Chapter 6

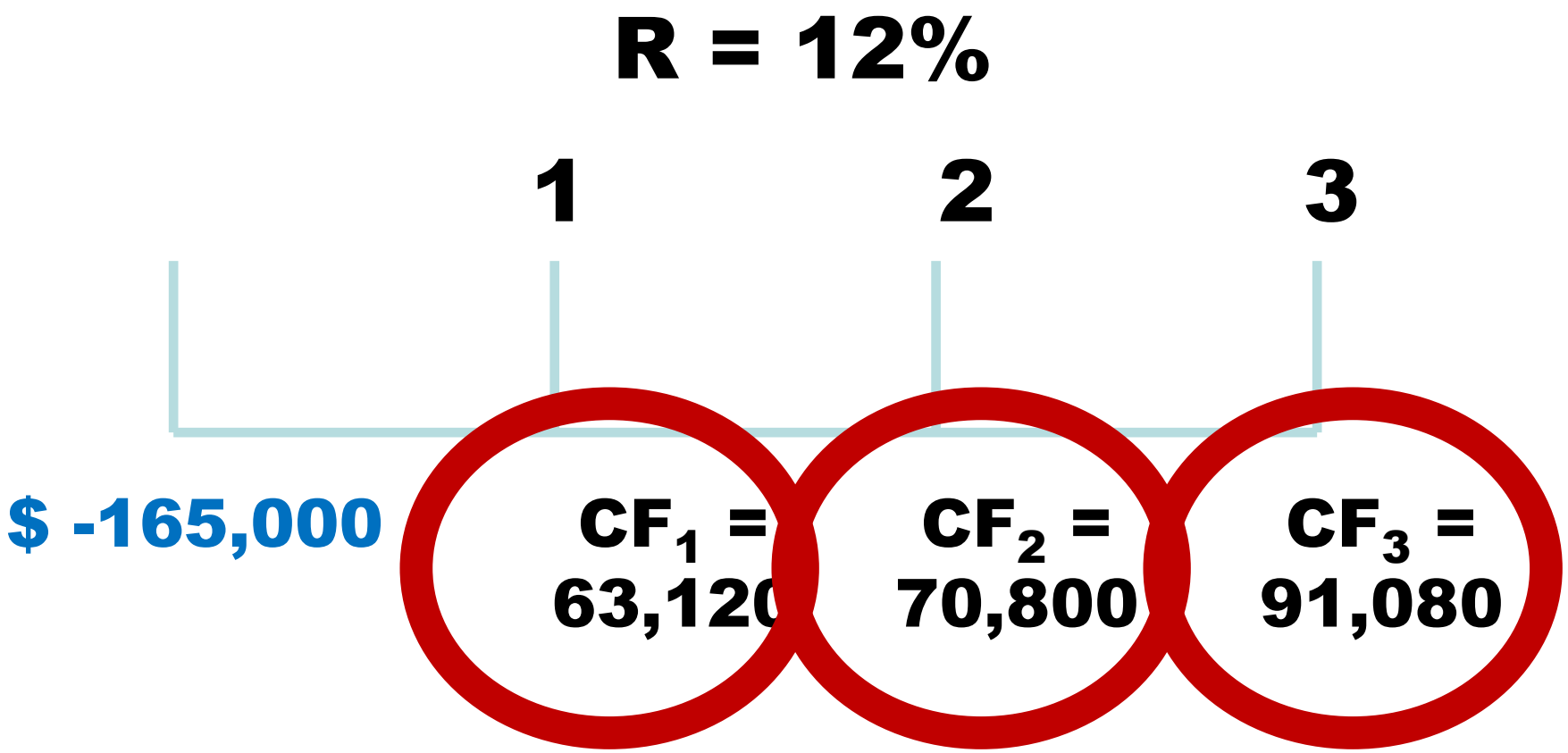
Making Capital Investment Decisions
投资决策

Capital Budgeting and Cash Flows

In the previous chapter we focused on multiple techniques of capital budgeting to evaluate projects.

