxes, and investors can borrow and lend at the risk-free rate.

1a) (5 points) What should the value of L's stock be if there are no arbitrage opportunities?

1b) (5 points) Suppose that you invest $40 in U's stock. Is there an alternative involving an investment in L that would give identical payoffs to those from owning $40 of U's stock in both a boom and a slump? What is the expected annual payoff from such a strategy?

1c) (5 points) Now, suppose that you invest $40 in L's stock. Is there an alternative portfolio involving an investment in U that would give identical payoffs to those from owning $40 of L's stock in both a boom and a slump? What is the expected annual payoff from such a strategy?

1d) (5 points) Show that the expected return of the alternative portfolio you constructed in part c is the same as the formula for the cost of equity on slide 25 of the 03 – Financing Fundamentals slide predicts that it should be.

Question 2

Companies X and Y each generate identical cash flow one year from today and then cease to operate. Current information about the financial structure of the two companies is as follows:

    <u>Company X:</u>
    1,000 shares outstanding, with a current market price of $10 per share
    100 bonds outstanding, with a current market price of $100 per bond

    <u>Company Y:</u>
    2,000 shares outstanding, with a current market price of $8 per share
    50 bonds outstanding, with a current market price of $100 per bond

The bonds of both companies are risk-free zero-coupon bonds that will pay the holder principal and interest due one year from today. The risk-free interest rate is 10%. An individual investor can also borrow or lend at the 10% risk-free rate. There are no taxes.

2a) (10 points) Use the four securities described above (Company X's stocks and bonds and Company Y's stocks and bonds) to construct an arbitrage portfolio (i.e., one that generates a positive profit today with no future risk) that includes exactly 100 shares of stock in Company X. How large are the arbitrage profits from this portfolio? Construction of this arbitrage portfolio will require short-selling some of the securities. Note: There are actually infinitely many arbitrage portfolios that differ only in their scale. I am asking you to construct one with exactly 100 shares of Company X's stock in order to pin down the specific arbitrage portfolio.

2b) (10 points) Suppose that Company Y is planning to issue $2,000 in new stock and use the proceeds to repurchase some of its existing bonds. You currently owns 40 shares of stock in Company Y and are concerned that the stock will offer a lower return after the financial restructuring because you (correctly) anticipate that the stock will be less risky if the company has lower leverage. You want to counteract Company Y's financial restructuring so that your payoffs are exactly the same as they would have been absent the restructuring. What financial transactions do you need to make after the restructuring in order to restore the payoffs you would have received in the absence of the restructuring? Hint: Denote that the amount of cash flow you receive before the change in capital structure if the firm's total cash flow (EBIT) by X, where X is unknown today and could be any number. Choose the financial transactions that you need to make in order to receive exactly the same amount of cash flow after the change in capital structure as you would have before when total cash flow is X.

Question 3

A company has zero-coupon bonds outstanding that mature one year from today and have a face value of $500. The bonds do not include any covenants that restrict the company from issuing additional debt, even if this additional debt is of higher seniority than the existing bonds. The company will realize all of its cash flow next year. This cash flow will be $200 with probability 1/3, $600 with probability 1/3, and $1,000 with probability 1/3. The company is planning to issue new bonds with a face value of $200 that will be senior to the old debt and that will also be due in one year. Assume for simplicity that the risk-free rate and market risk premium are zero (so there is no discounting, and thus the value of a claim today is equal to the expected payoff to the claimholder one year from today) and that there are no taxes.

3a) (10 points) How much money will the company receive from selling its new bonds?

3b) (10 points) Suppose that the proceeds from the new bonds are used to pay a one-time dividend to shareholders. After the company issues the new bonds, what will the market value of (i) the old debt, (ii) the new debt, and (iii) the company's equity be? Has total firm value changed? Who is made better off or worse off from the transaction?

