

Value Engineering (VE) Value Analysis (VA)

CIVE 4000
Spring 2019

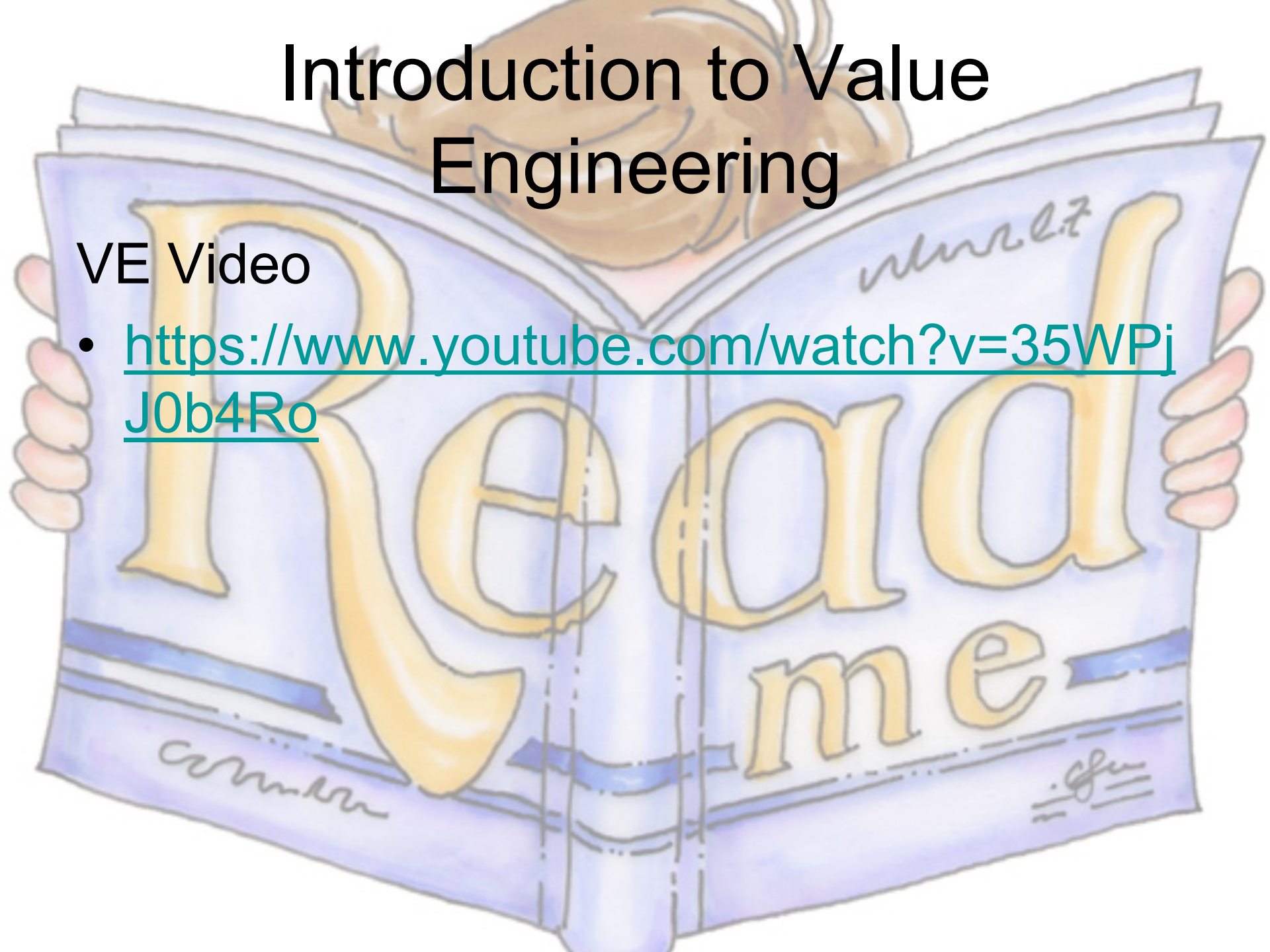
Definition

- **VAVE: Value Analysis/Value Engineering** is a systematic and organized procedural decision-making process. It has been used in almost any kind of application. It helps people creatively generate alternatives to secure essential functions at the greatest worth as opposed to costs. This is referred to as **value**. **Value** can therefore be increased by either improving the function or reducing the cost.

Introduction to Value Engineering

VE Video

- <https://www.youtube.com/watch?v=35WPjJ0b4Ro>



SAVE International

- <http://www.value-eng.org/>

Adding Value. Enhancing Ideas.