This chapter is all about how each of the cash flows (CF's) are determined.

Project Example



The required return for assets of this risk level is 12% (as determined by the firm).

Relevant Cash Flows

- Include only cash flows that will only occur if the project is accepted
- Incremental cash flows 增量现金流量
  - These cash flows are the changes in the firm's cash flows that occur as a direct consequence of accepting the project
- The *stand-alone principle* allows us to analyze each project in isolation from the firm simply by focusing on incremental cash flows

Relevant Cash Flows:
Incremental Cash Flow for a Project

Corporate cash flow with the project

Minus

Corporate cash flow without the project

Relevant Cash Flows

- **"Sunk" Costs 沉没成本…… N**
  - A cost that has already been incurred and cannot be removed and therefore should not be considered in an investment decision.
- **Opportunity Costs 机会成本…….. Y**
  - The most valuable alternative that is given up if a particular investment is undertaken
  - Your firm may have an asset that it is considering selling, leasing, or employing elsewhere in the business. If the asset is used in a new project, potential revenues from alternative uses are lost. They are called opportunity cost because, by taking the project, the firm forgoes other opportunities for using the assets.
- **Side Effects副效应……Y**
  - Positive side effects (Synergy) 协同效应 – benefits to other projects (a new product increases the sales and, hence, the cash flows of existing products)
  - Negative side effects (Erosion) 侵蚀效应 – costs to other projects (a new project reduces the cash flows of existing projects)

Incremental Cash Flows

- Sunk costs are not relevant
  - Just because “we have come this far” does not mean that we should continue to throw good money after bad. Because sunk costs are in the past, they cannot be changed by the decision to accept or reject the project.
- Opportunity costs *do* matter.
  - Just because a project has a positive NPV, that does not mean that it should also have automatic acceptance. Specifically, if another project with a higher NPV would have to be passed up, then we should not proceed.

Sunk Costs

- The General Milk Company (GMC) is currently evaluating the NPV of establishing a line of chocolate milk. As part of the evaluation, the company paid a consulting firm $100,000 **last year** for a test marketing analysis. Is this cost relevant for the capital budgeting decision now confronting GMC's management?
- **No.** Since the $100,000 was already spent, acceptance of the project does not affect this cash flow. Therefore, the cash flow should be ignored for capital budgeting purposes.
- Of course, the decision to spend $100,000 for a marketing analysis was a capital budgeting decision itself and was perfectly relevant **before** it was sunk. Once the company incurred the expense, the cost became irrelevant for any future decision.

Relevant Cash Flows

- Net Working Capital 净营运资本…….. Y
  - The firm supplies working capital at the beginning and recovers it toward the end
  - Purchase raw materials before production and sale, giving rise to an investment in inventory; maintain cash as a buffer against unforeseen expenditures
  - In the final year of the project, net working capital will decline to zero; the investment in working capital is to be completely recovered by the end of the project's life
- Financing Costs 融资成本……. N
  - We generally don't include the cash flows associated with interest payments or principal on debt, dividends, or other financing costs in computing cash flows. Financing costs are reflected in the discount rate used to discount the project cash flows.
- Tax Effects 税收效应…….. Y

Relevant Cash Flows

Mason Farms purchased a building for $689,000 eight years ago. Six years ago, repairs were made to the building which cost $136,000. The building has a current market value of $840,000 and a current book value of $494,000. If the company decides to use this building for a new project, what value, if any, should be included in the initial cash flow of the project for this building?

Practice Problems Ch. 6

- Waterfront Shirts is a specialty retailer offering T-shirts, sweatshirts, and caps. Its most recent annual sales consisted of $14,000 of T-shirts, $11,000 of sweatshirts, and $1,300 of caps. The company is adding polo shirts to the line-up and projects that this addition will result in sales next year of $12,000 of T-shirts, $8,000 of sweatshirts, $7,800 of polo shirts, and $1,300 of caps. What sales amount should be used when evaluating the Polo shirt project?

