Chapter 10 Developing Project Cash Flows

Generating Net Cash Flows

10.1 The cash flow chart are as below:

$\therefore$ Annual unit rental rate = \$3,034,510 / 50 = \$60,690

Income Statement

	0	1	2	3	4	5
Income Statement						
Revenue		$3,034,510	$3,034,510	$3,034,510	$3,034,510	$3,034,510
Expenses:						
O&M		330,000	380,000	430,000	480,000	530,000
Depreciation		306,713	320,513	320,513	320,513	306,713
Debt interest		0	0	0	0	0
Taxable Income		$2,397,797	$2,333,997	$2,283,997	$2,233,997	$2,197,797
Income Taxes		$839,229	$816,899	$799,399	$781,899	$769,229
Net Income		$1,558,568	$1,517,098	$1,484,598	$1,452,098	$1,428,568
Cash Flow Statement						
Cash from operation						
Net Income		$ 1,558,568	$ 1,517,098	$ 1,484,598	$ 1,452,098	$ 1,428,568
Depreciation		$ 306,713	$ 320,513	$ 320,513	$ 320,513	$ 306,713
Investment / Salvage	$ (12,500,000)					$ 14,000,000
Gains Tax						$ (1,076,238)
Loan repayment	$ -	$ -	$ -	$ -	$ -	$ -
Net Cash Flow (actual)	($12,500,000)	$1,865,281	$1,837,611	$1,805,111	$1,772,611	$14,659,043
	PW (15%) =	$3				
	IRR =	15.00%				

10.2 Investment in industrial robot:

	0	1	2	3	4	5	6	7
Income Statement								
Revenues (savings)		$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000
Expenses:								
Depreciation		$37,000	$59,200	$35,520	$21,312	$21,312	$10,656	
Taxable Income		$83,000	$60,800	$84,480	$98,688	$98,688	$109,344	$120,000
Income Taxes(35%)		$29,050	$21,280	$29,568	$34,541	$34,541	$38,270	$42,000
Net Income		$53,950	$39,520	$54,912	$64,147	$64,147	$71,074	$78,000
Cash Flow Statement								
Operating Activities:								
Net Income		$53,950	$39,520	$54,912	$64,147	$64,147	$71,074	$78,000
Depreciation		$37,000	$59,200	$35,520	$21,312	$21,312	$10,656	$0
Investment Activities:								
Investment	($185,000)							
Salvage								$40,000
Gains Tax								($14,000)
Net Cash Flow	($185,000)	$90,950	$98,720	$90,432	$85,459	$85,459	$81,730	$104,000

10.3 Cash flow diagram

	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$25,000	$25,000	$25,000	$25,000	$25,000	$25,000
Expenses:							
O&M		$7,000	$7,000	$7,000	$7,000	$7,000	$7,000
Depreciation		11000	17600	10560	6336	6336	3168
Taxable Income		$7,000	$400	$7,440	$11,664	$11,664	$14,832
Income Taxes(40%)		2,800	160	2,976	4,666	4,666	5,933
Net Income		$4,200	$240	$4,464	$6,998	$6,998	$8,899
Cash Flow Statement							
Operating Activities:							
Net Income		$4,200	$240	$4,464	$6,998	$6,998	$8,899
Depreciation		$11,000	$17,600	$10,560	$6,336	$6,336	$3,168
Investment Activities:							
Investment	($55,000)						
Salvage							
Gains Tax							
Net Cash Flow	($55,000)	$15,200	$17,840	$15,024	$13,334	$13,334	$12,067
PW(15%)	$1,056						

∴ Since the PW of the project is positive, buy the machine.

10.4 Investment in an answering device:

- Depreciation: It is assured that the building will be placed in service in January during the first project year. Then, it will be depreciated based on 39-year MACRS.

- Gains and losses:

Property (asset)	Cost base	Salvage value	Book value	Gains (losses)	Gains taxes
Land	$100,000	$115,000	$100,000	$115,000	$6,000
Building	$500,000	$575,000	$436,965	$138,035	$55,214
Equipment	$500,000	$50,000	$133,873	($83,873)	($33,549)

- Project cash flows

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		$2,500,000	$2,500,000	$2,500,000	$2,500,000	$2,500,000
Expenses:						
O&M costs		1,280,000	1,280,000	1,280,000	1,280,000	1,280,000
Depreciation :						
Building		12,287	12,821	12,821	12,821	12,821
Equipment		71,450	122,450	87,450	62,450	22,325
Taxable Income		1,136,264	1,084,730	1,119,730	1,144,730	1,184,855
Income Taxes		454,505	433,892	447,892	457,892	473,942
Net Income		$681,758	$650,838	$671,838	$686,838	$710,913
Cash Flow Statement						
Operating Activities:						
Net Income		$681,758	$650,838	$671,838	$686,838	$710,913
Depreciation		$83,737	$135,271	$100,271	$75,271	$35,146
Investment Activities:						
Land	($100,000)					115000
Building	($500,000)					575000
Machines	($500,000)					50000
Gains Tax						
Land						($6,000)
Building						($55,214)
Equipment						$33,549
Net Cash Flow	($1,100,000)	$765,495	$786,108	$772,108	$762,108	$1,458,393

10.5 Investment in a new trench excavator:

	0	1	2	3	4	5
Income Statement						
Revenues (savings)						
Expenses:						
Required annual digging (ft)		6,400	6,400	6,400	6,400	6,400
Number of hours to operate		400	400	400	467	533
Operating cost (@$15/hr)		$6,000	$6,000	$6,000	$7,005	$7,995
Depreciation		$40,000	$64,000	$38,400	$23,040	$11,520
Taxable Income		($46,000)	($70,000)	($44,400)	($30,045)	($19,515)
Income Taxes (34%)		($15,640)	($23,800)	($15,096)	($10,215)	($6,635)
Net Income		($30,360)	($46,200)	($29,304)	($19,830)	($12,880)
Cash Flow Statement						
Operating Activities:						
Net Income		($30,360)	($46,200)	($29,304)	($19,830)	($12,880)
Depreciation		$40,000	$64,000	$38,400	$23,040	$11,520
Investment Activities:						
Investment	($200,000)					
Salvage						$40,000
Gains Tax						$5,766
Net Cash Flow	($200,000)	$9,640	$17,800	$9,096	$3,210	$44,407

10.6

Revenues (savings)		$52,000	$52,000	$52,000	$52,000	$52,000
Expenses:						
Software development		$20,000				
Operating expenses		$12,000	$12,000	$12,000	$12,000	$12,000
Depreciation		20,800	33,280	19,968	11,981	5,990
Taxable Income		($800)	$6,720	$20,032	$28,019	$34,010
Income Taxes (35%)		(280)	2,352	7,011	9,807	11,903
Net Income		($520)	$4,368	$13,021	$18,212	$22,106
Cash Flow Statement						
Operating Activities:						
Net Income		(520)	4,368	13,021	18,212	22,106
Depreciation		20,800	33,280	19,968	11,981	5,990
Investment Activities:						
Investment	(104,000)					0
Gains Tax (35%)						4,194
Net Cash Flow	($104,000)	$20,280	$37,648	$32,989	$30,193	$32,290

10.7

Input		Output	
Tax Rate(%)=	40	PW(i)=	$9,465
MARR(%)=	12	IRR(%)=	31.17%

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		$20,160	$20,160	$20,160	$20,160	$20,160
Expenses:						
Operating expenses		$10,000	$10,000	$10,000	$10,000	$10,000
Depreciation		3,700	5,920	3,552	2,131	1,066
Taxable Income		$6,460	$4,240	$6,608	$8,029	$9,094
Income Taxes(40%)		2,584	1,696	2,643	3,212	3,638
Net Income		$3,876	$2,544	$3,965	$4,817	$5,457
Cash Flow Statement						
Operating Activities:						
Net Income		3,876	2,544	3,965	4,817	5,457
Depreciation		3,700	5,920	3,552	2,131	1,066
Investment Activities:						
Investment	(18,500)					
Salvage						1,850
Gains Tax						112
Net Cash Flow	($18,500)	$7,576	$8,464	$7,517	$6,948	$8,260

10.8 (a) & (b) – a good investment to undertake.