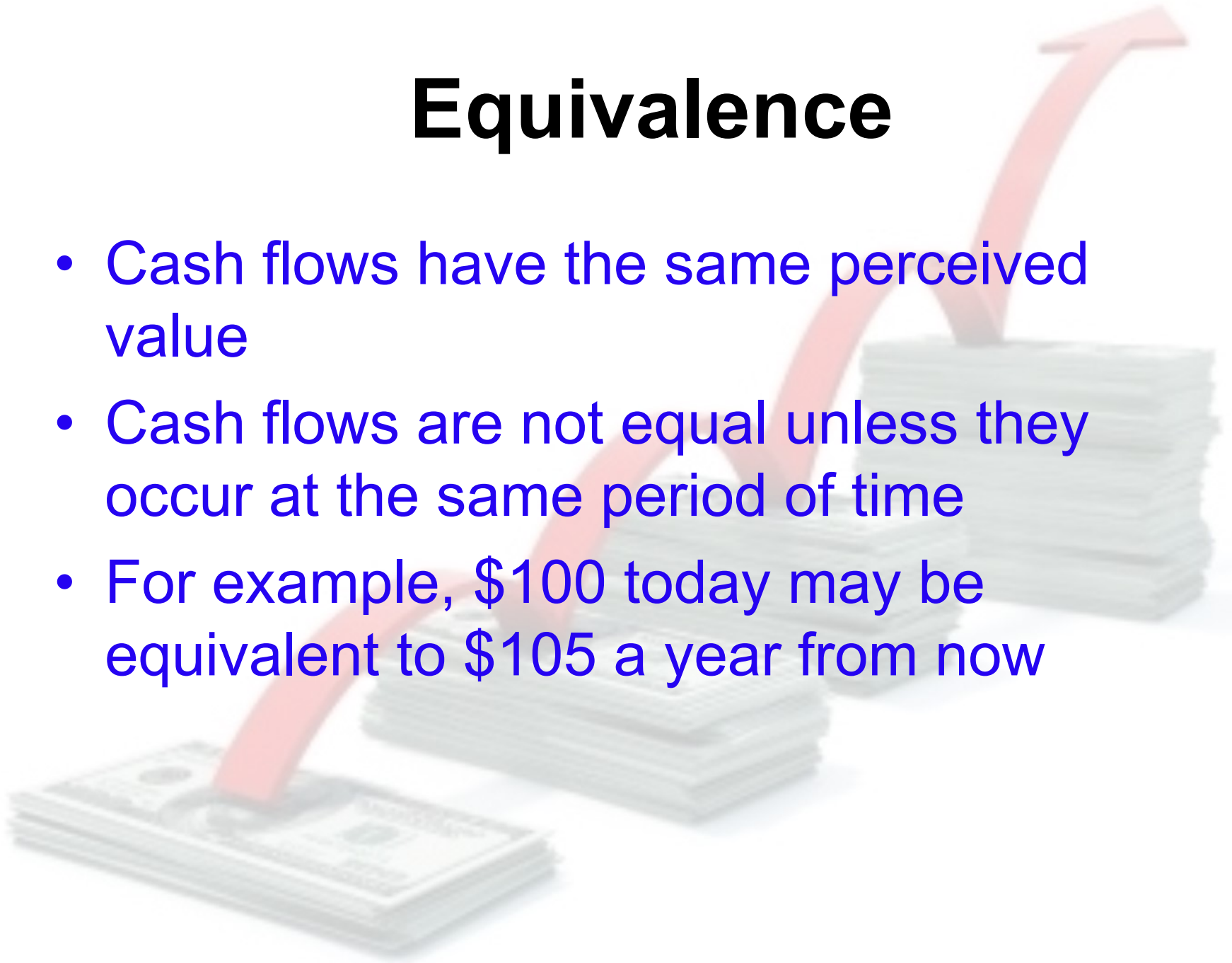
Economic Comparison Methods

Time Value of Money



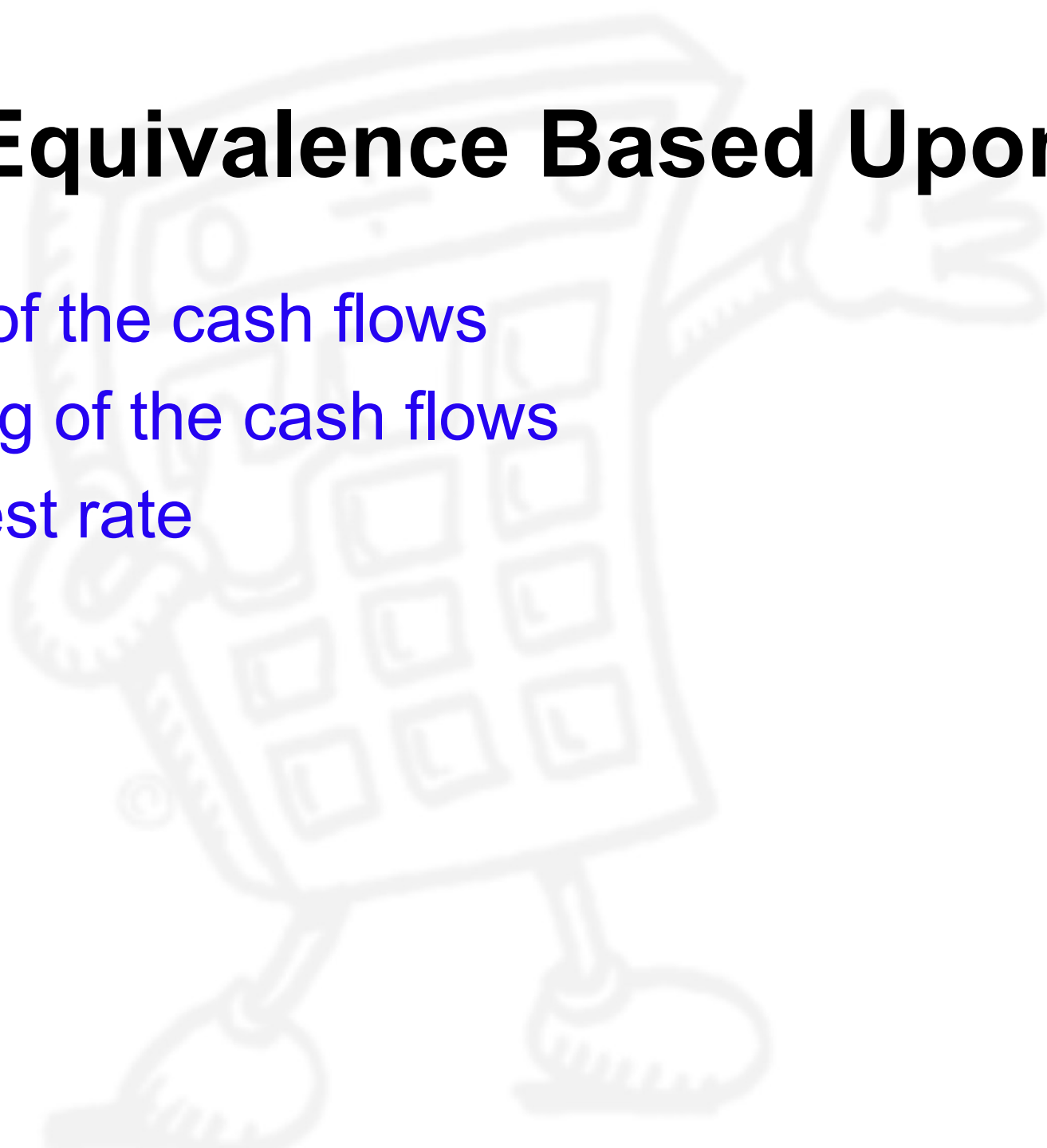
Equivalence

- Cash flows have the same perceived value
- Cash flows are not equal unless they occur at the same period of time
- For example, \$100 today may be equivalent to \$105 a year from now



Equivalence Based Upon

- Size of the cash flows
- Timing of the cash flows
- Interest rate



Variables

- P = Present value
 - Value at beginning of period 1 (end of period 0)
- F = Future value
 - Value at end of period n
- A = Uniform series
 - Cash flows are the same for the end of periods 1 through n
 - Occurs each and every period

Variables

- i = Periodic interest rate
 - Interest rate for one period
 - Period may be month or year
- n = Number of interest compounding periods
 - Must be the same length

Single-Payment Compound-Amount Factor

- Converts a present value into a future value
- $F = P(1 + i)^n$
- What will be the value of P dollars in n years at an annual interest rate of i ?

