Math 34: Fall 2015
Section 7.2 (Bonds)

• **Bond** is a type of promissory note.
  - A bond written agreement between borrower and a lender specifying the terms of the loan.
  - We usually use the word *bond* when the borrower make periodic interest payments to the lender.

• **Vocab.**
  - *issuer* of the bond is the entity that creates it as a way to borrow.
  - *buyer* of a bond is the lender.
  - *par value* of a bond, is the amount that will be paid to the bonds owner at maturity.
    (there are often other payments along the way).
    This is also know as *face value* or *redemption value*
  - Although bonds can sometimes be redeemed (or *called*) early, we won’t consider those.
  - *coupon rate* is the interest rate for the bond’s periodic interest payments as a percent of the par value.
  - Since bonds can be resold, how does the issuer know where to send the interest payments?
    * *coupon bond* there are actual coupons attached to the bonds that the bond owner detaches and submits when interest payments are due.
      (used to be more common)
    * *registered bond* the issue must be notified when the bond is sold.
      (more common now)
Comparing Different Kinds of Loans

Loan (Simple or Compound Interest)

Borrower

Lender

PV Annuity

Borrower

Lender

Bonds

Borrower

Lender
Comparing Different Kinds of Loans (With Vocabulary)

### Loan (Simple or Compound Interest)

- **Borrower**
  - (Debtor)
  - **PV**
- **Lender**
  - (Creditor)
  - $$$ (Principal)
  - $$$ (PV)
  - $$$ (Total Amt Repaid) (FV)

### PV Annuity

- **Borrower**
  - (PMT)
  - $$
- **Lender**
  - $$$ (PV)
  - $$$

### Bonds

- **Borrower**
  - (Issuer)
  - (Interest Payment)
  - $
  - $$
- **Lender**
  - (Buyer)
  - $$$? (Selling Price)
  - $$$ (Par Value)
  - $$$ (Face Value)
  - $$$ (Redemption Value)
• How Bonds are Sold
  – Sold at par (bond is sold for par value)
  – Sold at at premium (bond is sold for more than par value)
  – Sold at a discount (bond is sold for below par value)

• Current Yield of a bond is the interest rate the bond pays as a percent of current market price.
  – Use simple interest formula $I = PRT$
  – $I$ = amount of interest (in dollars) you get from the bond
  – $P$ = current market price
  – $R$ = find
  – $T$ = amount of time per interest payment (in years, always)

• Comparing Stocks and Bonds
  – Most estimates are bond market is larger than stock market
  – Some bonds are liquid, others are illiquid
  – Bond prices also fluctuate every minute like stock prices (but usually less)

• Risk
  – With every bond there is risk because the issuer may not be able to pay back what they owe you.
  – There is also a risk because (prevailing) interest rates change:

• Bonds and Interest Rates
  – As interest rates rise, the selling price of bonds tend to go down
    (And as internist rates decline, bond prices tend to rise)

• Special Types of Bonds:
  – Zero Coupon Bonds (long term bonds that don’t make any interest payments before maturity)
    interest rates found using CARG/rate of return formula.
    selling price (PV) found using compound interest formula.
  – Savings Bonds (issued by US government, can be kept past maturity and continue to earn interest)
• **Reading Bond Quotes:**

<table>
<thead>
<tr>
<th>Company</th>
<th>Coupon</th>
<th>Maturity</th>
<th>Current Yield</th>
<th>$ Volume</th>
<th>Last Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft (semi-annual)</td>
<td>2.375</td>
<td>5/01/2023</td>
<td>2.38</td>
<td></td>
<td>99.60</td>
</tr>
</tbody>
</table>

For March 30, 2015: From http://quicktake.morningstar.com/

- *Coupon:* Is coupon rate (percent sign omitted)
- *Current Yield:* Is the current yield rate (percent sign omitted)
- *Volume:* Is the $ amount of this bond that has been traded in the past day
- *Last Price:* is as a percent of par value (percent sign omitted)

• **Example** What is the selling price of these $1,000 Microsoft bonds today (March 30, 2015)?
1. Johny’s Landscaping business issued a $1000 par value bond with a 7.25% coupon rate on March 15, 2015. The bond has a maturity date of March 15, 2025. Interest will be paid semiannually.

   (a) How much will each interest payment be?
   (b) How much will the buyer receive on March 15, 2025?
   (c) How much in total will the buyer receive from owning this bond?
   (d) Do we know how much the buyer paid for the bond on March 15, 2015?

2. If Johny’s landscaping business is trustworthy and doing well, and bonds issued from other (similar) companies have coupon rates of 6.85%, would you expect this bond to sell at par, at a premium, or at a discount?

3. If people are willing to buy Johny’s Landscaping Bonds for $1,051.40, what is their current yield?

4. | Company               | Coupon | Maturity      | Current Yield | $ Volume | Last Price |
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Apple (semi-annual)</td>
<td>3.450</td>
<td>5/06/2024</td>
<td></td>
<td>2,500 (mill)</td>
<td>104.0</td>
</tr>
</tbody>
</table>


   (a) What is the current selling price of this Apple bond?
   (b) Calculate the Current Yield for this semiannual bond.
5. Paul is planning on buying a car this month (and taking out a loan to finance it). He overhear a (trusted) radio broadcast saying bond prices are expected to rise over the next few months. What should Paul infer from this about his impending car loan?

6. The city of Faketopia issued five thousand, ten year, $1000 par value bonds with a 4.5% quarterly coupon. The city is setting up a sinking fund into which they will make quarterly payments to accumulate to the bonds’ redemption value. The sinking fund earns 3.6% interest. How much do the city need quarterly to meet its bond obligations? *You should take into account deposits into the sinking fund and coupon payments.*

7. Find the selling price of a zero coupon bond with 7 year to maturity and a $10,000 maturity value if the interest is $5\frac{3}{4}\%$ compounded daily.