CHAPTER 10
MAKING CAPITAL INVESTMENT DECISIONS

Answers to Concepts Review and Critical Thinking Questions

1. In this context, an opportunity cost refers to the value of an asset or other input that will be used in a project. The relevant cost is what the asset or input is actually worth today, not, for example, what it cost to acquire.

2. For tax purposes, a firm would choose MACRS because it provides for larger depreciation deductions earlier. These larger deductions reduce taxes, but have no other cash consequences. Notice that the choice between MACRS and straight-line is purely a time value issue; the total depreciation is the same, only the timing differs.

3. It's probably only a mild over-simplification. Current liabilities will all be paid, presumably. The cash portion of current assets will be retrieved. Some receivables won't be collected, and some inventory will not be sold, of course. Counterbalancing these losses is the fact that inventory sold above cost (and not replaced at the end of the project's life) acts to increase working capital. These effects tend to offset.

4. Management's discretion to set the firm's capital structure is applicable at the firm level. Since any one particular project could be financed entirely with equity, another project could be financed with debt, and the firm's overall capital structure remains unchanged, financing costs are not relevant in the analysis of a project's incremental cash flows according to the stand-alone principle.

5. The EAC approach is appropriate when comparing mutually exclusive projects with different lives that will be replaced when they wear out. This type of analysis is necessary so that the projects have a common life span over which they can be compared; in effect, each project is assumed to exist over an infinite horizon of N-year repeating projects. Assuming that this type of analysis is valid implies that the project cash flows remain the same forever, thus ignoring the possible effects of, among other things: (1) inflation, (2) changing economic conditions, (3) the increasing unreliability of cash flow estimates that occur far into the future, and (4) the possible effects of future technology improvement that could alter the project cash flows.

6. Depreciation is a non-cash expense, but it is tax-deductible on the income statement. Thus depreciation causes taxes paid, an actual cash outflow, to be reduced by an amount equal to the depreciation tax shield t_cD. A reduction in taxes that would otherwise be paid is the same thing as a cash inflow, so the effects of the depreciation tax shield must be added in to get the total incremental aftertax cash flows.

7. There are two particularly important considerations. The first is erosion. Will the essentialized book simply displace copies of the existing book that would have otherwise been sold? This is of special concern given the lower price. The second consideration is competition. Will other publishers step in and produce such a product? If so, then any erosion is much less relevant. A particular concern to

book publishers (and producers of a variety of other product types) is that the publisher only makes money from the sale of new books. Thus, it is important to examine whether the new book would displace sales of used books (good from the publisher's perspective) or new books (not good). The concern arises any time there is an active market for used product.

8. This market was heating up rapidly, and a number of other manufacturers were planning competing products.

9. One company may be able to produce at lower incremental cost or market better. For example, GM may have been able to retool existing production more cheaply, and GM also has a larger dealer network. Also, of course, one of the two may have made a mistake!

10. GM would recognize that the outsized profits would dwindle as more product comes to market and competition becomes more intense.

Solutions to Questions and Problems

Basic

1. The $5 million acquisition cost of the land six years ago is a sunk cost. The $4.2 million current appraisal of the land is an opportunity cost if the land is used rather than sold off. The $7.3 million cash outlay and $325,000 grading expenses are the initial fixed asset investments needed to get the project going. Therefore, the proper year zero cash flow to use in evaluating this project is $4,200,000 + 7,300,000 + 325,000 = $11,825,000.

2. Sales due solely to the new product line are 16,000($12,000) = $192 million. Increased sales of the motor home line occur because of the new product line introduction; thus 5,000($45,000) = $225 million in new sales is relevant. Erosion of luxury motor coach sales is also due to the new mid-size campers; thus 1,000($78,000) = $78 million loss in sales is relevant. The net sales figure to use in evaluating the new line is thus $192 million + 225 million – 78 million = $339 million.

3.

Sales	$ 700,000
Variable costs	420,000
Fixed costs	175,000
Depreciation	75,000
EBT	$ 30,000
Taxes@35%	10,500
Net income	$ 19,500

4.

Sales	$ 864,350
Variable costs	501,500
Depreciation	112,000
EBT	$ 250,850
Taxes@34%	85,289
Net income	$ 165,561

OCF = EBIT + D – T
= $250,850 + 112,000 – 85,289 = $277,561
Depreciation tax shield = t_cD
= .34($112,000) = $38,080

5.