Input		Output	
Tax Rate(%)=	40	PW(i)=	$334,792
MARR(%)=	12	IRR(%)=	92%

	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$300,000	$300,000	$300,000	$300,000	$300,000	$300,000
Expenses:							
Labor		$80,000	$80,000	$80,000	$80,000	$80,000	$80,000
Materials		50,000	50,000	50,000	50,000	50,000	50,000
Depreciation		24,000	38,400	23,040	13,824	13,824	6,912
Taxable Income		$146,000	$131,600	$146,960	$156,176	$156,176	$163,088
Income Taxes		58,400	52,640	58,784	62,470	62,470	65,235
Net Income		$87,600	$78,960	$88,176	$93,706	$93,706	$97,853
Cash Flow Statement							
Operating Activities:							
Net Income		87,600	78,960	88,176	93,706	93,706	97,853
Depreciation		24,000	38,400	23,040	13,824	13,824	6,912
Investment Activities:							
Investment	(120,000)						
Salvage							0
Gains Tax							0
Net Cash Flow	($120,000)	$111,600	$117,360	$111,216	$107,530	$107,530	$104,765

10.9

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		$250,000	$250,000	$250,000	$250,000	$250,000
Expenses:						
O&M costs		$50,000	$50,000	$50,000	$50,000	$50,000
Depreciation		40,000	64,000	38,400	23,040	11,520
Taxable Income		$160,000	$136,000	$161,600	$176,960	$188,480
Income Taxes (40%)		64,000	54,400	64,640	70,784	75,392
Net Income		$96,000	$81,600	$96,960	$106,176	$113,088
Cash Flow Statement						
Operating Activities:						
Net Income		$ 96,000	$ 81,600	$ 96,960	$ 106,176	$ 113,088
Depreciation		$ 40,000	$ 64,000	$ 38,400	$ 23,040	$ 11,520
Investment Activities:						
Investment	$ (200,000)					
Salvage						$ 5,000
Gains Tax						$ 7,216
Net Cash Flow	($200,000)	$136,000	$145,600	$135,360	$129,216	$136,824

∴ Return on invest = 62.88%.

10.10 Investment in energy management system: $N = 9$ years

Input		Output	
Tax Rate(%) =	35	PW(i) =	$1,998
MARR(%) =	10	IRR(%) =	11.19%

	0	1	2	3	4	5 - 8	9
Income Statement							
Energy Savings		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Expenses:							
Depreciation		16,665	22,225	7,405	3,705	0	0
Taxable Income		($6,665)	($12,225)	$2,595	$6,295	$10,000	$10,000
Income Taxes		(2,333)	(4,279)	908	2,203	3,500	3,500
Net Income		($4,332)	($7,946)	$1,687	$4,092	$6,500	$6,500
Cash Flow Statement							
Operating Activities:							
Net Income		$ (4,332)	$ (7,946)	$ 1,687	$ 4,092	$ 6,500	$ 6,500
Depreciation		$ 16,665	$ 22,225	$ 7,405	$ 3,705	$ -	$ -
Investment Activities:							
Investment	$ (50,000)						
Salvage							0
Gains Tax							(0)
Net Cash Flow	($50,000)	$12,333	$14,279	$9,092	$7,797	$6,500	$6,500

10.11 Investment decision based on after-tax IRR:

Input		Output	
Tax Rate(%) =	40	PW(i) =	($0)
MARR(%) =	12	IRR(%)=	12.00%

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		$130,000	$130,000	$130,000	$130,000	$130,000
Expenses:						
O&M costs		$20,000	$20,000	$20,000	$20,000	$20,000
Depreciation		116,920	155,928	51,953	25,994	0
Taxable Income		($6,920)	($45,928)	$58,047	$84,006	$110,000
Income Taxes (40%)		(2,768)	(18,371)	23,219	33,602	44,000
Net Income		($4,152)	($27,557)	$34,828	$50,404	$66,000
Cash Flow Statement						
Operating Activities:						
Net Income		$ (4,152)	$ (27,557)	$ 34,828	$ 50,404	$ 66,000
Depreciation		$ 116,920	$ 155,928	$ 51,953	$ 25,994	$ -
Investment Activities:						
Investment	$ (350,794)					
Salvage						0
Gains Tax						0
Net Cash Flow	($350,794)	$112,768	$128,371	$86,781	$76,398	$66,000

Investment in Working Capital

10.12

	0	1	2	3	4	5	6	7	8	9	10
Income Statement											
Revenues (savings)		$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000	$675,000
Expenses:											
Production cost		$425,000	$425,000	$425,000	$425,000	$425,000	$425,000	$425,000	$425,000	$425,000	$425,000
Depreciation :											
Building		$36,860	$38,462	$38,462	$38,462	$38,462	$38,462	$38,462	$38,462	$38,462	$36,860
Equipment		$71,450	$122,450	$87,450	$62,450	$44,650	$44,600	$44,650	$22,300		
Taxable Income		$141,691	$89,089	$124,089	$149,089	$166,889	$166,939	$166,889	$189,239	$211,539	$213,141
Income Taxes		$56,676	$35,635	$49,635	$59,635	$66,755	$66,775	$66,755	$75,695	$84,615	$85,256
Net Income		$85,014	$53,453	$74,453	$89,453	$100,133	$100,163	$100,133	$113,543	$126,923	$127,884
Cash Flow Statement											
Operating Activities:											
Net Income		$85,014	$53,453	$74,453	$89,453	$100,133	$100,163	$100,133	$113,543	$126,923	$127,884
Depreciation		$108,310	$160,912	$125,912	$100,912	$83,112	$83,062	$83,112	$60,762	$38,462	$36,860
Investment Activities:											
Land	($250,000)										$500,000
Building	($1,500,000)										$700,000
Machines	($500,000)										$50,000
Gains Tax											
Land											($87,500)
Building											$182,179
Equipment											($20,000)
Working capital	($150,000)										$150,000
Net Cash Flow	($2,400,000)	$193,324	$214,365	$200,365	$190,365	$183,245	$183,225	$183,245	$174,305	$165,385	$1,639,423

(a) $PW(15\%)_{with\ working\ capital} = -\$1,083,867$, do not accept the project.

(b) $PW(15\%)_{without\ working\ capital} = -\$970,945$, still do not accept the project.

10.13

Input		Output	
Tax Rate(%)=	35	PW(i)=	$52,163
MARR(%)=	18	IRR(%)=	42%

	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$55,800	$55,800	$55,800	$55,800	$55,800	$55,800
Expenses:							
Operating cost		$8,120	$8,120	$8,120	$8,120	$8,120	$8,120
Depreciation		13,100	20,960	12,576	7,546	7,546	1,886
Taxable Income		$34,580	$26,720	$35,104	$40,134	$40,134	$45,794
Income Taxes (35%)		$12,103	$9,352	$12,286	$14,047	$14,047	$16,028
Net Income		$22,477	$17,368	$22,818	$26,087	$26,087	$29,766
Cash Flow Statement							
Operating Activities:							
Net Income		$22,477	$17,368	$22,818	$26,087	$26,087	$29,766
Depreciation		$13,100	$20,960	$12,576	$7,546	$7,546	$1,886
Investment Activities:							
Investment	($65,500)						
Salvage							$3,000
Gains Tax							($390)
Worikng capital	($10,000)						$10,000
Net Cash Flow	($75,500)	$35,577	$38,328	$35,394	$33,633	$33,633	$44,262

Comments: The operating cost represents the annual expenses related to operate the scanning equipment.

10.14 Delaware Chemical Corporation: (a), (b), and (c)

(All units in $000)

Calendar year	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Base period	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Income Statement														
Revenues (savings)					$50,000	$55,000	$60,500	$66,550	$73,205	$80,526	$72,473	$65,226	$58,703	$52,833
Expenses:														
R&D expenses	$500	$2,500	$2,000											
Production cost					$40,000	$44,000	$48,400	$53,240	$58,564	$64,420	$57,978	$52,181	$46,962	$42,266
Depreciation :														
Building					$49	$51	$51	$51	$51	$51	$51	$51	$51	$49
Equipment					$429	$735	$525	$375	$268	$268	$268	$134		
Taxable Income	($500)	($2,500)	($2,000)		$9,522	$10,214	$11,524	$12,884	$14,322	$15,786	$14,175	$12,860	$11,689	$10,517
Income Taxes	($200)	($1,000)	($800)		$3,809	$4,086	$4,610	$5,154	$5,729	$6,314	$5,670	$5,144	$4,676	$4,207
Net Income	($300)	($1,500)	($1,200)		$5,713	$6,128	$6,914	$7,730	$8,593	$9,472	$8,505	$7,716	$7,014	$6,310
Cash Flow Statement														
Operating Activities:														
Net Income	($300)	($1,500)	($1,200)		$5,713	$6,128	$6,914	$7,730	$8,593	$9,472	$8,505	$7,716	$7,014	$6,310
Depreciation					$478	$786	$576	$426	$319	$319	$319	$185	$51	$49
Investment Activities:														
Building				($2,000)										$1,000
Machines				($3,000)										$300
Gains Tax														
Building														$197
Equipment														($120)
Working capital				($5,000)	($500)	($550)	($605)	($666)	($732)	$805	$725	$652	$587	$5,283
Net Cash Flow	($300)	($1,500)	($1,200)	($10,000)	$5,691	$6,364	$6,885	$7,491	$8,180	$10,596	$9,549	$8,553	$7,652	$13,019