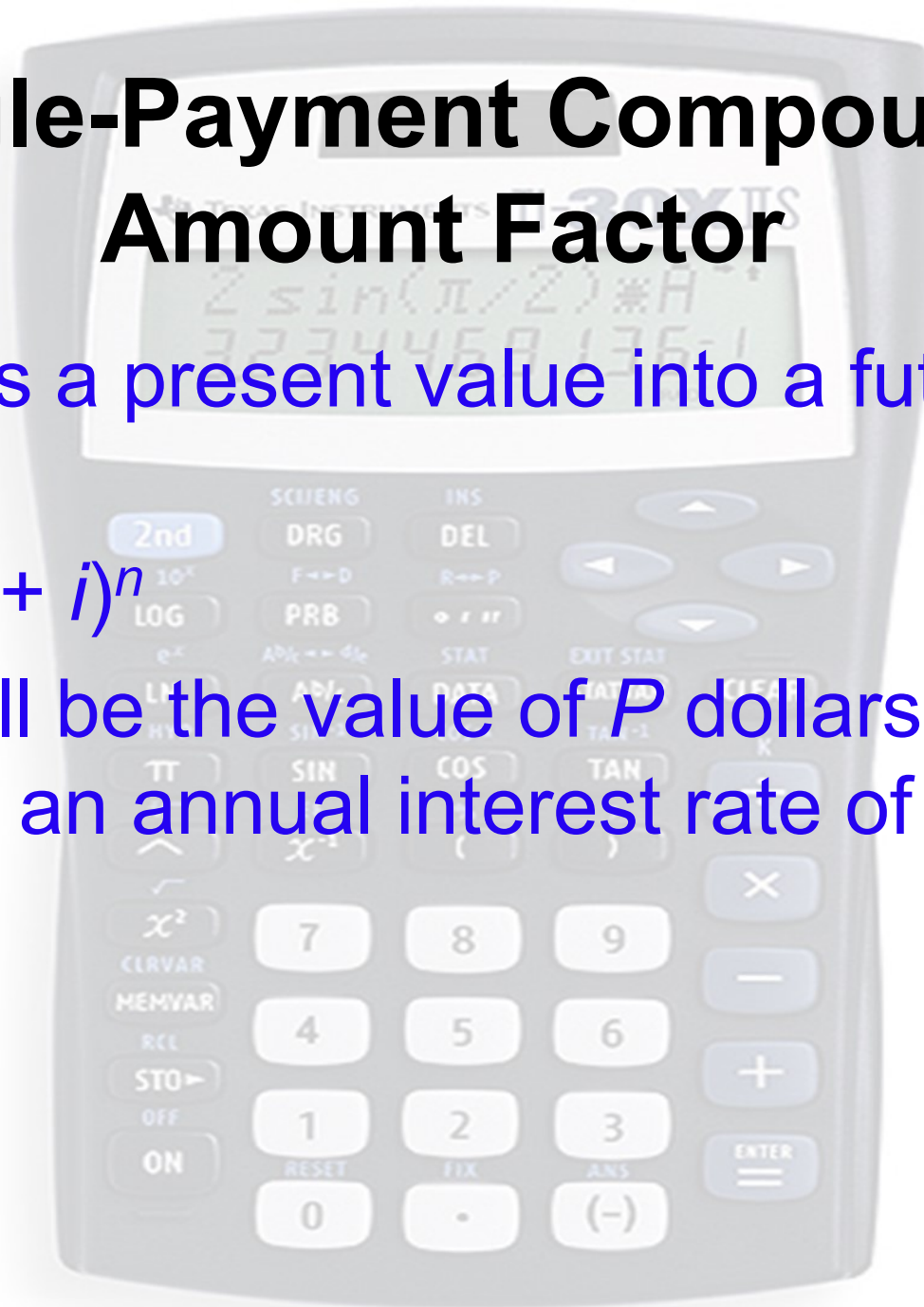
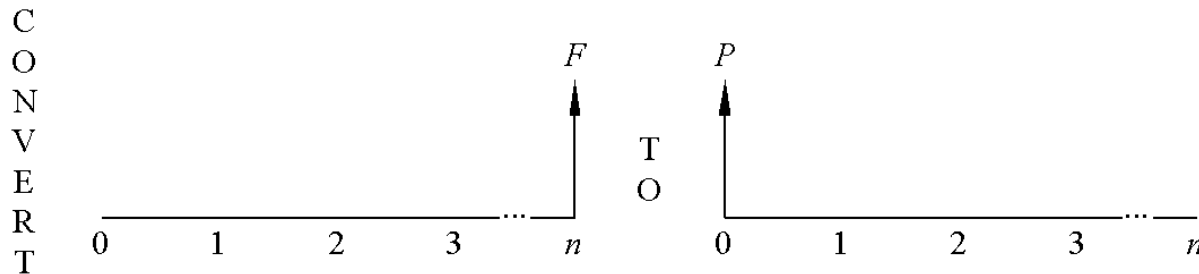


Table D-16
Interest Factors for 10.00%

n	Single-payment		Uniform-series			
	Compound- Amount Factor	Present- Worth Factor	Compound- Amount Factor	Sinking- Fund Factor	Present- Worth Factor	Capital- Recovery Factor
	Convert P to F ($F/P, i, n$)	Convert F to P ($P/F, i, n$)	Convert A to F ($F/A, i, n$)	Convert F to A ($A/F, i, n$)	Convert A to P ($P/A, i, n$)	Convert P to A ($A/P, i, n$)
1	1.1000	0.9091	1.0000	1.0000	0.9091	1.1000
2	1.2100	0.8264	2.1000	0.4762	1.7355	0.5762
3	1.3310	0.7513	3.3100	0.3021	2.4869	0.4021
4	1.4641	0.6830	4.6410	0.2155	3.1699	0.3155
5	1.6105	0.6209	6.1051	0.1638	3.7908	0.2638
6	1.7716	0.5645	7.7156	0.1296	4.3553	0.2296
7	1.9487	0.5132	9.4872	0.1054	4.8684	0.2054
8	2.1436	0.4665	11.4359	0.0874	5.3349	0.1874
9	2.3579	0.4241	13.5795	0.0736	5.7590	0.1736
10	2.5937	0.3855	15.9374	0.0627	6.1446	0.1627
11	2.8531	0.3505	18.5312	0.0540	6.4951	0.1540
12	3.1384	0.3186	21.3843	0.0468	6.8137	0.1468
13	3.4523	0.2897	24.5227	0.0408	7.1034	0.1408
14	3.7975	0.2633	27.9750	0.0357	7.3667	0.1357
15	4.1772	0.2394	31.7725	0.0315	7.6061	0.1315
16	4.5950	0.2176	35.9497	0.0278	7.8237	0.1278
17	5.0545	0.1978	40.5447	0.0247	8.0216	0.1247
18	5.5599	0.1799	45.5992	0.0219	8.2014	0.1219
19	6.1159	0.1635	51.1591	0.0195	8.3649	0.1195
20	6.7275	0.1486	57.2750	0.0175	8.5136	0.1175
21	7.4002	0.1351	64.0025	0.0156	8.6487	0.1156
22	8.1403	0.1228	71.4027	0.0140	8.7715	0.1140
23	8.9543	0.1117	79.5430	0.0126	8.8832	0.1126
24	9.8497	0.1015	88.4973	0.0113	8.9847	0.1113
25	10.8347	0.0923	98.3471	0.0102	9.0770	0.1102
26	11.9182	0.0839	109.1818	0.0092	9.1609	0.1092
27	13.1100	0.0763	121.0999	0.0083	9.2372	0.1083
28	14.4210	0.0693	134.2099	0.0075	9.3066	0.1075
29	15.8631	0.0630	148.6309	0.0067	9.3696	0.1067
30	17.4494	0.0573	164.4940	0.0061	9.4269	0.1061
35	28.1024	0.0356	271.0244	0.0037	9.6442	0.1037
40	45.2593	0.0221	442.5926	0.0023	9.7791	0.1023
45	72.8905	0.0137	718.9048	0.0014	9.8628	0.1014