Pro Forma Statements and Cash Flow

- Pro Forma Financial Statements

  Projects future operations

- Operating Cash Flow:

  OCF = EBIT + Depr – Taxes

  OCF = NI + Depr, if no interest expense

  OCF = (Sales – Costs)(1 – T) + Depreciation*T, if no interest expense

- Cash Flow From Assets:

  CFFA = OCF – NCS –ΔNWC

  NCS = Net capital spending

Shark Attractant Project

- Estimated sales — 50,000 cans
- Sales Price per can — $4.00
- Cost per can — $2.50
- Estimated life — 3 years
- Fixed costs — $12,000/year
- Initial equipment cost — $90,000
  - 100% depreciated over 3 year life
- Investment in NWC — $20,000
- Tax rate — 34%
- Cost of capital — 20%

Pro Forma Income Statement

Sales (50,000 units at $4.00/unit)	$200,000
Variable Costs ($2.50/unit)	125,000
Fixed costs	12,000
Depreciation ($90,000 / 3)	30,000
EBIT	$ 33,000
Taxes (34%)	11,220
Net Income	$ 21,780

Projected Total Cash Flows
Table 10.5

	Year			
	0	1	2	3
OCF		$51,780	$51,780	$51,780
△ NWC	-$20,000			20,000
Capital Spending	-$90,000			
CFFA	-$110,00	$51,780	$51,780	$71,780

Note: Investment in NWC is recovered in final year

Equipment cost is a cash outflow in year 0

Shark Attractant Project

Pro Forma Income Statement				
Year	0	1	2	3
Sales		200,000	200,000	200,000
Variable Costs		125,000	125,000	125,000
Gross Profit		75,000	75,000	75,000
Fixed Costs		12,000	12,000	12,000
Depreciation		30,000	30,000	30,000
EBIT		33,000	33,000	33,000
Taxes		11,220	11,220	11,220
Net Income		21,780	21,780	21,780

Cash Flows				
Operating Cash Flow		51,780	51,780	51,780
Changes in NWC	-20,000			20,000
Net Capital Spending	-90,000			
Cash Flow From Assets	-110,000	51,780	51,780	71,780

Net Present Value	$10,647.69
IRR	25.76%

OCF = Net Income + Depreciation (if no interest)

Computing NPV for the Project

- Bruno's Lunch Counter is expanding and expects operating cash flows of $29,000 a year for 4 years as a result. This expansion requires $39,000 in new fixed assets. These assets will be worthless at the end of the project. In addition, the project requires $3,000 of net working capital throughout the life of the project. What is the net present value of this expansion project at a required rate of return of 15 percent?

Cash Flow From Assets

Year	0	1	2	3	4
OCF		29000	29000	29000	29000
NCS	-39000				
NWC	-3000				3000
CFFA	-42000	29000	29000	29000	32000

NPV = 42510

Changes in NWC

- GAAP requirements:
  - Sales recorded when made, not when cash is received
    - Cash in = Sales - ΔAR
  - Cost of goods sold recorded when the corresponding sales are made, whether suppliers paid yet or not
    - Cash out = COGS - ΔAP
- Buy inventory/materials to support sales before any cash collected

Changes in NWC

- The Buck Store is considering a project that will require additional inventory of $216,000 and will increase accounts payable by $181,000. Accounts receivable are currently $525,000 and are expected to increase by 9 percent if this project is accepted. What is the project's initial cash flow for net working capital?

Changes in NWC

- The Buck Store is considering a project that will require additional inventory of $216,000 and will increase accounts payable by $181,000. Accounts receivable are currently $525,000 and are expected to increase by 9 percent if this project is accepted. What is the project's initial cash flow for net working capital?