(b) IRR = **43.28%**

(c) PW(20%) = **$10,253**

Effects of Borrowing

10.15

Income Statement

	0	1	2	3	4	5
Income Statement						
Revenue		$3,034,510	$3,034,510	$3,034,510	$3,034,510	$3,034,510
Expenses:						
O&M		330,000	380,000	430,000	480,000	530,000
Depreciation		306,713	320,513	320,513	320,513	306,713
Debt interest		1,250,000	1,045,253	820,032	572,288	299,770
Taxable Income		$1,147,797	$1,288,744	$1,463,965	$1,661,709	$1,898,027
Income Taxes		$401,729	$451,060	$512,388	$581,598	$664,309
Net Income		$746,068	$837,684	$951,577	$1,080,111	$1,233,718
Cash Flow Statement						
Cash from operation						
Net Income		$ 746,068	$ 837,684	$ 951,577	$ 1,080,111	$ 1,233,718
Depreciation		$ 306,713	$ 320,513	$ 320,513	$ 320,513	$ 306,713
Investment / Salvage	$ (12,500,000)					$ 14,000,000
Gains Tax						$ (1,076,238)
Loan repayment	$ 12,500,000	$ (2,047,469)	$ (2,252,216)	$ (2,477,437)	$ (2,725,181)	$ (2,997,699)
Net Cash Flow	$0	($994,688)	($1,094,019)	($1,205,347)	($1,324,557)	$11,466,494

PW (15%) = $2,458,837
IRR = 41.91%

10.16

	0	1	2	3	4	5	6	7
Income Statement								
Revenues (savings)		$120,000	$120,000	$120,000	$120,000	$120,000	$120,000	$120,000
Expenses:								
Depreciation		$37,000	$59,200	$35,520	$21,312	$21,312	$10,656	
Deit interest		$18,500	$14,800	$11,100	$7,400	$3,700		
Taxable Income		$64,500	$46,000	$73,380	$91,288	$94,988	$109,344	$120,000
Income Taxes(35%)		$22,575	$16,100	$25,683	$31,951	$33,246	$38,270	$42,000
Net Income		$41,925	$29,900	$47,697	$59,337	$61,742	$71,074	$78,000
Cash Flow Statement								
Operating Activities:								
Net Income		$41,925	$29,900	$47,697	$59,337	$61,742	$71,074	$78,000
Depreciation		$37,000	$59,200	$35,520	$21,312	$21,312	$10,656	$0
Investment Activities:								
Investment	($185,000)							
Salvage								$40,000
Gains Tax								($14,000)
Financing Activities:								
Borrowed funds	$185,000							
Principal repayment		($37,000)	($37,000)	($37,000)	($37,000)	($37,000)		
Net Cash Flow	$0	$41,925	$52,100	$46,217	$43,649	$46,054	$81,730	$104,000

Note: This situation calls for a constant rate of reduction on principal payment.

10.17

- Annual payment = $\$100,000(A/P,11\%,5) = \$27,060$
- New after tax cash flow

	0	1	2	3	4	5
Income Statement						
Revenues (savings)		$250,000	$250,000	$250,000	$250,000	$250,000
Expenses:						
O&M costs		$50,000	$50,000	$50,000	$50,000	$50,000
Depreciation		40,000	64,000	38,400	23,040	11,520
Debt interest		11,000	9,233	7,272	5,096	2,680
Taxable Income		$149,000	$126,767	$154,328	$171,864	$185,800
Income Taxes (40%)		59,600	50,707	61,731	68,746	74,320
Net Income		$89,400	$76,060	$92,597	$103,118	$111,480
Cash Flow Statement						
Operating Activities:						
Net Income		$ 89,400	$ 76,060	$ 92,597	$ 103,118	$ 111,480
Depreciation		$ 40,000	$ 64,000	$ 38,400	$ 23,040	$ 11,520
Investment Activities:						
Investment	$ (200,000)					
Salvage						$ 5,000
Gains Tax						$ 7,216
Financing Activities:						
Borrowed funds	$ 100,000					
Principal repayment		$ (16,060)	$ (17,827)	$ (19,788)	$ (21,964)	$ (24,380)
Net Cash Flow	$ (100,000)	$ 113,340	$ 122,233	$ 111,209	$ 104,194	$ 110,836

10.18

Cash flow statement	0	1	2
Operating activities:			
Net income		$10,400	$12,019
Depreciation		$6,666	$4,445
Investment activities:			
Investment	($20,000)		
Salvage			$8,000
Gains Tax (40%)			$356
Financial activities:			
Borrowed funds	$10,000		
Principal repayment		($4,762)	($5,238)
Net cash flow	($10,000)	$12,304	$19,581

NPW(15%) = $15,505.48

Note: Annual installments for the loan = $\$10,000(A/P,10\%,2) = \$5,762$

10.19 Income statement approach:

Input		Output	
Tax Rate(%)=	40	PW(i) =	$241,601
MARR(%) =	18	IRR(%) =	91.54%

(a)

	0	1	2	3	4	5 - 7	8	9	10
Income Statement									
Revenues:									
Additional revenue		$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000	$80,000
Labor & materials savings		$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000	$ 55,000
Expenses:									
Depreciation		$ 28,580	$ 48,980	$ 34,980	$ 24,980	$ 17,860	$ 8,920		
Debt interest		$ 13,500	$ 9,000	$ 4,500					
Taxable Income		$ 92,920	$ 77,020	$ 95,520	$ 110,020	$ 117,140	$ 126,080	$ 135,000	$ 135,000
Income Taxes		$ 37,168	$ 30,808	$ 38,208	$ 44,008	$ 46,856	$ 50,432	$ 54,000	$ 54,000
Net Income		$55,752	$46,212	$57,312	$66,012	$70,284	$75,648	$81,000	$81,000
Cash Flow Statement									
Operating Activities:									
Net Income		$ 55,752	$ 46,212	$ 57,312	$ 66,012	$ 70,284	$ 75,648	$ 81,000	$ 81,000
Depreciation		$ 28,580	$ 48,980	$ 34,980	$ 24,980	$ 17,860	$ 8,920	$ -	$ -
Investment Activities:									
Investment	$ (200,000)								
Salvage									$ 20,000
Gains Tax									$ (8,000)
Financing Activities:									
Borrowed funds	$ 150,000								
Principal repayment		$ (50,000)	$ (50,000)	$ (50,000)					
Net Cash Flow	($50,000)	$34,332	$45,192	$42,292	$90,992	$88,144	$84,568	$81,000	$93,000

10.20 (a) and (b)

Input		Output	
Tax Rate(%) =	35	PW(i) =	($1,318,770)
MARR(%) =	18	IRR(%) =	

	0	1	2	3	4	5
Income Statement						
Revenues (savings)						
Expenses:						
Depreciation		285,800	489,800	349,800	249,800	89,300
Debt interest		80,000	66,896	52,482	36,626	19,185
Taxable Income		($365,800)	($556,696)	($402,282)	($286,426)	($108,485)
Income Taxes (35%)		(128,030)	(194,844)	(140,799)	(100,249)	(37,970)
Net Income		($237,770)	($361,853)	($261,483)	($186,177)	($70,515)
Cash Flow Statement						
Operating Activities:						
Net Income		$ (237,770)	$ (361,853)	$ (261,483)	$ (186,177)	$ (70,515)
Depreciation		$ 285,800	$ 489,800	$ 349,800	$ 249,800	$ 89,300
Investment Activities:						
Investment	$ (2,000,000)					
Salvage						$ 200,000
Gains Tax						$ 117,425
Financing Activities:						
Borrowed funds	$ 800,000					
Principal repayment		$ (131,038)	$ (144,142)	$ (158,556)	$ (174,412)	$ (191,853)
Net Cash Flow	($1,200,000)	$ (83,008)	$ (16,194)	$ (70,239)	$ (110,789)	$ 144,357

(b) This is a service project. The equivalent annual cost is

$$AEC(18\%) = \$1,318,770(A/P,18\%,5)$$
$$= \$421,743$$

10.21

(a) After tax cash flow

Input		Output	
Tax Rate(%) =	36	PW(i) =	$3,593
MARR(%) =	15	IRR(%) =	

	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Expenses:							
Depreciation		$5,002	$8,572	$6,122	$4,372	$3,126	$1,563
Debt interest		$4,200	$3,683	$3,103	$2,454	$1,727	$913
Taxable Income		$799	($2,254)	$775	$3,175	$5,148	$7,524
Income Taxes (36%)		$287	($811)	$279	$1,143	$1,853	$2,709
Net Income		$511	($1,443)	$496	$2,032	$3,294	$4,816
Cash Flow Statement							
Operating Activities:							
Net Income		$511	($1,443)	$496	$2,032	$3,294	$4,816
Depreciation		$5,002	$8,572	$6,122	$4,372	$3,126	$1,563
Investment Activities:							
Investment	($35,000)						
Salvage							$3,000
Gains Tax							$1,168
Financing Activities:							
Borrowed funds	$35,000						
Principal repayment		($4,312)	($4,829)	($5,409)	($6,058)	($6,785)	($7,599)
Net Cash Flow	$0	$1,201	$2,299	$1,209	$345	($365)	$2,948

(b) No meaningful IRR exists. We need to use the present worth analysis. Since PW(15%) > 0, the project is acceptable.

