Midterm 1

1. (12 points) What is the effective annual interest rate in each situation?
a. A savings account with 4% annual interest rate compounded daily (assume a year consists of 365 days)?

ANSWER: (1+0.04/365)^365 - 1= 0.0408 = **4.08%**

b. A savings account with 4% annual interest rate compounded monthly?

ANSWER: (1+0.04/12)^12 - 1= 0.0407 = **4.07%**

2. Northwestern's endowment bought a year ago a bond with face value $10,000, paying semiannual coupons at an annual coupon rate of 10%.

2.1 (5 points) What is the dollar amount of each coupon payment?
(a) $1200
(b) $1000
(c) $600
(d) $500
(e) zero
(f) Something else.
(g) More information is required to answer the question.

ANSWER: 10000*10%/2=**$500, (d)**

2.2 (10 points) The bond's yield fell by 1.5% (150 basis points) over the last year. This implies that:
a) The value of this bond increased.
b) The value of this bond stayed the same.
c) The value of this bond fell.

ANSWER: **(a)** Yield goes down, so value goes up.

3. (10 points) You need to invest money for one year and decide to buy a 30-year Treasury bond issued this month with a 5% yield. What risk results from this mismatch of when you need the money and when the bond matures?
a) inflation risk
b) interest-rate risk
c) reinvestment risk
d) credit risk
e) funding liquidity risk

ANSWER: **(b)** You will need to sell the bond after 1 year (i.e., before it matures), so its value depends on the current interest rates.

4. (10 points) Which type of risk is most relevant for the bond issuer?

a) inflation risk
b) interest-rate risk
c) reinvestment risk
d) credit risk
e) funding liquidity risk

ANSWER: **(e)** This is the only of these risks that apply to issuers of bonds (the other risks apply to bond investors).

5. (11 points) Consider the following cashflow stream and a bank account paying 3% annual interest. What is the present value? Is the account value ever negative?

Year	Cashflow
0	8
1	2
2	4
3	-15
4	16

ANSWER: Present value equals 8+2*1.03^-1 + 4*1.03^-2 – 15*1.03^-3 + 16*1.03^-4 = **14.20**. If the account value is ever negative, then it will be at the end of year 3. The present value up cashflows through year 3 is 8+2*1.03^-1 + 4*1.03^-2 – 15*1.03^-3=-0.01. Since this is negative, **the account will be negative at the end of year 3**.

6. (24 points) Which of the following cashflows do you most prefer using a discount rate of 10%? Using a discount rate of 1%? Show and explain all supporting calculations!

Cashflow A: receive $10 every year, forever, with the first payment next year
Cashflow B: receive $19 every other year, forever, with the first payment being next year
Cashflow C: pay $5 every year for 20 years, with the first payment being today, and then subsequently receive $30 every year for 20 years.
Cashflow D: receive $70 today and then receive $50 in five years.

ANSWER: The present value of cashflow A is 10/r, or 100 when r= 10% and 1000 when r=1%. The two period interest rate is s=(1+r)^2-1, or 21% when r=10% and 2.01% when r=1%. The present value of cashflow B is (1+r)*19/s where the 1+r factor accounts for the fact that the first payment is in one year (half of a two year period). Thus the present value is 99.52 when r=10% and 955 when r=1%. The present value of cashflow C is -5-5/r*(1-(1+r)^-19)+(1+r)^-19*(30/r*(1-(1+r)^-20), or -5.06 when r=10% and 357 when r=1%. The present value of cashflow D is 70+50*(1+r)^-5, or 101 when r=10% and 118 when r=1%. **Thus when r=10% then cashflow D is preferred and when r=1% then cashflow A is preferred.**

7. (18 points) Irene Engels recently graduated with an MBA. In August 2007, she borrowed $50,000, and she borrowed another $50,000 in August 2008. Her student loan

has an annual interest rate of 2% compounded monthly. Irene doesn't make any payments on her student debt until she starts a lucrative Wall St. job. Then starting in September 2009 she makes a payment of $1000 every month. Now bonus time is coming near. For January 2010 she plans to make another $1000 payment (her 5th) and also apply her bonus to the debt. How big must her bonus be so that she will have completely paid-off the debt at the end of this January?

ANSWER: Let r=0.02/12 be the monthly interest rate. The future value of the debt at the end of August 2009 is 50000*(1+r)^24+50000*(1+r)^12 = 103,048. The present value at the end of August 2009 of the future payments is 1000/r*(1-(1+r)^-5) = 4975. Thus the value of the debt at the end of August 2009 is 103,048-4975=98,073. Thus the future value of the debt at the end of January 2010 is 98,073*(1+r)^5=**$98,893**. A bonus this big would allow her to pay off the debt.

8. (10 points extra credit) You are analyzing the value of the company Twitter using a 15% discount rate. You expect its cashflows over the next 4 years to be as shown below and you estimate its NPV as $1B. Explain.

Year	Cashflow
0	-20M
1	-10M
2	0
3	12M
4	40M

ANSWER: Clearly the present value of the cashflows over the next 4 years is less than $1B. So to have a present value of $1B the cashflows after year 4 must be pretty big. Another way of saying the same thing is that the value of Twitter, X, at the end of year 4 must be quite high. We can actually calculate X. The future value X at year 4 is X=(1B-20M)*1.15^4 – 10M*1.15^3+12M*1.15^1+40M = 1.753B.