NWC requirement = -$216,000 + $181,000 - ($525,000 × 0.09)

= - $82,250

Depreciation & Capital Budgeting

- Use the schedule required by the IRS for tax purposes
- Depreciation = non-cash expense
  - Only relevant due to tax affects
- Depreciation tax shield 税盾= DT
  - D = depreciation expense
  - T = marginal tax rate

Computing Depreciation

- Straight-line depreciation 直线折旧法

  D = (Initial cost – salvage) / number of years

  Straight Line → Salvage Value

- MACRS (Modified accelerated cost recovery system) 加速折旧法

  Depreciate → 0

  Recovery Period = Class Life

  Multiply percentage in table by the initial cost

加速折旧

- 2009年《关于企业固定资产加速折旧所得税处理有关问题的通知》
- 一、根据《企业所得税法》第三十二条及《实施条例》第九十八条的相关规定，企业拥有并用于生产经营的主要或关键的固定资产，由于以下原因确需加速折旧的，可以缩短折旧年限或者采取加速折旧的方法：
  （一）由于技术进步，产品更新换代较快的；
  （二）常年处于强震动、高腐蚀状态的。
- 双倍余额递减法，是指在不考虑固定资产预计净残值的情况下，根据每期期初固定资产原值减去累计折旧后的金额和双倍的直线法折旧率计算固定资产折旧的一种方法。应用这种方法计算折旧额时，由于每年年初固定资产净值没有减去预计净残值，所以在计算固定资产折旧额时，应在其折旧年限到期前的两年期间，将固定资产净值减去预计净残值后的余额平均摊销。计算公式如下：
  年折旧率＝2÷预计使用寿命(年)×100％
  月折旧率＝年折旧率÷12
  月折旧额＝月初固定资产账面净值×月折旧率
- 年数总和法，又称年限合计法，是指将固定资产的原值减去预计净残值后的余额，乘以一个以固定资产尚可使用寿命为分子、以预计使用寿命逐年数字之和为分母的逐年递减的分数计算每年的折旧额。计算公式如下：
  年折旧率＝尚可使用年限÷预计使用寿命的年数总和×100%
  月折旧率＝年折旧率÷12
  月折旧额＝(固定资产原值-预计净残值)×月折旧率

MACRS schedule

MACRS Depreciation Table			
Year	3-Year	5-Year	7-Year
1	33.33%	20.00%	14.29%
2	44.44%	32.00%	24.29%
3	14.82%	19.20%	17.49%
4	7.41%	11.52%	12.49%
5		11.52%	8.93%
6		5.76%	8.93%
7			8.93%
8			4.45%

MACRS schedule
(initial cost is $110,000)

Year	MACRS percent	Depreciation per year
1	.3333	.3333(110,000) D_1= $36,663
2	.4445	.4445(110,000) D_2= $48,895
3	.1481	.1481(110,000) D_3= $16,291
4	.0741	.0741(110,000) D_4= $8,151

Straight-line Depreciation

- Keyser Mining is considering a project that will require the purchase of $875,000 in new equipment. The equipment will be depreciated straight-line to a zero book value over the 7-year life of the project. What is the value of the depreciation in year 4 of the project?

MACRS schedule

- Bernie's Beverages purchased some fixed assets classified as 5-year property for MACRS. The assets cost $94,000. What will the accumulated depreciation be at the end of year three?

MACRS 5-year property	
Year	Rate
1	20.00%
2	32.00%
3	19.20%
4	11.52%
5	11.52%
6	5.76%

After-Tax Salvage

- If the salvage value is different from the book value of the asset, then there is a tax effect
- Book value = initial cost – accumulated depreciation
- After-tax salvage = salvage – T(salvage – book value)

Tax Effect on Salvage

Net Salvage Cash Flow
= SP - (SP-BV)(T)

Where:

SP = Selling Price
BV = Book Value
T = Corporate tax rate

Example:
Depreciation and After-tax Salvage

- Car purchased for $12,000
- 5-year property
- Marginal tax rate = 34%.