10.22 (a) and (b)

	Input			Output					
	Tax Rate(%) =	40		PW(i) =	$35,723				
	MARR(%) =	14		IRR(%) =	31.02%				
	0	1	2	3	4	5	6	7	8
Income Statement									
Revenues (savings)		$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000
Expenses:									
O&M cost		5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Depreciation		14,290	24,490	17,490	12,490	8,930	8,920	8,930	4,460
Debt interest		4,000	3,650	3,265	2,842	2,377	1,865	1,301	682
Taxable Income		$16,710	$6,860	$14,245	$19,668	$23,693	$24,215	$24,769	$29,858
Income Taxes (40%)		6,684	2,744	5,698	7,867	9,477	9,686	9,907	11,943
Net Income		$10,026	$4,116	$8,547	$11,801	$14,216	$14,529	$14,861	$17,915
Cash Flow Statement									
Operating Activities:									
Net Income		$ 10,026	$ 4,116	$ 8,547	$ 11,801	$ 14,216	$ 14,529	$ 14,861	$ 17,915
Depreciation		$ 14,290	$ 24,490	$ 17,490	$ 12,490	$ 8,930	$ 8,920	$ 8,930	$ 4,460
Investment Activities:									
Investment	$ (100,000)								
Salvage									$ 10,000
Gains Tax									$ (4,000)
Financing Activities:									
Borrowed funds	$ 40,000								
Principal repayment		$ (3,498)	$ (3,848)	$ (4,232)	$ (4,656)	$ (5,121)	$ (5,633)	$ (6,196)	$ (6,816)
Net Cash Flow	($60,000)	$20,818	$24,758	$21,804	$19,635	$18,025	$17,816	$17,595	$21,559

Generalized Cash Flow Method

10.23 (a) with no borrowed funds:

	Input Data			Output		
	Tax Rate(%) =	35		PW(9%) =	$416	
	MARR(%) =	9				
Financial Data						
year	0	1	2	3	4	5
Depreciation		$ 2,000	$ 2,667	$ 889	$ 445	
Book value	$ 6,000	$ 4,000	$ 1,333	$ 445	$ -	$ -
Salvage value						$ 2,000
Gains tax						$ (700)
Loan payment schedule						
Interest						
Principal						
Revenues		$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500
O & M costs						
Cash Flow Statement						
	0	1	2	3	4	5
Investment	($6,000)					
Net proceeds from sale						$1,300
Investment in working capital						
Recovery of working capital						
(1 - 0.35) (Revenue)		$975	$975	$975	$975	$975
-(1 - 0.35) (Expenses)		-	-	-	-	-
-(1 - 0.35) (Debt interest)		-	-	-	-	-
+ (0.35) (Depreciation)		$ 700	$ 933	$ 311	$ 156	-
Borrowed funds	-					
Principal repayment		-	-	-	-	-
Net Cash Flow	($6,000)	$1,675	$1,908	$1,286	$1,131	$2,275

(b) With borrowed funds:

	Input Data			Output		
	Tax Rate(%)=	35		PW(9%)=	$10,104	
	MARR(%)=	9				
year	0	1	2	3	4	5
Depreciation		$2,000	$2,667	$889	$445	$0
Book value	$6,000	4,000	1,333	445	0	0
Salvage value						$2,000
Gains tax						-700
Loan payment schedule						
Interest		$ 540	$ 450	$ 351	$ 244	$ 127
Principal	$ 6,000	$ 1,003	$ 1,093	$ 1,191	$ 1,298	$ 1,415
Revenues		$ 1,500	$ 1,500	$ 1,500	$ 1,500	$ 1,500
O&M costs						
Cash Flow Statement						
	0	1	2	3	4	5
Investment	($6,000)					
Net proceeds from sale						$1,300
Investment in working capital						
Recovery of working capital						
(1 - 0.35) (Revenue)		$975	$975	$975	$975	$975
-(1 - 0.35) (Expenses)		-	-	-	-	-
-(1 - 0.35) (Debt interest)		-351	-292	-228	-159	-83
+ (0.35) (Depreciation)		700	933	311	156	-
Borrowed funds	$6,000					
Principal repayment		$ 1,003	$ 1,093	$ 1,191	$ 1,298	$ 1,415
Net Cash Flow	$0	$2,327	$2,709	$2,249	$2,270	$3,607

(c) The debt financing option is more attractive. Note that the debt financing option results in a higher net present value ($10,104 versus $416) due to the fact that the interest payments are tax deductible and the loan interest rate is the same as the MARR.

10.24 Net cash flow

	Input Data			Output		
	Tax Rate(%) =	40		PW(12%) =	$75,393	
	MARR(%) =	12				
Financial Data						
year	0	1	2	3	4	5
Depreciation		$ 17,863	$ 30,613	$ 21,863	$ 15,613	$ 5,581
Book value	$ 125,000	$107,138	$ 76,525	$ 54,663	$ 39,050	$ 33,469
Salvage value						$ 50,000
Gains tax						$ (6,613)
Loan payment schedule						
Interest		$ 12,500	$ 10,453	$ 8,200	$ 5,723	$ 2,998
Principal	$ 125,000	$ 20,475	$ 22,522	$ 24,774	$ 27,252	$ 29,977
Revenues		$ 60,000	$ 60,000	$ 60,000	$ 60,000	$ 60,000
O&M costs						
Cash Flow Statement						
	0	1	2	3	4	5
Investment	($125,000)					
Net proceeds from sale						$43,388
Investment in working capital						
Recovery of working capital						
(1 - 0.40) (Revenue)		$36,000	$36,000	$36,000	$36,000	$36,000
-(1 - 0.40) (Expenses)		-	-	-	-	-
-(1 - 0.40) (Debt interest)		$ (7,500)	$ (6,272)	$ (4,920)	$ (3,434)	$ (1,799)
+ (0.40) (Depreciation)		$ 7,145	$ 12,245	$ 8,745	$ 6,245	$ 2,233
Borrowed funds	$ 125,000					
Principal repayment		$ (20,475)	$ (22,522)	$ (24,774)	$ (27,252)	$ (29,977)
Net Cash Flow	$0	$15,170	$19,451	$15,050	$11,559	$49,844

10.25 Air South Airline

Cash Flow Statement	0	1	2	3	4	5	6	7
Investment	$ (60,000)							
Net proceeds from sale								
Investment in working capital								
Recovery of working capital								
(1 - 0.38)(Revenue)		$ 21,700	$ 21,700	$ 21,700	$ 21,700	$ 21,700	$ 21,700	$ 21,700
-(1 - 0.38)(Expenses)		$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)
-(1 - 0.38) (Debt interest)		$ (4,018)	$ (4,018)	$ (4,018)	$ (4,018)	$ (4,018)	$ (4,018)	$ (4,018)
+(0.38)(Depreciation)		$ 3,257	$ 5,584	$ 3,988	$ 2,849	$ 2,035	$ 2,035	$ 2,035
Borrowed funds	$ 54,000							
Principal repayment								
Net cash flow	$ (6,000)	$ 8,539	$ 10,866	$ 9,270	$ 8,131	$ 7,317	$ 7,317	$ 7,317

Cash Flow Statement	8	9	10	11	12	13	14	15
Investment								
Net proceeds from sale								$ 5,580
Investment in working capital								
Recovery of working capital								
(1 - 0.38)(Revenue)	$ 21,700	$ 21,700	$ 21,700	$ 21,700	$ 21,700	$ 21,700	$ 21,700	$ 21,700
-(1 - 0.38)(Expenses)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)	$ (12,400)
-(1 - 0.38) (Debt interest)	$ (4,018)	$ (4,018)	$ (4,018)					
+(0.38)(Depreciation)	$ 1,017							
Borrowed funds								
Principal repayment			$ (54,000)					
Net cash flow	$ 6,299	$ 5,282	$ (48,718)	$ 9,300	$ 9,300	$ 9,300	$ 9,300	$ 14,880

PW(18%) = $ 26,663 > 0, Accept the investment.