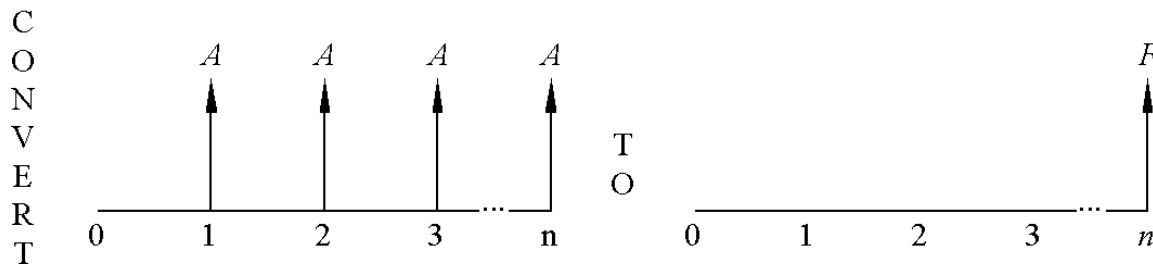
Single-Payment Present-Worth Factor

- Converts a future value into a present value
- $P = F/(1 + i)^n$



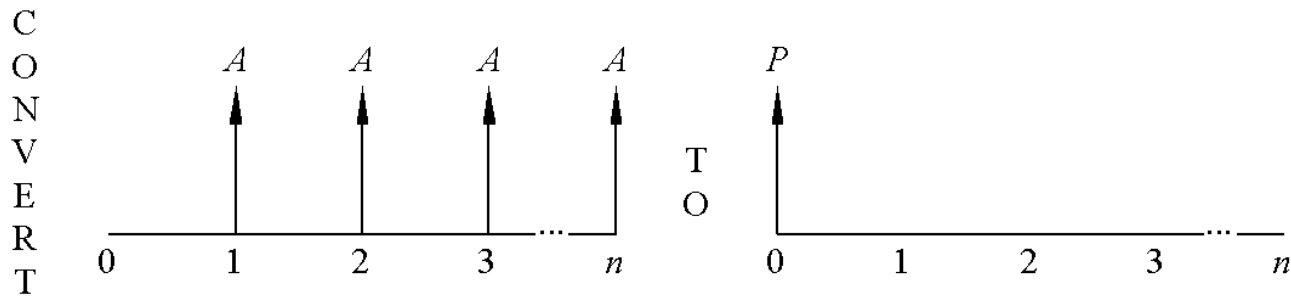
Uniform-Series Compound-Amount Factor

- Converts a uniform series into a future value