Depreciation		5-year Asset		
Year	Beg BV	Depr %	Deprec	End BV
1	$ 12,000.00	20.00%	$ 2,400.00	$ 9,600.00
2	$ 9,600.00	32.00%	$ 3,840.00	$ 5,760.00
3	$ 5,760.00	19.20%	$ 2,304.00	$ 3,456.00
4	$ 3,456.00	11.52%	$ 1,382.40	$ 2,073.60
5	$ 2,073.60	11.52%	$ 1,382.40	$ 691.20
6	$ 691.20	5.76%	$ 691.20	$ -
		100.00%	$ 12,000.00	

Salvage Value & Tax Effects

Depreciation	5-year Asset			
Year	Beg BV	Depr %	Deprec	End BV
1	$ 12,000.00	20.00%	$ 2,400.00	$ 9,600.00
2	$ 9,600.00	32.00%	$ 3,840.00	$ 5,760.00
3	$ 5,760.00	19.20%	$ 2,304.00	$ 3,456.00
4	$ 3,456.00	11.52%	$ 1,382.40	$ 2,073.60
5	$ 2,073.60	11.52%	$ 1,382.40	$ 691.20
6	$ 691.20	5.76%	$ 691.20	$ -
		100.00%	$ 12,000.00	

Net Salvage Cash Flow = SP - (SP-BV)(T)

If sold at EOY 5 for $3,000:

NSCF = 3,000 - (3000 - 691.20)(.34) = $2,215.01

= $3,000 – 784.99 = $2,215.01

If sold at EOY 2 for $4,000:

NSCF = 4,000 - (4000 - 5,760)(.34) = $4,598.40

= $4,000 – (-598.40) = $4,598.40

After-tax Salvage

- You own some equipment that you purchased 4 years ago at a cost of $225,000. The equipment is 5-year property for MACRS. You are considering selling the equipment today for $87,000. Which one of the following statements is correct if your tax rate is 35 percent?

MACRS 5-year property

Year	Rate
1	20.00%
2	32.00%
3	19.20%
4	11.52%
5	11.52%
6	5.76%

After-tax Salvage= SP - (SP-BV)(T)

- You own some equipment that you purchased 4 years ago at a cost of $225,000. The equipment is 5-year property for MACRS. You are considering selling the equipment today for $87,000. Which one of the following statements is correct if your tax rate is 35 percent?

MACRS 5-year property

Year	Rate
1	20.00%
2	32.00%
3	19.20%
4	11.52%
5	11.52%
6	5.76%

After-tax Salvage= SP - (SP-BV)(T)

- Accumulated depreciation$_4$ = $225,000 × (0.20 + 0.32 + 0.192 + 0.1152) = $186,120
  Book Value$_4$ = $225,000 - $186,120 = $38,880
  Taxable gain on sale = $87,000 - $38,880 = $48,120
  Tax due = $48,120 × 0.35 = $16,842
  Aftertax salvage value = $87,000 - $16,842 = $70,158

Practice Problems Ch. 6

- Metal Makers, Inc. purchased some welding equipment 7 years ago at a cost of $579,000. Today, the company is selling this equipment for $110,000. The tax rate is 34 percent. What is the aftertax cash flow from this sale? The MACRS allowance percentages are as follows, commencing with year one: 14.29, 24.49, 17.49, 12.49, 8.93, 8.92, 8.93, and 4.46 percent.