Comparing Mutually Exclusive Alternatives

10.26

(a) The net after-tax cash flows for each financing option:

- Option 1: Retained earnings

	Input			Output			
	Tax Rate(%) =	39		PW(i) =	$161,321		
	MARR(%) =	18		IRR(%) =	42.46%		
Option 1: Financing with retained earnings							
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$174,000	$174,000	$174,000	$174,000	$174,000	$174,000
Expenses:							
O&M costs		$22,000	$22,000	$22,000	$22,000	$22,000	$22,000
Depreciation		28,580	48,980	34,980	24,980	17,860	8,930
Debt interest							
Taxable Income		$123,420	$103,020	$117,020	$127,020	$134,140	$143,070
Income Taxes		48,134	40,178	45,638	49,538	52,315	55,797
Net Income		$75,286	$62,842	$71,382	$77,482	$81,825	$87,273
Cash Flow Statement							
Operating Activities:							
Net Income		$ 75,286	$ 62,842	$ 71,382	$ 77,482	$ 81,825	$ 87,273
Depreciation		$ 28,580	$ 48,980	$ 34,980	$ 24,980	$ 17,860	$ 8,930
Investment Activities:							
Investment	$ (200,000)						
Salvage							$ 30,000
Gains Tax							$ 2,219
Working capital	$ (25,000)						$ 25,000
Financing Activities:							
Borrowed funds							
Principal repayment							
Net Cash Flow	($225,000)	$103,866	$111,822	$106,362	$102,462	$99,685	$153,422

- Option 2:Use a 12% term loan

	Input			Output			
	Tax Rate(%) =	39		PW(i) =	$214,470		
	MARR(%) =	18		IRR(%) =	263.36%		
Option 2: Debt Financing							
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$174,000	$174,000	$174,000	$174,000	$174,000	$174,000
Expenses:							
O&M costs		$22,000	$22,000	$22,000	$22,000	$22,000	$22,000
Depreciation		28,580	48,980	34,980	24,980	17,860	8,930
Debt interest		24,000	21,043	17,730	14,021	9,866	5,212
Taxable Income		$99,420	$81,977	$99,290	$112,999	$124,274	$137,858
Income Taxes		38,774	31,971	38,723	44,070	48,467	53,765
Net Income		$60,646	$50,006	$60,567	$68,929	$75,807	$84,093
Cash Flow Statement							
Operating Activities:							
Net Income		$ 60,646	$ 50,006	$ 60,567	$ 68,929	$ 75,807	$ 84,093
Depreciation		$ 28,580	$ 48,980	$ 34,980	$ 24,980	$ 17,860	$ 8,930
Investment Activities:							
Investment	$ (200,000)						
Salvage							$ 30,000
Gains Tax							$ 2,219
Working capital	$ (25,000)						$ 25,000
Financing Activities:							
Borrowed funds	200,000						
Principal repayment		$ (24,645)	$ (27,602)	$ (30,915)	$ (34,624)	$ (38,780)	$ (43,433)
Net Cash Flow	($25,000)	$64,581	$71,384	$64,632	$59,285	$54,887	$106,809

- Option 3: Leasing

	Input			Output			
	Tax Rate(%) =	39		PW(i) =	$170,092		
	MARR(%) =	18		IRR(%) =	101.06%		
Option 3: Lease Financing							
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$174,000	$174,000	$174,000	$174,000	$174,000	$174,000
Expenses:							
O&M costs		$22,000	$22,000	$22,000	$22,000	$22,000	$22,000
Financial lease	$55,000	$55,000	$55,000	$55,000	$55,000	$55,000	
Taxable Income	($55,000)	$97,000	$97,000	$97,000	$97,000	$97,000	$152,000
Income Taxes	($21,450)	37,830	37,830	37,830	37,830	37,830	59,280
Net Income	($33,550)	$59,170	$59,170	$59,170	$59,170	$59,170	$92,720
Cash Flow Statement							
Operating Activities:							
Net Income	$ (33,550)	$ 59,170	$ 59,170	$ 59,170	$ 59,170	$ 59,170	$ 92,720
Investment Activities:							
Investment							
Salvage							
Gains Tax							
Working capital	$ (25,000)						$ 25,000
Financing Activities:							
Borrowed funds							
Principal repayment							
Net Cash Flow	($58,550)	$59,170	$59,170	$59,170	$59,170	$59,170	$117,720

Note: With the financial lease, the lessee must assume responsibility for paying most of the operating costs of the equipment, including the maintenance expenses.

(b) Vermont's PW cost of owning the equipment by borrowing:

- PW of after-tax O&M

$$\begin{aligned} P_1 &= \$22,000(1-0.39)(P/A,18\%,6) \\ &= \$46,938 \end{aligned}$$

- PW of after-tax loan repayment:

$$\begin{aligned} P_2 &= \$48,645(P/A,18\%,6) \\ &= \$170,141 \end{aligned}$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$28,571	\$24,000	\$52,571(0.39) = \$20,503
2	\$48,980	\$21,043	\$70,023(0.39) = \$27,309
3	\$34,985	\$17,730	\$52,715(0.39) = \$20,559
4	\$24,990	\$14,021	\$39,011(0.39) = \$15,214
5	\$17,850	\$9,866	\$27,716(0.39) = \$10,809
6	\$8,925	\$5,212	\$14,137(0.39) = \$5,513

$$\begin{aligned} P_3 &= \$20,503(P/F,18\%,1)+\cdots \\ &\quad +\$5,513(P/F,18\%,6) \\ &= \$64,115 \end{aligned}$$

- PW of net proceeds from sale:

$$\begin{aligned} \text{total depreciation amount} &= \$164,301 \\ \text{book value} &= \$35,699 \\ \text{taxable gain} &= \$30,000 - \$35,699 \\ &= (\$5,699) \\ \text{loss credit} &= (0.39)(\$5,699) = \$2,223 \\ \text{net proceeds from sale} &= \$30,000 + \$2,223 \\ &= \$32,223 \\ P_4 &= \$32,223(P/F,18\%,6) \\ &= \$11,936 \end{aligned}$$

$$PW(15\%)_{\text{buy}} = P_1 + P_2 - P_3 + P_4 = \$141,028$$

(c) Vermont's PW cost of leasing the equipment:

- PW of after-tax operating cost:

$$P_1 = \$22,000(1-0.39)(P/A,18\%,6)$$
$$= \$46,938$$

- PW of after-tax leasing expenses:

$$P_2 = \$55,000(1-0.39) + \$55,000(1-0.39)(P/A,18\%,5)$$
$$= \$138,467$$
$$P = P_1 + P_2$$
$$= \boxed{\$185,405}$$

(d) Buy the tipping machine.

10.27

- Option 1: Lease

$$PW(12\%)_{\text{lease}} = \$144,000(1-0.40)(P/A,12\%,30)$$
$$= \boxed{\$695,968}$$

- Option 2: Purchase

  - Note 1: Net proceeds from sale of building:

total depreciation amount = \$498,611
book value = \$151,389
taxable gain (loss) = \$65,000 - \$151,389
= \$86,389
loss credit = (0.40)(\$86,389) = \$34,556
net proceeds from sale = \$65,000 + \$34,556
= \$99,556

  - Note 2: It is assumed that the property is placed in service during the month of January and is disposed of during the month of December:

$$D_1 \,\&\, D_{30} = (11.5/12)(1/39)(\$650,000) = \$15,972$$
$$D_2 \text{ to } D_{29} = \$650,000/39 = \$16,667$$

- Note 3: Property tax calculation:

$$(\$800{,}000)(0.05) = \$40{,}000$$

Cash Flow Elements	End of Period 0	1	2 - 29	30
Investment	-$800,000			
Net Proceeds:				
Building				$99,556
Land				$150,000
-(0.60)(property tax)		($24,000)	($24,000)	-$24,000
+(0.40)Dn		$6,389	$6,667	$6,389
Net Cash Flow	-$800000	-$17,611	($17,333)	$231,945

$$\begin{aligned} PW(12\%)_{\text{purchase}} &= \$800,000 + \$17,611(P/F,12\%,1) \\ &\quad + \$17,333(P/A,12\%,28)(P/F,12\%,1) \\ &\quad - \$231,945(P/F,12\%,30) \\ &= \boxed{\$931,548} \end{aligned}$$

- Option 3: Remodel
  - Note 1: Cost basis for property tax:
    Land + building + remodeling cost = $660,000
  - Note 2: Depreciation base: Remodeling cost = $300,000
  - Note 3: Net proceeds from sale of building:

total depreciation amount = $230,128

$$\begin{aligned} \text{book value} &= \$300,000 - \$230,128 \\ &= \$69,872 \\ \text{taxable gain (loss)} &= \$30,000 - \$69,872 \\ &= \$39,872 \\ \text{gains tax} &= (0.40)(\$39,872) = \$15,949 \\ &= \$45,949 \end{aligned}$$

Cash Flow Elements	End of Period 0	1	2 - 29	30
Investment	-$300,000			
Net Proceeds:				
Building				$45,949
Land		-$5,400	'-$5,100 - 300n	($14,100)
-(0.60)(property tax)		-$19,800	-$19,800	($19,800)
+(0.40)Dn		$2,949	$3,077	$2,949
Net Cash Flow	-$300000	-$22,251	…	$14,698

$$
\begin{aligned}
PW(12\%)_{\text{purchase}} &= \$300,000 + \$22,251(P/F,12\%,1) \\
&\quad +\$22,423(P/A,12\%,28)(P/F,12\%,1) \\
&\quad +\$300(P/G,12\%,28)(P/F,12\%,1) \\
&\quad -\$14,698(P/F,12\%,30) \\
&= \boxed{\$494,434}
\end{aligned}
$$

$\therefore$ Option 3 is the least cost alternative.