Question 4

A company consists of a machine that will produce cash flows of $450 one year from today if the economy is good and $150 if the economy is bad. The economy is good or bad each with 50% probability. Assume for simplicity that the risk-free rate and market risk premium are zero (so that there is no discounting, and thus the value of a claim today is equal to the expected payoff to the claimholder one year from today) and that there are no taxes. The company has 100 shares outstanding and debt with a face value of $200 due at the end of the year.

4a) (6 points) What is the company's share price (i.e., the market value of one of its shares)?

Suppose that the company unexpectedly announces that it will issue additional debt with the same seniority as existing debt (i.e., pari passu) and a face value of $100. The company will use the entire proceeds to repurchase some of its outstanding shares.

4b) (7 points) What is the market price of the new debt?

4c) (7 points) Just after the announcement, what will the price of a share of the company's stock be?

Question 5

Company X has $10 of excess cash (i.e., cash that is not used in the company's operations) and operating assets that will generate risky (i.e., uncertain) future cash flows with a present value today of $25. It has no other assets. The company has risky zero-coupon bonds outstanding with a face value of $20 and no other debt. Who is likely to gain and who is likely to lose from the following maneuvers? Justify your answers. Note that you do not need to perform any calculations here.

5a) (10 points) Company X pays a cash dividend of $10 to its shareholders.

5b) (10 points) Company X halts operations and sells all of its operating assets for $15. It invests the proceeds from this sale along with its $10 of existing cash in Treasury Bills (i.e., risk-free bonds).

Question 6

Ace Manufacturing is an all equity firm with a current market value of $500 million and 10 million shares outstanding. Ace plans to announce that it will issue $100 million of perpetual bonds and use these funds to repurchase equity. The bonds will have a 6-percent coupon rate. After the sale of the bonds and the share repurchase, Ace will maintain the new capital structure indefinitely. The corporate tax rate for Ace is 35%, and there are no personal taxes.

6a) (5 points) Immediately after Ace announces its plan to issue bonds and repurchase equity, what will its stock price be?

6b) (5 points) Immediately after Ace announces its plan to issue bonds and repurchase equity, what will the total market value of its equity be?

6c) (5 points) How many shares will Ace repurchase?

6d) (5 points) After the bond issue and share repurchase are completed, what will be the market value of Ace's equity?

Question 7

Obtain the following variables from Compustat North America's Fundamentals Annual data via WRDS: GVKEY (firm identifier), FYEAR, DLTT, DLC, CEQ, PRCC_F, CSHO, SICH, and SIC for all available firm-year records. Compute the following variables for each firm-year record in the data:

- BookLeverage = (DLTT + DLC) / (DLTT + DLC + CEQ)
- MarketLeverage = (DLTT + DLC) / (DLTT + DLC + PRCC_F * CSHO)

Note that the firm identifier in Compustat is gvkey and the year variable is fyear. For a variety of reasons, these variables are likely to contain outliers. One (fairly unscientific) approach to reducing the influence of outliers is to winsorize the data. Winsorizing sets all values of a variable above some upper threshold percentile to the value at that percentile and all values below some lower threshold percentile to the value at that percentile. For example, winsorzing at the 1st and 99th percentiles involves setting all values of a variable above (below) the 99th (1st) percentile of the distribution to the value at the 99th (1st) percentile. Winsorize the two leverage variables at the 1st and 99th percentiles.

The standard industrial code (SIC) is an industry classification system. The Compustat variable SICH is a company's "historical" SIC – it's SIC as recorded at the time of the record. The Compustat variable SIC is a company's current-in-time SIC. In some cases, a company's SICH will be missing. Replace any missing values of SICH with a firm's current-in-time SIC. Then, calculate and report the mean values of BookLeverage and MarketLeverage and number of observations for each of the following:

- All firm-years in Compustat
- All firm-years for which SICH is in the range 4900-4999 (utilities)
- All firm-years for which SICH is in the range 2000-3999 (manufacturing firms)
- All firm-years for which SICH is in the range 6000-6199 (banks and credit unions)
- All firm-years for which SICH is 7372 (computer software)