Sales	$ 85,000
Variable costs	43,000
Depreciation	3,000
EBT	$ 39,000
Taxes@35%	13,650
Net income	$ 25,350

OCF = EBIT + D – T = $39,000 + 3,000 – 13,650 = $28,350
OCF = S – C – T = $85,000 – 43,000 – 13,650 = $28,350
OCF = (S – C)(1 – t_c) + t_cD = ($85,000 – 43,000)(1 – .35) + .35(3,000) = $28,350
OCF = NI + D = $25,350 + 3,000 = $28,350

6.

Year	Beginning Book Value	MACRS %	Depreciation Allowance	Ending Book Value
1	$847,000.00	14.29	$121,036.30	$725,963.70
2	725,963.70	24.49	207,430.30	518,533.40
3	518,533.40	17.49	148,140.30	370,393.10
4	370,393.10	12.49	105,790.30	264,602.80
5	264,602.80	8.93	75,637.10	188,965.70
6	188,965.70	8.93	75,637.10	113,328.60
7	113,328.60	8.93	75,637.10	37,691.50
8	37,691.50	4.45	37,691.50	0

7. BV_5 = $320,000 – 320,000(5/8) = $120,000
The asset is sold at a loss to book value, so the depreciation tax shield of the loss is recaptured.
Aftertax salvage value = $70,000 + ($120,000 – 70,000)(0.35) = $87,500

8. BV_4 = $8.4M – 8.4M(0.2000 + 0.3200 + 0.1920 + 0.1152) = $1,451,520
The asset is sold at a gain to book value, so this gain is taxable.
Aftertax salvage value = $1,600,000 + ($1,451,520 – 1,600,000)(.35) = $1,548,032

9. A/R fell by $3,380, and inventory increased by $2,580, so net current assets fell by $800
ΔNWC = Δ(CA – CL) = – $800 – 2,300 = –$3,100
Net cash flow = S – C – ΔNWC = $61,800 – 26,300 – (–3,100) = $38,600

10. OCF = (S – C)(1 – t_c) + t_cD = ($1.9M – 850K)(1 – 0.35) + 0.35($2.1/3) = $927,500

11. NPV = – $2.1M + $927,500($PVIFA_{15\%,3}$) = $17,691.30

12.

Year	Cash Flow	
0	– $2,375,000	= –$2.1M – 275K
1	927,500	
2	927,500	
3	1,413,750	= $927,500 + 275,000 + 325,000(1 - 35)

NPV = –$2,375,000 + 927,500($PVIFA_{15\%,2}$) + (1,413,750 / 1.15^3) = $62,408.56

13. $D_1 = \$2.1M(0.3333) = \$699,930$; $D_2 = \$2.1M(0.4444) = \$933,240$
$D_3 = \$2.1M(0.1482) = \$311,220$; thus, $BV_3 = \$2.1M – (699,930 + 933,240 + 311,220) = \$155,610$
The asset is sold at a gain to book value, so this gain is taxable.
Aftertax salvage value = $325,000 + (155,610 – 325,000)(0.35) = \$265,713.50$
$OCF_t = (S – C)(1 – t_c) + t_cD_t$, so:

Year	Cash Flow	
0	– $2,375,000	= –$2.1M – 275K
1	927,475.50	= ($1,050,000)(.65) + 0.35($699,930)
2	1,009,134	= ($1,050,000)(.65) + 0.35($933,240)
3	1,332,140.50	= ($1,050,000)(.65) + 0.35($311,220) + 265,713.50 + 275,000

$NPV = – \$2.375M + (\$927,475.50/1.15) + (\$1,009,134/1.15^2) + (\$1,332,140.50/1.15^3) = \$70,454.72$

14. Annual depreciation charge = $410,000/5 = \$82,000$
Aftertax salvage value = $70,000(1 – 0.34) = \$46,200$
$OCF = \$115,000(1 – 0.34) + 0.34(\$82,000) = \$103,780$
$NPV = – \$410,000 – 15,000 + 103,780(PVIFA_{10\%,5}) + [(\$46,200 + 15,000) / 1.1^5] = \$6,408.24$

