Topic: Time Value of Money

Introduction:

1. $1 today is better than $1 tomorrow.

2. Most decisions, such as investments, focus on doing something today with returns flowing over future time periods.

3. Cash flows occurring in different periods are not comparable and must be adjusted to a common time period, usually to the present, before comparison and analyses can be performed.

4. Future value (FV) -- is the amount to which an investment will grow after earning interest.

$$FV = PV(1 + r)^t$$

   Present value (PV) -- is the value today of a future cash flow.

5. Simple interest -- Interest earned only on the original investment.
   Compound interest -- Interest earned on interest and principal

   (Compounding period: How often interest is compounded.

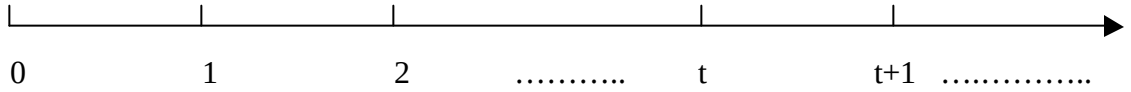
   Immediately after, you start earning (or paying) interest on the interest.

   (Annually, semi-annually, quarterly, monthly, daily, and continuously.)

I. Future Value: $FV = PV(1 + r)^t$ r: interest rate, $[(1+r)^t]$: growth factor

Ex: $100 @ 6% annually compounded

Principal 100 106 112.36 ..… $100(1+6\%)^t$



FV: PV $PV(1+r)$ $PV(1+r)^2$ …….. $PV(1+r)^t$

Ex: Credit Card (Assume interest accrues monthly)
APR: 18% Charge:$100

(1) If you decide to wait for 2 years to pay it off, how much will you owe? [Ans: $142.95]
(2) What is the effective annual rate (EAR)? [Ans: 19.56%]

APR: The annual growth rate of funds using simple interest.
EAR: The annual growth rate of funds allowing for the effects of compounding.

$1 + EAR = (1 + APR)$, $(1 + \text{monthly rate})^{12}$, …… or $(1 + \text{daily rate})^{365}$

$1 + EAR = (1 + r)^t$ Note: r and t have to be consistent!!!!

II. Present Value: $PV = FV/(1 + r)^t$ r: discount rate, $[1/(1+r)^t]$: discount factor

Ex: How much to invest today for it to grow to $500 in 2 years if interest rate is 7%? [Ans: $436.72]

Ex: How much to invest today for it to grow to $50,000 in 10 years if interest rate is 9%? [Ans: $21,120.54]

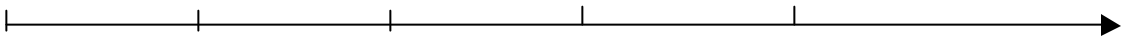
Ex: You lend me $100 today and I promise you $122.50 in 3 years. Is this a good deal for you if today's interest rate is 8.50%? [Ans: No. 6.99% vs. 8.50%]

Ex: What's the rate of return if a savings bond (a.k.a. IOU) will be worth $1,000 in 5 years and I pay $747.26 for it now? [Ans: 6.00%]

Ex: If you invest $100,000 in the UA Fund with an expected return of 12.20%, how long will it take you to be a millionaire? [Ans: 20 years]

III. Multiple CFs:

Ex: (invest) $3000 (Assume your opportunity cost of capital is 5%.)



	0	1	2	3	4
(payments)			$1,160	$1,160	$1,160
	PV of Pmt #1:		$1,052.15		
	PV of Pmt #2:		1,002.05		
	PV of Pmt #3:		954.33		
	Total		$3,008.53	>	$3,000 (initial investment)

Note 1: You can always add PV's, but not FV's unless they are in the same year.

Note 2: The project's net present value, NPV = 3,008.53 – 3,000 = 8.53 > 0

➔ worth investing according to NPV criterion.