- $F = A[(1 + i)^n - 1]/i$



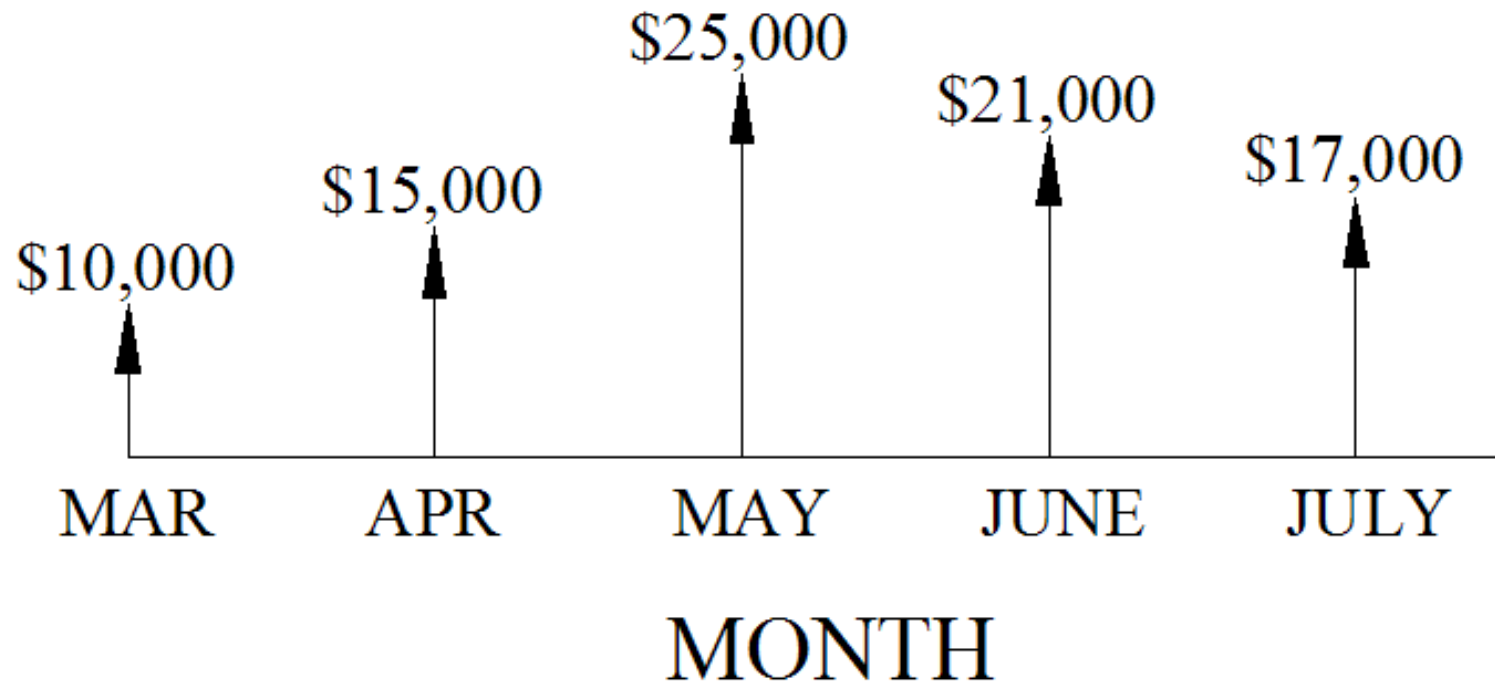
Uniform-Series Present-Worth Factor

- Converts a uniform series into a present value
- $P = A[(1 + i)^n - 1]/[i(1 + i)^n]$

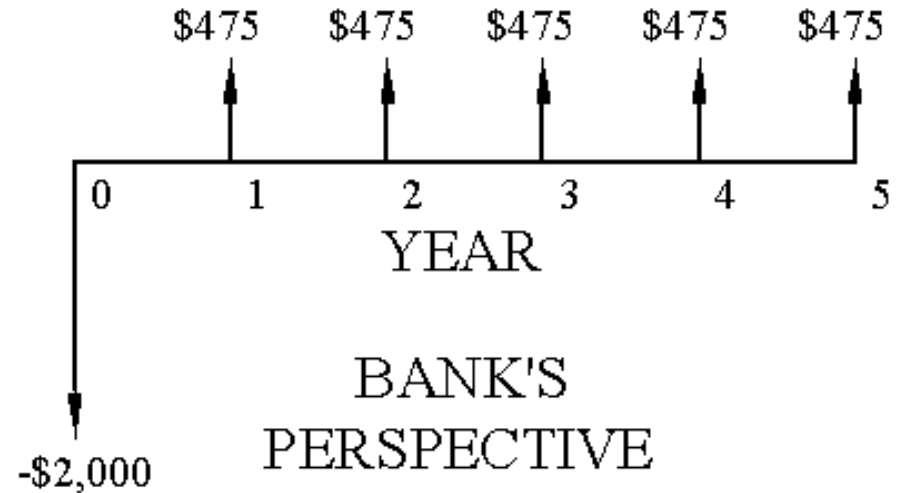
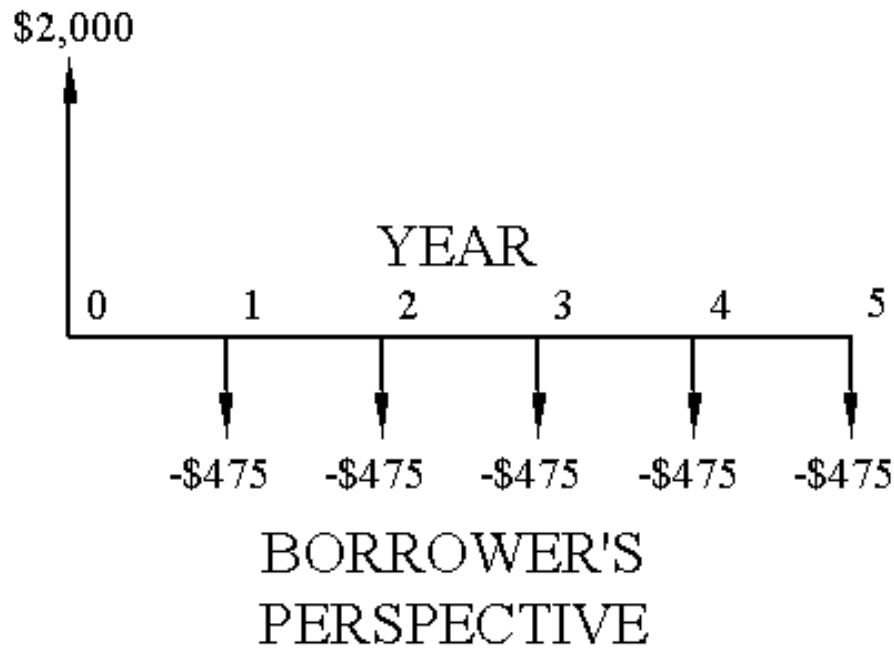