15. Annual depreciation charge = $750,000/5 = \$150,000$
Aftertax salvage value = $80,000(1 – 0.35) = \$52,000$
$OCF = \$310,000(1 – 0.35) + 0.35(\$150,000) = \$254,000$
$NPV = 0 = – \$750,000 + 125,000 + 254,000(PVIFA_{IRR\%,5}) + [(\$52,000 – 125,000) / (1+IRR)^5]$
IRR = 27.74%

16. $300K cost savings case: $OCF = \$300,000(1 – 0.35) + 0.35(\$150,000) = \$247,500$
$NPV = – \$750,000 + 125,000 + 247,500(PVIFA_{20\%,5}) + [(\$52,000 – 125,000) / (1.20)^5]$
$= \$85,839.44$
$200K cost savings case: $OCF = \$200,000(1 – 0.35) + 0.35(\$150,000) = \$182,500$
$NPV = – \$750,000 + 125,000 + 182,500(PVIFA_{20\%,5}) + [(\$52,000 – 125,000) / (1.20)^5]$
$= – \$108,550.35$
Required pretax cost-savings case:
$NPV = 0 = – \$750,000 + \$125,000 + OCF(PVIFA_{20\%,5}) + [(\$52,000 – 125,000) / (1.20)^5]$,
so $OCF = \$218,797.03 = (S – C)(1 – 0.35) + 0.35(\$150K)$; $(S – C) = \$255,841.59$

17. $NPV = – \$225,000 – 20,000 – 25,000(PVIFA_{15\%,5}) + \$20,000/1.15^5 = –\$318,860.34$
$EAC = – \$318,860.34 / (PVIFA_{15\%,5}) = –\$95,121$

18. Both cases: aftertax salvage value = $20,000(1 – 0.35) = \$13,000$
Techron I: $OCF = – \$32,000(1 – 0.35) + 0.35(\$195,000/3) = \$1,950$
$NPV = –\$195,000 + 1,950(PVIFA_{14\%,3}) + (\$13,000/1.14^3) = –\$181,698.19$
$EAC = –\$181,698.19 / (PVIFA_{14\%,3}) = –\$78,263.13$

Techron II: $OCF = – \$19,000(1 – 0.35) + 0.35(\$295,000/5) = \$8,300$
$NPV = –\$295,000 + 8,300(PVIFA_{14\%,5}) + (\$13,000/1.14^5) = –\$259,753.64$
$EAC = –\$259,753.64 / (PVIFA_{14\%,5}) = –\$75,661.96$

The two milling machines have unequal lives, so they can only be compared by expressing both on an equivalent annual basis, which is what the EAC method does. Thus, you prefer the Techron II because it has the lower (less negative) annual cost.

19. Aftertax salvage value = $40,000(1 – 0.35) = $26,000
NPV = 0 = – $510,000 – 60,000 + OCF($PVIFA_{16\%,5}$) + [($60,000 + 26,000) / 1.16^5]
OCF = $529,054.28 / $PVIFA_{16\%,5}$ = $161,578.14
OCF = $161,578 = [(P–v)Q – FC](1 – t_c) + t_cD
$161,578 = [(P – 8.00)(170,000) – 160,000](1 – 0.35) + 0.35($510,000/5) ; P = $10.08

Intermediate

20. D_1 = $450,000(0.20) = $90,000; D_2 = $450,000(0.32) = $144,000
D_3 = $450,000(0.192) = $86,400; D_4 = $450,000(0.1152) = $51,840
BV_4 = $450,000 – ($90,000 + 144,000 + 86,400 + 51,840) = $77,760
The asset is sold at a gain to book value, so this gain is taxable.
After-tax salvage value = $90,000 + ($77,760 – 90,000)(0.35) = $85,716
OCF_1 = $150,000(1 – 0.35) + 0.35($90,000) = $129,000
OCF_2 = $150,000(1 – 0.35) + 0.35($144,000) = $147,900
OCF_3 = $150,000(1 – 0.35) + 0.35($86,400) = $127,740
OCF_4 = $150,000(1 – 0.35) + 0.35($51,840) = $115,644
NPV = – $450,000 – 18,000 + ($129,000 – 3,000)/1.14 + ($147,900 – 3,000)/$1.14^2$
+ ($127,740 – 3,000)/$1.14^3$ + ($115,644 + 27,000 + 85,716)/1.14^4 = –$26,574.44

21. OCF_A = –$105,000(1 – 0.34) + 0.34($405,000/3) = –$23,400
NPV_A = –$405,000 – 23,400($PVIFA_{20\%,3}$) = –$454,291.67
OCF_B = –$60,000(1 – 0.34) + 0.34($450,000/5) = –$9,000
NPV_B = –$450,000 – 9,000($PVIFA_{20\%,5}$) = –$476,915.51
If the system will not be replaced when it wears out, then system A should be chosen, because it has the more positive NPV.