- Book value = 579000*0.0446=25823.4
- After-tax salvage = 110000-0.34*(110000-25823.4)
- = 81380

Majestic Mulch & Compost Co

Majestic Mulch and Compost Company (MMCC)										
	YEAR		0	1	2	3	4	5	6	7	8
Background Data:										
	Unit Sales Estimates			3,000	5,000	6,000	6,500	6,000	5,000	4,000	3,000
	Variable Cost /unit	$ 60.00									
	Fixed Costs per year	$ 25,000.00									
	Sale Price per unit	$ 120.00		$ 120.00	$ 120.00	$ 120.00	$ 110.00	$ 110.00	$ 110.00	$ 110.00	$ 110.00
	Tax Rate	34.0%									
	Required Return on Project	15.0%									
	Yr 0 NWC	$ 20,000.00									
	NWC % of sales	15%									
	Equipment cost - installed	$ 800,000									
	Salvage Value in year 8	20%	of equipment cost								
Depreciation Calculations:										
	Equipment Depreciable Base	800,000									
	MACRS % (Eqpt-7 yr)			14.29%	24.49%	17.49%	12.49%	8.92%	8.93%	8.93%	4.46%
	Recovery Allowance			114,320	195,920	139,920	99,920	71,360	71,440	71,440	35,680
	Book Value			685,680	489,760	349,840	249,920	178,560	107,120	35,680	0
After-Tax Salvage Value											
	Salvage Value	20%	160,000								
	Book Value (Year 8)		0								
	Capital Gain/Loss		160,000								
	Taxes		54,400								
	Net SV (SV-Taxes)		105,600								
Required Net Working Capital Investment											
			20,000	54,000	90,000	108,000	107,250	99,000	82,500	66,000	49,500

Given Data and Projected Revenues

Majestic Mulch & Compost Co

	YEAR	0	1	2	3	4	5	6	7	8
Initial Investment										
	Equipment Cost	(800,000)								
	Sales		360,000	600,000	720,000	715,000	660,000	550,000	440,000	330,000
	Variable Costs		180,000	300,000	360,000	390,000	360,000	300,000	240,000	180,000
	Fixed Costs		25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
	Depreciation (Eqpt))		114,320	195,920	139,920	99,920	71,360	71,440	71,440	35,680
	EBT		40,680	79,080	195,080	200,080	203,640	153,560	103,560	89,320
	Taxes		13,831	26,887	66,327	68,027	69,238	52,210	35,210	30,369
	Net Operating Income		26,849	52,193	128,753	132,053	134,402	101,350	68,350	58,951
	Add back Depreciation		114,320	195,920	139,920	99,920	71,360	71,440	71,440	35,680
	Operating Cash Flows		141,169	248,113	268,673	231,973	205,762	172,790	139,790	94,631
	NWC investment & Recovery	(20,000)	(34,000)	(36,000)	(18,000)	750	8,250	16,500	16,500	66,000
	Salvage Value									105,600
	TOTAL PROJECTED CF	(820,000)	107,169	212,113	250,673	232,723	214,012	189,290	156,290	266,231
	Discounted Cash Flows	(820,000)	93,190	160,388	164,821	133,060	106,402	81,835	58,755	87,031
	Cumulative Cash flows	(820,000)	(712,831)	(500,718)	(250,046)	(17,323)	196,690	385,979	542,269	808,500

NPV	$65,483
IRR	17.24%
Payback	4.08

MMC Projected Cash Flows

Special Case: Cost Cutting

1. Your company is considering a new computer system that will initially cost $1 million.
2. It will save $300,000 per year in inventory and receivables management costs.
3. The system is expected to last for five years and will be depreciated using 3-year MACRS.
4. The system is expected to have a salvage value of $50,000 at the end of year 5.
5. There is no impact on net working capital.
6. The marginal tax rate is 40%.
7. The required return is 8%.