10.28 Comparison by the annual equivalent cost (all units in thousand dollars):

Book Value ($n = 20$)	\$380.61	\$423.80	\$470.56
Salvage Value	\$853.00	\$949.80	\$1,054.60
Taxable gains	\$469.39	\$526.00	\$584.04
Gains tax (39%)	\$183.06	\$205.14	\$227.78
Net Proceeds from sale	\$669.94	\$744.66	\$826.82

Plant A

- Capital recovery cost with return:

$$A_1 = (\$8,530) - \$669.94)(A/P,12\%,20) + \$669.94(0.12) = \$1,132.69$$

- After-tax O&M cost:

$$A_2 = (1-0.39)(\$1,964) = \$1,198.04$$

- Depreciation tax shield:

$$
\begin{aligned}
A_3 &= 0.39(\$8,530)\left[0.0375(P/F,12\%,1) + \cdots\right](A/P,12\%,20) \\
&= \$172.22
\end{aligned}
$$

- Total equivalent annual cost:

$$A = \$1,132.69 + \$1,198.04 - \$172.22 = \$2,158.51$$

- Unit cost:

$$\frac{\$2,158,510}{50,000,000\text{kWh}} = \boxed{\$0.04317/\text{kWh}}$$

Plant B

- Capital recovery cost with return:

$$A_1 = (\$9,498 - \$744.66)(A/P,12\%,20) + \$744.66(0.12) = \$1,261.25$$

- After-tax O&M cost:

$$A_2 = (1 - 0.39)(\$1,744) + \$1,063.84$$

- Depreciation tax shield:

$$\begin{aligned} A_3 &= 0.39(\$9,498)\left[0.0375(P/F,12\%,1) + \cdots\right](A/P,12\%,20) \\ &= \$191.76 \end{aligned}$$

- Total equivalent annual cost:

$$A = \$1,261.25 + \$1,063.84 - \$191.76 = \$2,133.33$$

- Unit cost:

$$\frac{\$2,133,330}{50,000,000\text{kWh}} = \boxed{\$0.04267/\text{kWh}}$$

Plant C

- Capital recovery cost with return:

$$A_1 = (\$10,546 - \$826.82)(A/P,12\%,20) + \$826.82(0.12) = \$1,400.41$$

- After-tax O&M cost:

$$A_2 = (1 - 0.39)(\$1,632) = \$995.52$$

- Depreciation tax shield:

$$\begin{aligned} A_3 &= 0.39(\$10,546)\left[0.0375(P/F,12\%,1) + \cdots\right](A/P,12\%,20) \\ &= \$212.92 \end{aligned}$$

- Total equivalent annual cost:

$$A = \$1,400.41 + \$1,995.52 - \$212.92 = \$3,183.01$$

- Unit cost:

$$\frac{\$3,183,010}{50,000,000\text{kWh}} = \boxed{\$0.06366/\text{kWh}}$$

$\therefore$ Plant B is the most economical.

Lease -Versus - Buy Decisions

10.29

(a) Jacob's cost of leasing in present worth:

$$\begin{aligned}\text{after-tax lease expense} &= (1 - 0.40)(\$11,000)\\ &= \$6,600\\ PW(15\%)_{\text{lease}} &= \$6,600 + \$6,600(P/A,15\%,3)\\ &= \boxed{\$21,670}\end{aligned}$$

(b) Jacob's cost of owning in present worth:

- PW of after-tax maintenance expenses:

$$\begin{aligned}P_1 &= \$1,200(1-0.40)(P/A,15\%,4)\\ &= \$2,055\end{aligned}$$

- PW of after-tax loan repayment:

$$\begin{aligned}P_2 &= \$13,169(P/A,15\%,4)\\ &= \$37,597\end{aligned}$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$8,000	\$4,800	\$12,800(0.40) = \$5,120
2	\$12,800	\$3,796	\$16,596(0.40) = \$6,638
3	\$7,680	\$2,671	\$10,351(0.40) = \$4,140
4	\$2,304	\$1,411	\$3,715(0.40) = \$1,486

$$\begin{aligned}P_3 &= \$5,120(P/F,15\%,1) + \$6,638(P/F,15\%,2)\\ &\quad +\$4,140(P/F,15\%,3) + \$1,486(P/F,15\%,4)\\ &= \$13,043\end{aligned}$$

- PW of net proceeds from sale:

$$\begin{aligned}
\text{total depreciation amount} &= \$30{,}784 \\
\text{book value} &= \$9{,}216 \\
\text{taxable gain} &= \$10{,}000 - \$9{,}216 \\
&= \$784 \\
\text{gains tax} &= (0.40)(\$784) = \$314 \\
\text{net proceeds from sale} &= \$10{,}000 - \$314 \\
&= \$9{,}686 \\
P_4 &= \$9{,}686(P/F, 15\%, 4) \\
&= \$5{,}538
\end{aligned}$$

$$PW(15\%)_{\text{buy}} = P_1 + P_2 - P_3 - P_4 = \$21{,}071$$

(c) Should the truck be leased or purchased? The "borrow–buy" option is a better choice.

10.30

(a) PW (incremental) cost of owing the equipment:

- PW of after-tax O&M:

$$\begin{aligned}
P_1 &= \$50{,}000(1-0.40)(P/A, 15\%, 4) \\
&= \$85{,}649
\end{aligned}$$

- PW of after-tax loan repayment:

$$\begin{aligned}
P_2 &= \$37{,}857(P/A, 15\%, 4) \\
&= \$108{,}080
\end{aligned}$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$24,000	\$12,000	\$36,000(0.40) = \$14,400
2	\$38,400	\$9,414	\$47,817(0.40) = \$19,126
3	\$23,040	\$6,570	\$29,610(0.40) = \$11,814
4	\$6,912	\$3,441	\$10,353(0.40) = \$4,141

$$P_3 = \$14,400(P/F,15\%,1) + \$19,126(P/F,15\%,2) + \$11,814(P/F,15\%,3) + \$4,141(P/F,15\%,4) = \$37,139$$

- PW of net proceeds from sale:

total depreciation amount = \$92,352

book value = \$27,648

taxable gain = \$20,000 - \$27,648 = (\$7,648)

loss credit = (0.40)(\$7,648) = \$3,059

net proceeds from sale = \$20,000 + \$3,059

= \$23,059

$$P_4 = \$23,059(P/F,15\%,4) = \$13,184$$

$$PW(15\%)_{\text{buy}} = P_1 + P_2 - P_3 - P_4 = \$143,406$$

(b) PW (incremental) cost of leasing the equipment:

- PW of after-tax operating cost:

$$P_1 = \$40,000(1-0.40)(P/A,15\%,4) = \$68,519$$

- PW of after-tax leasing:

$$P_2 = \$44,000(1-0.40) + \$44,000(1-0.40)(P/A,15\%,3) = \$86,67$$

$$P = P_1 + P_2 = \boxed{\$155,196}$$

(c) Should ICI buy or lease the equipment? The buying option is a better choice.

10.31

(a) PW of after-tax cash flow of leasing:

$$PW(15\%)_{lease} = \$70,000(1-0.4)(P/A,15\%,4) = \$119,909$$

(Note: The lease payments are made at the end of each year.)

(b) PW of after-tax cash flow of owing:

$$PW(15\%)_{own} = 0 + \$34,430(P/F,15\%,1) + \cdots + \$48,872(P/F,15\%,4)$$
$$= \$113,259$$

10.32

(a) Determine the annual cash flows for each option.

- Buy option:

Cash flow elements	End of period			
	0	1	2	3
Investment	($16,170)			
Net proceeds				$5,943
$-(0.65)I_n$		($1,151)	($740)	($275)
$+0.35D_n$		$1,132	$1,811	$543
Loan repayment	$16,170	($4,730)	($5,362)	($6,078)
Net cash flow	$0	($4,749)	($4,291)	$134

- Lease option:

Cash flow elements	End of period			
	0	1	2	3
Security deposit	($500)			
Refund				$500
$-(0.65)L_n$		($3,315)	($3,315)	($3,315)
Net cash flow	($500)	($3,315)	($3,315)	($2,815)

(b) PW cost of owing versus leasing:

$$PW(13\%)_{buy} = \$7,470$$
$$PW(13\%)_{lease} = \$7,981$$

$\therefore$ The buy option is a better choice.

