E120 MIDTERM Spring 2017

Name: _____ (3pts)

SID: _____ (2pts)

- Any communication with other students during the exam (including showing, viewing or sharing any writing) is strictly prohibited. Any violation will result in a score of 0 points for the exam.

- Clearly state all the mathematical expressions that are needed to solve the problems. No credit will be given to numerical answers without the proper setup.

- Answer each of the following questions in the space provided. If you need more space to show major computations you performed to obtain your answer for a particular problem, use the back of the preceding page.

- **For problems show both the analytical formula for the answer and compute the numerical value of the answer, unless told otherwise.**

- This exam is closed book; however you may use your 1 page "cheat sheet" as described in class and on bcourses.

- You may use any calculator without communication ability.

- Present your work in an organized and neat fashion.

- Good luck!

Multiple Choice – circle the correct answer(s) – more than one may be correct.

1) (5pts) What is the most important difference between a corporation and all other organization forms?

   a) A corporation is a legal entity separate from its owners.

   b) A corporation is the only legal entity that can issue bonds to raise money.

   c) A corporation is the only legal entity that pays taxes.

2) (5pts) What is the main disadvantage of organizing a firm as a corporation?

   a) **Double taxation**

   b) Limited liability

   c) Liquidity

   d) Infinite life.

3) (5pts) Are hostile takeovers necessarily bad for firms or their investors? Explain.

   a) Yes. They allow new investors to profit at the expense of employees and existing investors. If existing investors and employees were better off being taken over, there would be no reason for the takeover to be hostile.

   b) No. They are a way to discipline managers who are not working in the interests of shareholders.

   c) Yes. They allow the entity taking over, the raider, to make a quick profit. This profit must come from somewhere. The only place is existing shareholders and employees, so hostile takeovers must be bad for existing shareholders.

4) (5pts) Explain how the bid-ask spread is determined today.

   a) The bid-ask spread of a stock is determined by the outstanding limit orders.

   b) The limit sell order with the lowest price is the ask price.

   c) The limit buy order with the highest price is the bid price.

   d) The limit buy order with the lowest price is the ask price.

   e) The limit sell order with the highest price is the bid price.

5) (5pts) What checks are there on the accuracy of 10-K reports?

   a) Financial statements in form 10-K are required to be audited by a neutral third party.

   b) Financial statements are always sufficiently accurate so no checks are needed.

   c) It is up to each investor to certify the accuracy of the financial statements.

   d) The accuracy of the firm's financial statements is certified by the firm's board of directors, which is the only required check.

6) (30pts) Suppose you invest $50 today and receive $1,000 in five years.
   a) What is the present value of this opportunity if the risk free rate is 5%?

$$\text{PV} = -50 + \frac{1000}{1.05^5} = 733.53$$

   b) What is the internal rate of return (IRR) of this opportunity?

$$\text{IRR} = \left(\frac{1000}{50}\right)^{\frac{1}{5}} - 1 = 82.06\%$$

   c) Suppose that instead of receiving the money in a single payment, it is split equally between a payment in five years and one in six years. Write the equation for the IRR. (You don't need to solve this equation.)

$$0 = -50 + \frac{500}{(1+\text{IRR})^5} + \frac{500}{(1+\text{IRR})^6}$$

7) (10pts) The British government has a bond paying £50 per year forever. Assume the current interest rate is 5% per year. What is the value of the bond immediately before a payment is made?

$$PV = C + \frac{C}{r} = 50 + \frac{50}{0.05} = 1050$$

8) (10pts) Suppose that the YTM for a Zero-coupon bond is 4% for one year and 5% for two years. What is the forward rate for year 2 (the forward rate quoted today for an investment that begins in one year and matures in two years)?

$$f_2 = \frac{1.05^2}{1.04} - 1 = 6\%$$

9) (20pts) Your bank is offering a 30-year mortgage with an APR of 6% and monthly payments.
   a) If you plan to borrow $400,000, what will your monthly payment be?

$$\mathrm{PV} = 400000, \qquad \mathrm{r}_m = \frac{6\%}{12} = 0.5\%, \qquad \mathrm{n}_m = 30 * 12 = 360$$

$$\mathrm{C} = \mathrm{PV}\frac{\mathrm{r}_m}{1 - \frac{1}{(1+\mathrm{r}_m)^{\mathrm{n}_m}}} = \frac{400000 * 0.005}{1 - \frac{1}{(1+0.005)^{360}}} = 2398.20$$

   b) To pay off your mortgage sooner, you decide to use your holiday bonus to make an extra payment (equal to your normal monthly payment) every year with the first payment of the year. With this extra payment, how many years will it take to pay off the loan?

Find the effective yearly payment :
Paying amount C at the end of each month for 1 year and an extra C at the end of the first month is equivalent to paying this amount at the beginning of each year

$$\mathrm{C}_0 = \frac{\mathrm{C}}{\mathrm{r}_m}\left(1 - \frac{1}{(1+\mathrm{r}_m)^{12}}\right) + \frac{\mathrm{C}}{1+\mathrm{r}_m} = 30250.82$$

which is equivalent to paying this amount at the end of each year:

$$\mathrm{C}_{\mathrm{eff}} = \mathrm{C}_0\,(1+\mathrm{r}_m)^{12} = 32116.62$$

Now use

$$\mathrm{PV} = \frac{\mathrm{C}_{\mathrm{eff}}}{r}\left(1 - \frac{1}{(1+\mathrm{r})^{\mathrm{t}}}\right)$$

where

$$\mathrm{r} = \mathrm{EAR} = (1+\mathrm{r}_m)^{12} - 1 = 6.17\%$$

so

$$\mathrm{t} = \frac{\ln\left(\frac{1}{1 - \frac{\mathrm{PV} * \mathrm{r}}{\mathrm{C}_{\mathrm{eff}}}}\right)}{\ln(1+\mathrm{r})} = 24.42$$