Special Case: Cost Cutting

Initial Cost	1,000,000
Savings per year	300,000
Tax Rate	40%
Expected Salvage	50,000
Discount Rate	8%

3-Year MACRS Depreciation Schedule				
Year	1	2	3	4
Percentage	33.33%	44.45%	14.81%	7.41%
Depreciation Expense	333,300	444,500	148,100	74,100

Year	0	1	2	3	4	5
Operating Cash Flow		313,320	357,800	239,240	209,640	180,000
Net Capital Spending	-1,000,000					30,000
Changes in NWC	0					0
Cash Flow from Assets	-1,000,000	313,320	357,800	239,240	209,640	210,000

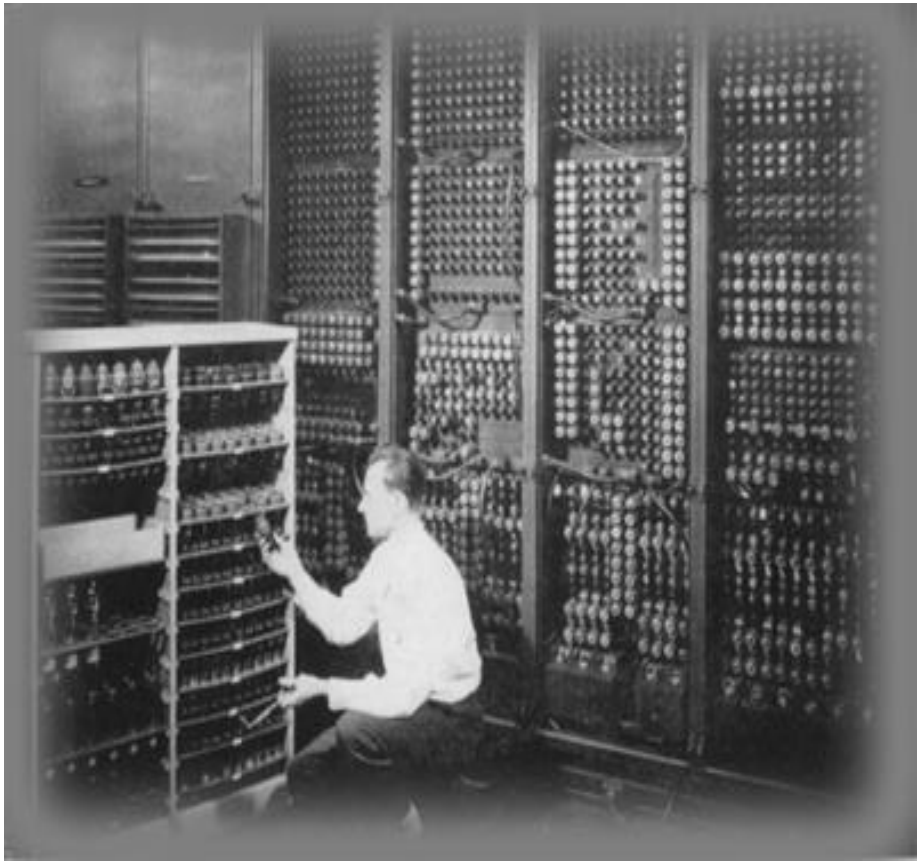
Net Present Value	$83,797.50
Internal Rate of Return	11.45%

Depreciation Expense = initial cost * percentage

Operating Cash Flow =(sales - costs)*(1 - tax rate) + depreciation*tax rate

note that sales = 0 and a cost savings is -costs

Special Case: Replacement Problem



What if we have an old asset to replace with a new asset?

Special Case: Replacement Problem

- **Original Machine**
  - **Initial cost = 100,000**
  - **Annual depreciation = 9,000**
  - **Purchased 5 years ago**
  - **Book Value = 55,000**
  - **Salvage today = 65,000**
  - **Salvage in 5 years = 10,000**
- **New Machine**
  - **Initial cost = 150,000**
  - **5-year life**
  - **Salvage in 5 years = 0**
  - **Cost savings = 50,000 per year**
  - **3-year MACRS depreciation**
- **Required return = 10%**
- **Tax rate = 40%**

Special Case: Replacement Problem

- **Remember that we are interested in incremental cash flows**
- **If we buy the new machine, then we will sell the old machine**
- **What are the cash flow consequences of selling the old machine today instead of in 5 years?**