10.33

(a) Boggs' PW cost of leasing: after-tax annual lease expense = $15,000(1 – 0.40) = $9,000.

$$PW(15\%)_{\text{leasing}} = \$9,000 + \$9,000(P/A,15\%,3)$$
$$= \$20,549$$

(b) Boggs' PW cost of owning:

- PW of after-tax maintenance expenses:

$$\begin{aligned} P_1 &= \$5,000(1-0.40)(P/A,15\%,3) \\ &= \$6,849 \end{aligned}$$

- PW cost of after-tax loan repayment:

$$\begin{aligned} P_2 &= \$41,635(P/A,15\%,3) \\ &= \$95,062 \end{aligned}$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$20,000	\$12,000	\$32,000(0.40) = \$12,800
2	\$32,000	\$8,444	\$40,444(0.40) = \$16,178
3	\$9,600	\$4,461	\$14,061(0.40) = \$5,624

$$\begin{aligned} P_3 &= \$12,800(P/F,15\%,1) + \$16,178(P/F,15\%,2) \\ &\quad + \$5,511(P/F,15\%,3) \\ &= \$27,061 \end{aligned}$$

- PW of net proceeds from sale:

$$\begin{aligned} \text{total depreciation amount} &= \$61{,}600 \\ \text{book value} &= \$38{,}400 \\ \text{taxable gain} &= \$50{,}000 - \$38{,}400 = \$11{,}600 \\ \text{loss credit} &= (0.40)(\$11{,}600) = \$4{,}640 \\ \text{net proceeds from sale} &= \$50{,}000 - \$4{,}640 \\ &= \$45{,}360 \\ P_4 &= \$45{,}360(P/F,15\%,3) \\ &= \$29{,}825 \end{aligned}$$

$$PW(15\\%)_{\text{buy}} = P_1 + P_2 - P_3 - P_4 = \boxed{\$45,043}$$

10.34

(a) Purchase with debt:

- PW of after-tax revenue:

$$P_1 = \$10,000(1-0.30)(P/A,10\%,5) = \$26,536$$

- PW of after-tax expenses:

$$P_2 = \$2,500(1-0.3)(P/A,10\%,5) = \$6,634$$

- PW of after-tax loan repayment:

$$A = \$25,000(A/P,12\%,5) = \$6,935.24$$
$$P_3 = \$6,935.24(P/A,10\%,5) = \$26,290$$

- PW of tax credit (shield) on depreciation and interest:

n	D_n	I_n	Combined Tax Savings
1	\$3,571	\$3,000	$\$6,571(0.30) = \$1,971$
2	\$6,122	\$2,528	$\$8,650(0.30) = \$2,595$
3	\$4,373	\$1,999	$\$6,372(0.30) = \$1,912$
4	\$3,123	\$1,407	$\$4,530(0.30) = \$1,359$
5	\$1,116	\$743	$\$1,859(0.30) =$ \$558

$$P_4 = \$1,971(P/F,10\%,1) + \$2,595(P/F,10\%,2) + \cdots = \$6,647$$

- PW of net proceeds from sale:

total depreciation amount = \$18,305
book value = \$6,695
taxable gain = \$5,000 - \$6,695=(\$1,695)
loss credit = (0.30)(\$1,695) = \$509
net proceeds from sale = \$5,000 + \$509
= \$5,509
P_5 = \$5,509$(P/F,10\%,5)$
= \$3,421

$$PW(10\%)_{\text{purchase}} = P_1 - P_2 - P_3 + P_4 + P_5 = \$3,680$$

(Note: This is a net after-tax savings in present worth.)

(b) Financial lease:

$$\begin{aligned} PW(10\%)_{lease} &= [(0.7)(\$10,000 - \$2,500 - \$3,500)](P/A,10\%,5) \\ &= \$2,800(P/A,10\%,5) \\ &= \$10,614 \end{aligned}$$

(c) The financial lease is a better choice.

10.35 Setting the lease payment schedule: Let X denote the annual lease receipt from the tractor lease. We will assume that these lease payments are received at year end.

Cash Flow Elements	End of Period 0	1	2	3
Investment	-$53,000			
Net Proceeds:				$21,423*
Security Deposit	$1,500			-$1,500
+(0.65)(*Rn*)		0.65X	0.65X	0.65X
+(0.35)D*n*		$3,710	$5,936	$1,781
		0.65X	0.65X	0.65X
Net Cash Flow	-$51,500	$3,710	$5,936	$21,704

Note:

$$\begin{aligned} \text{total depreciation amount} &= \$32,648 \\ \text{book value} &= \$53,000 - \$32,648 = \$20,352 \\ \text{taxable gain} &= \$22,000 - \$20,352 = \$1,648 \\ \text{gains tax} &= (0.35)(\$1,648) = \$577 \\ \text{net proceeds from sale} &= \$22,000 - \$577 \\ &= \$21,423 \end{aligned}$$

Now to expect an after-tax rate of return of 10%, we solve the following equation:

$$\begin{aligned} \$51,500 &= 0.65X(P/A,10\%,3) \\ &\quad +\$3,710(P/F,10\%,1) + \$5,936(P/F,10\%,2) \\ &\quad +\$21,704(P/F,10\%,3) \\ X &= \$16,655 \text{ per year} \end{aligned}$$

Short Case Studies

ST 10.1 (a), (b), and (c)

	0	1	2	3	4	5-7	8	9	10-11	12
Income Statement										
Revenue		$ 51,000	$ 51,000	$ 51,000	$ 51,000	$ 85,000	$136,000	$136,000	$136,000	$136,000
Expenses:										
Production costs		$ 36,000	$ 36,000	$ 36,000	$ 36,000	$ 60,000	$ 96,000	$ 96,000	$ 96,000	$ 96,000
Depreciation :										
Building		$ 1,106	$ 1,154	$ 1,154	$ 1,154	$ 1,154	$ 1,154	$ 1,154	$ 1,154	$ 1,106
Machines		$ 14,290	$ 24,490	$ 17,490	$ 12,490	$ 8,930	$ 4,460			
Taxable Income		$ (396)	$ (10,644)	$ (3,644)	$ 1,356	$ 14,916	$ 34,386	$ 38,846	$ 38,846	$ 38,894
Income Taxes (40%)		$ (158)	$ (4,258)	$ (1,458)	$ 542	$ 5,966	$ 13,754	$ 15,538	$ 15,538	$ 15,558
Net Income		$ (237)	$ (6,386)	$ (2,186)	$ 814	$ 8,950	$ 20,632	$ 23,308	$ 23,308	$ 23,337
Cash Flow Statement										
Operating Activities:										
Net Income		$ (237)	$ (6,386)	$ (2,186)	$ 814	$ 8,950	$ 20,632	$ 23,308	$ 23,308	$ 23,337
Depreciation		$ 15,396	$ 25,644	$ 18,644	$ 13,644	$ 10,084	$ 5,614	$ 1,154	$ 1,154	$ 1,106
Investment Activities:										
Land	$ (5,000)									$ 8,000
Building	$ (45,000)									$ 30,000
Machines	$ (100,000)									$ 10,000
Gains Tax:										
Land (35%)										$ (1,050)
Building										$ 500
Equipment										$ (4,004)
Net Cash Flow	($150,000)	$15,158	$19,258	$16,458	$14,458	$19,034	$26,246	$24,462	$24,462	$67,888
	PW(15%) =	($38,794)			IRR =	9.60%				

Note: A true sense of capital gains is realized only for the sale of land.