Cash-flow diagrams

- Shows direction, size, and timing of cash flow

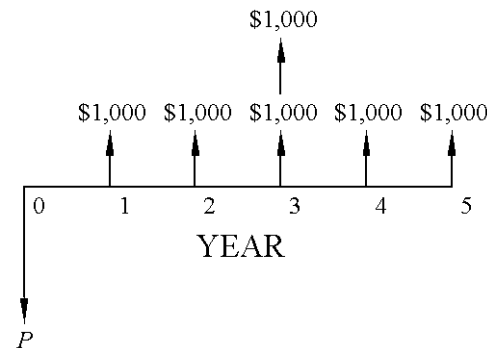
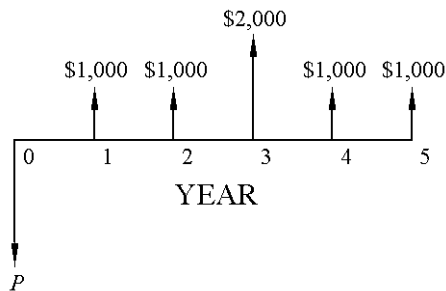


Cash Flow Diagrams



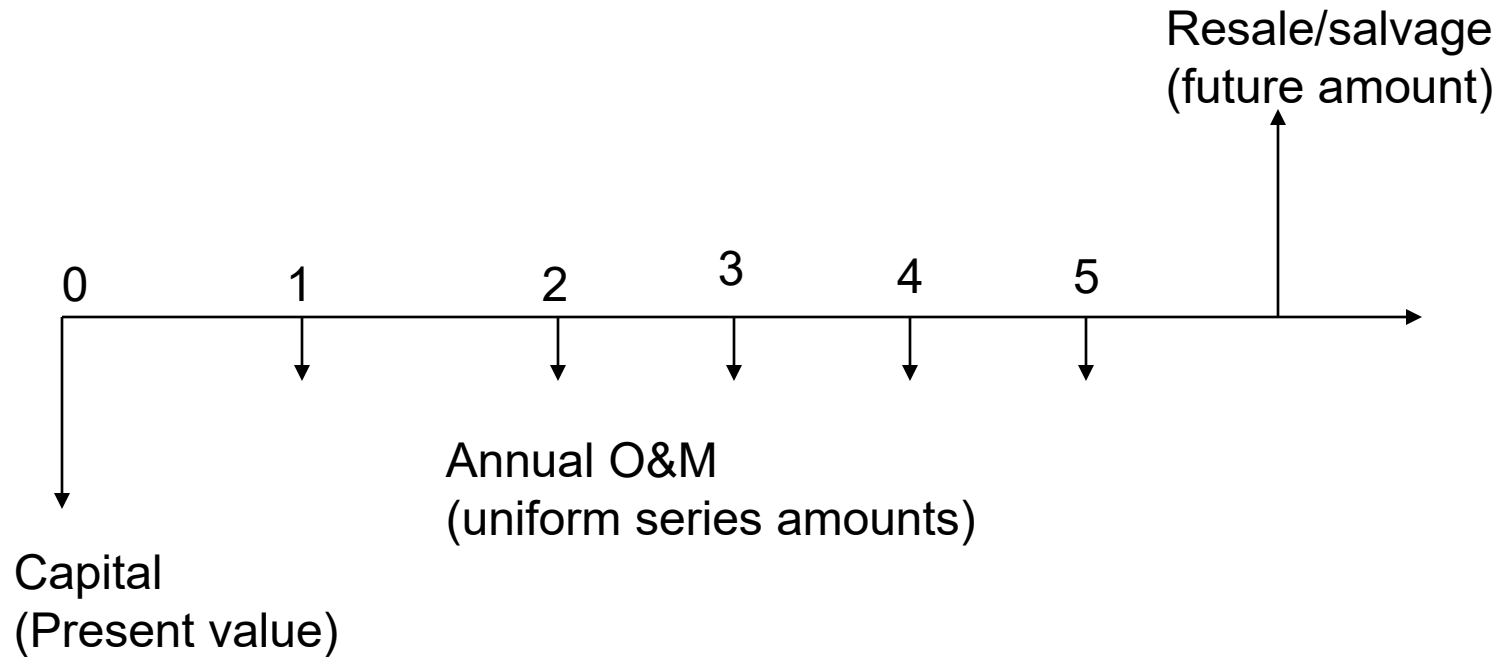
Complex cash flows

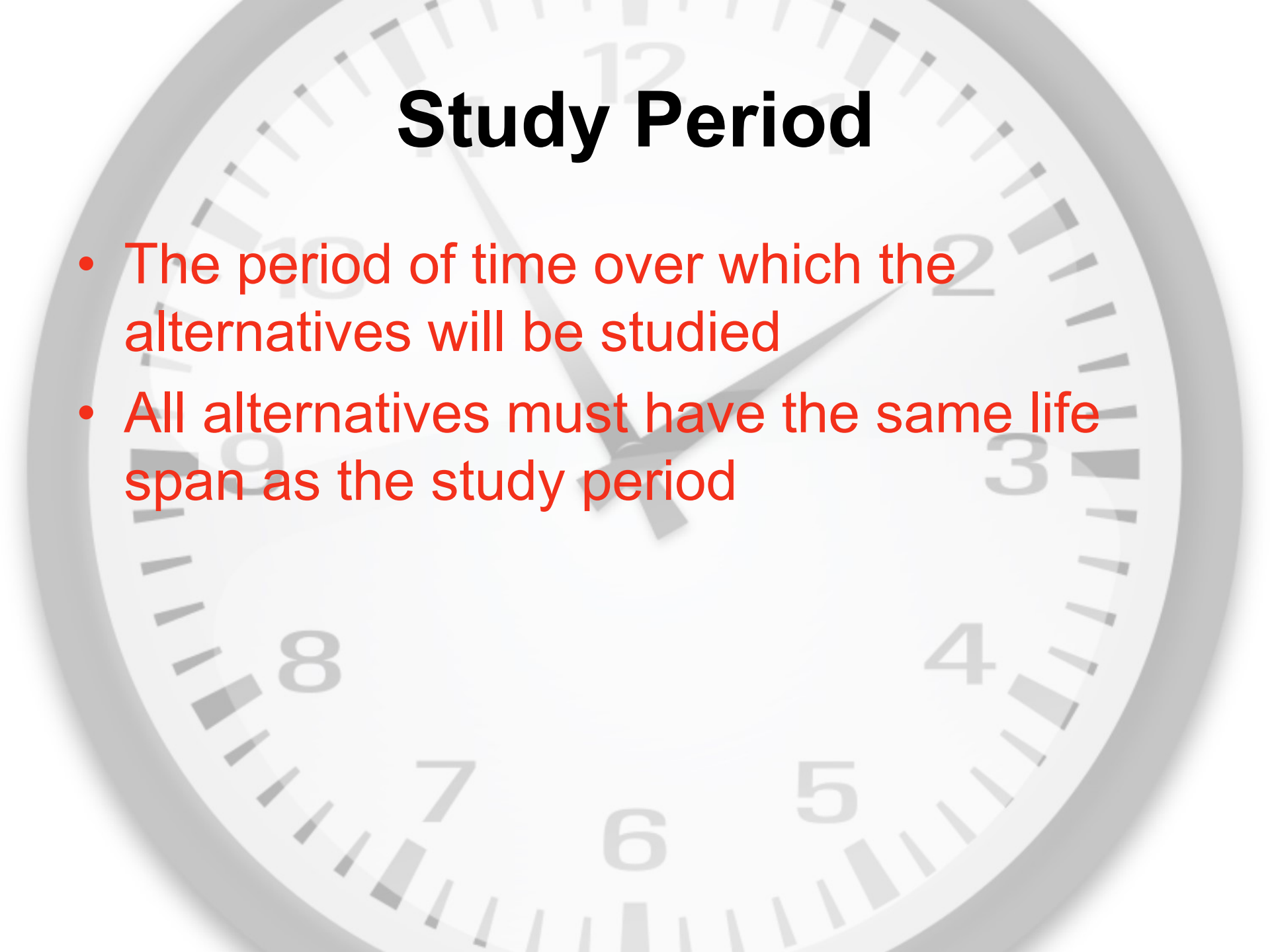
- Cash flows occurring at the same period of time may be added or subtracted
- Use time value of money to move all of the cash flows to the same point in time and add or subtract them



Life Cycle Costing (LCC) Typical

- Cash Flow Diagram





Study Period

- The period of time over which the alternatives will be studied
- All alternatives must have the same life span as the study period

Adjusting Live Spans

- Shorten by adding salvage value (sold at end of shorten life)
- Lengthen by adding maintenance or upgrade cost at end of life
 - For example, upgrading a computer
- Repurchase alternative
 - May be done until all alternatives end at the same time (least common multiple)
- Combination of above

Net Present Value (NPV) or Present Worth (Method)

- Determine present value (at beginning of the study period) for each alternative's cash flows at the MARR
- Typically used in a VE

Minimum Attractive Rate of Return (MARR)

Future Worth (FW) (Method)



Future

- Determine future worth (at end of the study period) for each alternative's cash flows

Past



Default Values

- Annual interest rate on capital loans: 8%
- Annual interest rate on money earned: 4%
- Annual inflation: 3%
- Design life: 20 years