22. EAC_A = – $454,291.67 / ($PVIFA_{20\%,3}$) = –$215,663.74
EAC_B = – $476,915.51 / ($PVIFA_{20\%,5}$) = –$159,470.87

23. After-tax salvage value = $400,000(1 – 0.34) = $264,000
NPV = 0 = – $2,400,000 – 900,000 – 600,000 + OCF ($PVIFA_{15\%,5}$) – 50,000($PVIFA_{15\%,4}$)
+ [($264,000 + 800,000) / 1.15^5]
OCF = $3,513,752.87 / $PVIFA_{15\%,5}$ = $1,048,207.13
OCF = $1,048,207.13 = [(P–v)Q – FC](1 – t_c) + t_cD
$1,048,207.13 = [(P – 0.006)(60,000,000) – 600,000](1 – 0.34) + 0.34(2,400,000/5); P = $0.03835

24. At a given price, taking accelerated depreciation compared to straight-line depreciation causes the NPV to be higher; similarly, at a given price, lower net working capital investment requirements will cause the NPV to be higher. Thus, NPV would be zero at a lower price in this situation. In the case of a bid price, you could submit a lower price and still break-even, or submit the higher price and make a positive NPV.

Challenge

25.

Year	1	2	3	4	5
Ending book value	$11,999,400	$8,570,800	$6,122,200	$4,373,600	$3,123,400
Units/year	95,000	107,000	110,000	112,000	85,000
Price/unit	$330	$330	$330	$330	$330
Variable cost/unit	$210	$210	$210	$210	$210
Sales	$31,350,000	$35,310,000	$36,300,000	$36,960,000	$28,050,000
Variable costs	19,950,000	22,470,000	23,100,000	23,520,000	17,850,000
Fixed costs	750,000	750,000	750,000	750,000	750,000
Depreciation	2,000,600	3,428,600	2,448,600	1,748,600	1,250,200
EBIT	8,649,400	8,661,400	10,001,400	10,941,400	8,199,800
Taxes (35%)	3,027,290	3,031,490	3,500,490	3,829,490	2,869,930
Net Income	5,621,110	5,629,910	6,500,910	7,111,910	5,329,870
Dep	2,000,600	3,428,600	2,448,600	1,748,600	1,250,200
Operating CF	$7,622,710	$9,058,510	$8,949,510	$ 8,860,510	$6,580,070

Year	0	1	2	3	4	5
Operating CF	$0	$7,622,710	$9,058,510	$8,949,510	$8,860,510	$6,580,070
Change in NWC	(1,500,000)	(792,000)	(198,000)	(132,000)	1,782,000	840,000
Capital spending	(14,000,000)	0	0	0	0	3,823,190
Total CF	($15,500,000)	$6,830,710	$8,860,510	$8,817,510	$10,642,510	$11,243,260

Net present value = $5,765,104.97; IRR = 46.77%

26. $D_1 = \$540,000(0.3333) = \$179,982$ $D_2 = \$540,000(0.4444) = \$239,976$
$D_3 = \$540,000(0.1482) = \$80,028$ $D_4 = \$540,000(0.0741) = \$40,014$
After-tax salvage value = $60,000(1 – 0.35) = $39,000
$OCF_1 = (S – C)(1 – 0.35) + 0.35(\$179,982)$
$OCF_2 = (S – C)(1 – 0.35) + 0.35(\$239,976)$
$OCF_3 = (S – C)(1 – 0.35) + 0.35(\$80,028)$
$OCF_4 = (S – C)(1 – 0.35) + 0.35(\$40,014)$
$OCF_5 = (S – C)(1 – 0.35)$
$NPV = 0 = – \$540,000 – 40,000 + (S – C)(0.65)(PVIFA_{12\%,5}) + 0.35(\$179,982/1.12 + \$239,976/1.12^2 + \$80,028/1.12^3 + \$40,014/1.12^4) + (\$39,000 + 40,000)/1.12^5$
$(S – C)(0.65)(PVIFA_{12\%,5}) = \$383,134.12$; $(S – C) = \$163,515.59$