ST 10.2 Morgantown Mining Company

(a) Unit-production method

(Units are thousand dollars)

	0	1	2	3	4	5	6	7	8	9	10
Income Statement											
Revenues (savings)		$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500
Expenses:											
O&M		$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400
Depreciation		$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880
Taxable Income		$5,220	$5,220	$5,220	$5,220	$5,220	$5,220	$5,220	$5,220	$5,220	$5,220
Income Taxes (40%)		$2,088	$2,088	$2,088	$2,088	$2,088	$2,088	$2,088	$2,088	$2,088	$2,088
Net Income		$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132
Cash Flow Statement											
Operating Activities:											
Net Income		$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132	$3,132
Depreciation		$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880	$1,880
Investment Activities:											
Investment	($19,300)										
Salvage											$500
Gains Tax											
Working capital	($2,500)										$2,500
Net Cash Flow	($21,800)	$5,012	$5,012	$5,012	$5,012	$5,012	$5,012	$5,012	$5,012	$5,012	$8,012

(b) 7 year MACRS

(Units are thousand dollars)

	0	1	2	3	4	5	6	7	8	9	10
Income Statement											
Revenues (savings)		$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500	$9,500
Expenses:											
O&M		$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400	$2,400
Depreciation		$2,758	$4,727	$3,376	$2,411	$1,723	$1,722	$1,723	$861	$0	$0
Taxable Income		$4,342	$2,373	$3,724	$4,689	$5,377	$5,378	$5,377	$6,239	$7,100	$7,100
Income Taxes (40%)		$1,737	$949	$1,490	$1,876	$2,151	$2,151	$2,151	$2,496	$2,840	$2,840
Net Income		$2,605	$1,424	$2,235	$2,814	$3,226	$3,227	$3,226	$3,744	$4,260	$4,260
Cash Flow Statement											
Operating Activities:											
Net Income		$2,605	$1,424	$2,235	$2,814	$3,226	$3,227	$3,226	$3,744	$4,260	$4,260
Depreciation		$2,758	$4,727	$3,376	$2,411	$1,723	$1,722	$1,723	$861	$0	$0
Investment Activities:											
Investment	($19,300)										
Salvage											$500
Gains Tax											($200)
Working capital	($2,500)										$2,500
Net Cash Flow	($21,800)	$5,363	$6,151	$5,610	$5,224	$4,949	$4,949	$4,949	$4,604	$4,260	$7,060

ST 10.3 Note to Instructors: In order to make the problem more realistic, the savings due to reduction in development time is changed from $114,000 to $314,000. This correction is already made for the 2nd printing.

- Savings = $314,000 + $35,000 = $349,000 per year
- Materials (resin) = $350(400) = $140,000 per year
- Cost base = $187,000 + $10,000 + $15,000 = $212,000
- Taxable gain = $30,000

(a) Equity financing (retained earnings):

	Input			Output			
	Tax Rate(%)=	40		PW(i)=	$181,889		
	MARR(%)=	20		IRR(%)=	50.80%		
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$349,000	$349,000	$349,000	$349,000	$349,000	$349,000
Expenses:							
O&M costs		$36,000	$36,000	$36,000	$36,000	$36,000	$36,000
Resin		$140,000	$140,000	$140,000	$140,000	$140,000	$140,000
Software development		$20,000					
Depreciation		42,400	67,840	40,704	24,422	24,422	12,211
Taxable Income		$110,600	$105,160	$132,296	$148,578	$148,578	$160,789
Income Taxes (40%)		44,240	42,064	52,918	59,431	59,431	64,316
Net Income		$66,360	$63,096	$79,378	$89,147	$89,147	$96,473
Cash Flow Statement							
Operating Activities:							
Net Income		66,360	63,096	79,378	89,147	89,147	96,473
Depreciation		42,400	67,840	40,704	24,422	24,422	12,211
Investment Activities:							
Investment	(212,000)						
Salvage							30,000
Gains Tax							(12,000)
Net Cash Flow	($212,000)	$108,760	$130,936	$120,082	$113,569	$113,569	$126,684

(b) Debt financing (term loan): annual installment = $212,000(*A*/*P*, 13%, 6) = $53,032

	Tax Rate(%)=	40		PW(i)=	$244,004		
	MARR(%)=	20		IRR(%)=	#NUM!		
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$349,000	$349,000	$349,000	$349,000	$349,000	$349,000
Expenses:							
O&M costs		$36,000	$36,000	$36,000	$36,000	$36,000	$36,000
Resin		$140,000	$140,000	$140,000	$140,000	$140,000	$140,000
Software development		$20,000					
Depreciation		42,400	67,840	40,704	24,422	24,422	12,211
Debt Interest		27,560	24,249	20,507	16,278	11,500	6,101
Taxable Income		$83,040	$80,911	$111,789	$132,299	$137,077	$154,688
Income Taxes (40%)		33,216	32,365	44,716	52,920	54,831	61,875
Net Income		$49,824	$48,547	$67,074	$79,380	$82,246	$92,813
Cash Flow Statement							
Operating Activities:							
Net Income		49,824	48,547	67,074	79,380	82,246	92,813
Depreciation		42,400	67,840	40,704	24,422	24,422	12,211
Investment Activities:							
Investment	(212,000)						
Salvage							30,000
Gains Tax							(12,000)
Financing Activities:							
Borrowed Funds	212,000						
Principal repayment		(25,472)	(28,784)	(32,526)	(36,754)	(41,532)	(46,931)
Net Cash Flow	$0	$66,752	$87,603	$75,252	$67,048	$65,137	$76,092

(c) Lease financing (financial lease):

	Tax Rate(%)=	40		PW(i)=	$185,396		
	MARR(%)=	20		IRR(%)=	156.94%		
	0	1	2	3	4	5	6
Income Statement							
Revenues (savings)		$349,000	$349,000	$349,000	$349,000	$349,000	$349,000
Expenses:							
O&M costs		$36,000	$36,000	$36,000	$36,000	$36,000	$36,000
Resin		$140,000	$140,000	$140,000	$140,000	$140,000	$140,000
Software development		$20,000					
Lease Payment	$62,560	$62,560	$62,560	$62,560	$62,560	$62,560	$0
Taxable Income	($62,560)	$90,440	$110,440	$110,440	$110,440	$110,440	$173,000
Income Taxes	($25,024)	36,176	44,176	44,176	44,176	44,176	69,200
Net Income	($37,536)	$54,264	$66,264	$66,264	$66,264	$66,264	$103,800
Cash Flow Statement							
Operating Activities:							
Net Income	(37,536)	54,264	66,264	66,264	66,264	66,264	103,800
Net Cash Flow	($37,536)	$54,264	$66,264	$66,264	$66,264	$66,264	$103,800

(d) The best financing method is the term loan option.

ST 10.4 (a) The net cash flows for each alternative over 10 years:

- Installing AGVS:

	Input Data				Output						
	Tax Rate(%)=	35			PW(9%)=	($167,864)					
	MARR(%)=	15									
Financial Data											
year	0	1	2	3	4	5	6	7	8	9	10
Depreciation		$22,721	$38,939	$27,809	$19,859	$14,199	$14,183	$14,199	$7,091	$0	$0
Book value	$159,000	136,279	97,340	69,531	49,672	35,473	21,290	7,091	(0)	(0)	(0)
Interest payment		15,900	13,296	10,431	7,280	3,813					
Principal payment	159,000	(26,044)	(28,648)	(31,513)	(34,664)	(38,131)					
O&M costs	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000	$20,000
Cash Flow Statement	(all units in thousands of dollars)										
	0	1	2	3	4	5	6	7	8	9	10
Investment	($159,000)										
Net proceeds from sale											
-(1 - 0.35) (Expenses)	($13,000)	($13,000)	($13,000)	($13,000)	($13,000)	($13,000)	($13,000)	($13,000)	($13,000)	($13,000)	$0
-(1 - 0.35) (Debt interest)		(10,335)	(8,642)	(6,780)	(4,732)	(2,478)					
+ (0.35) (Depreciation)		7,952	13,629	9,733	6,951	4,970	4,964	4,970	2,482	0	0
Borrowed funds	$159,000										
Principal repayment		(26,044)	(28,648)	(31,513)	(34,664)	(38,131)					
Net Cash Flow	($13,000)	($41,426)	($36,662)	($41,560)	($45,445)	($48,640)	($8,036)	($8,030)	($10,518)	($13,000)	$0

- Leasing gas-powered lift trucks (payable at the end of each year):

$$\begin{aligned}\text{total annual expenses} &= \$5{,}465 + \$6{,}317 \\ &\quad + \$1{,}660 + \$58{,}653 + \$10{,}000 \\ &= \$82{,}095 \\ \text{after-tax annual expenses} &= (1 - 0.35)(\$82{,}095) \\ &= \boxed{\$53{,}362} \text{ per year}\end{aligned}$$

(b) & (c) The incremental cash flows (AGVS option – Gas truck option)

$$\begin{aligned}PW(i)_{\text{agvs - gas}} &= -\$13{,}000 + \$11{,}933(P/F,i,1) \\ &\quad + \$16{,}700(P/F,i,2) + \$11{,}803(P/F,i,3) + \$7{,}919(P/F,i,4) + \$4{,}719(P/F,i,5) \\ &\quad + \$45{,}329(P/F,i,6) + \$45{,}329(P/F,i,7) + \$42{,}845(P/F,i,8) + \$40{,}362(P/F,i,9) \\ &\quad + \$53{,}362(P/F,i,10) \\ &= 0 \\ \text{IRR} &= 104.24\% > 15\%\end{aligned}$$

$\therefore$ Select the AGVS option.

(d) Repeat (c) based on the present worth criterion.

$$\begin{aligned}PW(15\%)_{\text{gas}} &= -\$267{,}810 \\ PW(15\%)_{\text{agvs}} &= -\$167{,}865\end{aligned}$$

$\therefore$ Select the AGVS option.