Replacement Problem
Pro Forma Income Statements

Year	1	2	3	4	5
Cost Savings	50,000	50,000	50,000	50,000	50,000
Depr.					
New	49,995	66,675	22,215	11,115	0
Old	9,000	9,000	9,000	9,000	9,000
Increm.	40,995	57,675	13,215	2,115	(9,000)
EBIT	9,005	(7,675)	36,785	47,885	59,000
Taxes	3,602	(3,070)	14,714	19,154	23,600
NI	5,403	(4,605)	22,071	28,731	35,400

Replacement Problem Incremental Net Capital Spending

- **Year 0**
  - **Cost of new machine = 150,000 (outflow)**
  - **After-tax salvage on old machine = 65,000 - .4(65,000 – 55,000) = 61,000 (inflow)**
  - **Incremental net capital spending = 150,000 – 61,000 = 89,000 (outflow)**
- **Year 5**
  - **After-tax salvage on old machine = 10,000 - .4(10,000 – 10,000) = 10,000 (outflow because we no longer receive this)**

Replacement Problem
Cash Flow From Assets

Year	0	1	2	3	4	5
OCF		46,398	53,070	35,286	30,846	26,400
NCS	-89,000					-10,000
∆ NWC	0					0
CFFA	-89,000	46,398	53,070	35,286	30,846	16,400

Practice Problems Ch. 6

- Industrial Services is analyzing a proposed investment that would initially require $538,000 of new equipment. This equipment would be depreciated on a straight-line basis to a zero balance over the 4-year life of the project. The estimated salvage value is $187,000. The project requires $39,000 initially for net working capital, all of which will be recouped at the end of the project. The projected operating cash flow is $194,900 a year. The relevant tax rate is 34 percent. What is the Net Present Value on this project if the cost of capital is 10 percent?

Cash Flow From Assets

Year	0	1	2	3	4
OCF		194900	194900	194900	194900
NCS	-538000				123420
NWC	-39000				39000
CFFA	-577000	194900	194900	194900	357320

After-tax salvage value = 187000 - 0.34*(187000-0) = 123420

NPV = 151741

Investments of Unequal Lives

- There are times when application of the NPV rule can lead to the wrong decision. Consider a factory that must have an air cleaner that is mandated by law. There are two choices:
  - The “Cadillac cleaner” costs $4,000 today, has annual operating costs of $100, and lasts 10 years.
  - The “Cheapskate cleaner” costs $1,000 today, has annual operating costs of $500, and lasts 5 years.
- Assuming a 10% discount rate, which one should we choose?

Investments of Unequal Lives

Cadillac Air Cleaner	Cheapskate Air Cleaner
CF0 = -4000	CF0 = -1000
CF1 = CF2 = … = CF10 = -100	CF1 = CF2 = … = CF5 = -500
r = 10%	r = 10%
NPV = -4614.46	NPV = -2895.39

Investments of Unequal Lives

- This overlooks the fact that the Cadillac cleaner lasts twice as long.
- When we incorporate the difference in lives, the Cadillac cleaner is actually cheaper (i.e., has a higher NPV).

Equivalent Annual Cost (EAC)
约当年均成本法

- The EAC is the value of the level payment annuity that has the same *PV* as our original set of cash flows.
  - For example, the EAC for the Cadillac air cleaner is $750.98.
  - The EAC for the Cheapskate air cleaner is $763.80, thus we should reject it.

Equivalent Annual Cost (EAC)

$$PV = PMT\left[\frac{1-\frac{1}{(1+r)^t}}{r}\right]$$

- The EAC for the Cadillac air cleaner is $750.98

  PV = -4614.46; r = 0.1; t =10

- The EAC for the Cheapskate air cleaner is $763.80

  PV = -2895.39; r = 0.1; t =5

Chapter 6

END