27. *a. Assume price per unit = $11 and units/year = 170,000*

Year	1	2	3	4	5
Sales	$1,870,000	$1,870,000	$1,870,000	$1,870,000	$1,870,000
Variable costs	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000
Fixed costs	160,000	160,000	160,000	160,000	160,000
Depreciation	102,000	102,000	102,000	102,000	102,000
EBIT	248,000	248,000	248,000	248,000	248,000
Taxes (35%)	86,800	86,800	86,800	86,800	86,800
Net Income	161,200	161,200	161,200	161,200	161,200
Dep	102,000	102,000	102,000	102,000	102,000
Operating CF	$263,200	$263,200	$263,200	$263,200	$263,200

Year	0	1	2	3	4	5
Operating CF	$0	$263,200	$263,200	$263,200	$263,200	$263,200
Change in NWC	(60,000)	0	0	0	0	60,000
Capital spending	(510,000)	0	0	0	0	26,000
Total CF	($570,000)	$263,200	$263,200	$263,200	$263,200	$349,200

Net Present Value = $332,739.81

b. Aftertax salvage value = $40,000(1 – 0.35) = $26,000

NPV = 0 = – $510,000 – 60,000 + OCF($PVIFA_{16\%,5}$) + [($60,000 + 26,000) / 1.16^5]

OCF = $529,054.28 / $PVIFA_{16\%,5}$ = $161,578.14

OCF = $161,578 = [(P–v)Q – FC](1 – t_c) + t_cD

$161,578 = [($11.00 – 8.00)Q – 160,000](1 – 0.35) + 0.35($510,000/5) ; Q = 117,886

Year	1	2	3	4	5
Sales	$1,296,746	$1,296,746	$1,296,746	$1,296,746	$1,296,746
Variable costs	943,088	943,088	943,088	943,088	943,088
Fixed costs	160,000	160,000	160,000	160,000	160,000
Depreciation	102,000	102,000	102,000	102,000	102,000
EBIT	91,658	91,658	91,658	91,658	91,658
Taxes (35%)	32,080	32,080	32,080	32,080	32,080
Net Income	59,578	59,578	59,578	59,578	59,578
Dep	102,000	102,000	102,000	102,000	102,000
Operating CF	$161,578	$161,578	$161,578	$161,578	$161,578

Year	0	1	2	3	4	5
Operating CF	$0	$161,578	$161,578	$161,578	$161,578	$161,578
Change in NWC	(60,000)	0	0	0	0	60,000
Capital spending	(510,000)	0	0	0	0	26,000
Total CF	($570,000)	$161,578	$161,578	$161,578	$161,578	$247,578

Net Present Value ≈ $0

c. Aftertax salvage value = $40,000(1 – 0.35) = $26,000

NPV = 0 = – $510,000 – 60,000 + OCF($PVIFA_{16\%,5}$) + [($60,000 + 26,000) / 1.16^5]

OCF = $529,054.28 / $PVIFA_{16\%,5}$ = $161,578.14

OCF = $161,578 = [(P–v)Q – FC](1 – t_c) + t_cD

$161,578 = [($11.00 – 8.00)(170,000) – FC](1 – 0.35) + 0.35($510,000/5); FC = $316,342

Year	1	2	3	4	5
Sales	$1,870,000	$1,870,000	$1,870,000	$1,870,000	$1,870,000
Variable costs	1,360,000	1,360,000	1,360,000	1,360,000	1,360,000
Fixed costs	316,342	316,342	316,342	316,342	316,342
Depreciation	102,000	102,000	102,000	102,000	102,000
EBIT	91,658	91,658	91,658	91,658	91,658
Taxes (35%)	32,080	32,080	32,080	32,080	32,080
Net Income	59,578	59,578	59,578	59,578	59,578
Dep	102,000	102,000	102,000	102,000	102,000
Operating CF	$161,578	$161,578	$161,578	$161,578	$161,578

Year	0	1	2	3	4	5
Operating CF	$0	$161,578	$161,578	$161,578	$161,578	$161,578
Change in NWC	(60,000)	0	0	0	0	60,000
Capital spending	(510,000)	0	0	0	0	26,000
Total CF	($570,000)	$161,578	$161,578	$161,578	$161,578	$247,578

Net Present Value ≈ $0