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.

6. Depreciation is a noncash 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 $TD$. 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.

Solutions to Questions and Problems

1. The $3.5 million acquisition cost of the land six years ago is a sunk cost. The $3.9 million current aftertax value of the land is an opportunity cost if the land is used rather than sold off. The $16.7 million cash outlay and $850,000 grading expenses are the initial fixed asset investments needed to get the project going. Therefore, the proper Year 0 cash flow to use in evaluating this project is

$$3,900,000 + 16,700,000 + 850,000 = 21,450,000$$

2. Sales due solely to the new product line are:

$$25,000($19,000) = 475,000,000$$

Increased sales of the motor home line occur because of the new product line introduction; thus:

$$2,700($73,000) = 197,100,000$$
in new sales is relevant. Erosion of luxury motor coach sales is also due to the new campers; thus:

\[ 1,300(\$120,000) = \$156,000,000 \text{ loss in sales} \]

is relevant. The net sales figure to use in evaluating the new line is thus:

\[ \$475,000,000 + 197,100,000 – 156,000,000 = \$516,100,000 \]

6. The MACRS depreciation schedule is shown in Table 10.7. The ending book value for any year is the beginning book value minus the depreciation for the year. Remember, to find the amount of depreciation for any year, you multiply the purchase price of the asset times the MACRS percentage for the year. The depreciation schedule for this asset is:

<table>
<thead>
<tr>
<th>Year</th>
<th>Beginning Book Value</th>
<th>MACRS</th>
<th>Depreciation</th>
<th>Ending Book Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$1,240,000.00</td>
<td>.1429</td>
<td>$177,196.00</td>
<td>$1,062,804.00</td>
</tr>
<tr>
<td>2</td>
<td>1,062,804.00</td>
<td>.2449</td>
<td>303,676.00</td>
<td>759,128.00</td>
</tr>
<tr>
<td>3</td>
<td>759,128.00</td>
<td>.1749</td>
<td>216,876.00</td>
<td>542,252.00</td>
</tr>
<tr>
<td>4</td>
<td>542,252.00</td>
<td>.1249</td>
<td>154,876.00</td>
<td>387,376.00</td>
</tr>
<tr>
<td>5</td>
<td>387,376.00</td>
<td>.0893</td>
<td>110,732.00</td>
<td>276,644.00</td>
</tr>
<tr>
<td>6</td>
<td>276,644.00</td>
<td>.0892</td>
<td>110,608.00</td>
<td>166,036.00</td>
</tr>
<tr>
<td>7</td>
<td>166,036.00</td>
<td>.0893</td>
<td>110,732.00</td>
<td>55,304.00</td>
</tr>
<tr>
<td>8</td>
<td>55,304.00</td>
<td>.0446</td>
<td>55,304.00</td>
<td>0</td>
</tr>
</tbody>
</table>

7. The asset has an eight-year useful life and we want to find the BV of the asset after five years. With straight-line depreciation, the depreciation each year will be:

Annual depreciation = \$730,000 / 8
Annual depreciation = \$91,250

So, after five years, the accumulated depreciation will be:

Accumulated depreciation = 5(\$91,250)
Accumulated depreciation = \$456,250

The book value at the end of Year 5 is thus:

\[ BV_5 = \$730,000 - 456,250 \]
\[ BV_5 = \$273,750 \]

The asset is sold at a loss to book value, so the depreciation tax shield of the loss is recaptured.

Aftertax salvage value = \$192,000 + (\$273,750 – 192,000)(.40)
Aftertax salvage value = \$224,700

To find the taxes on salvage value, remember to use the equation:

Taxes on salvage value = (BV – MV)TC
This equation will always give the correct sign for a tax inflow (refund) or outflow (payment).

8. To find the BV at the end of four years, we need to find the accumulated depreciation for the first four years. We could calculate a table as in Problem 6, but an easier way is to add the MACRS depreciation amounts for each of the first four years and multiply this percentage times the cost of the asset. We can then subtract this from the asset cost. Doing so, we get:

\[
BV_4 = \$6,500,000 - 6,500,000(0.2000 + 0.3200 + 0.1920 + 0.1152)
\]

\[
BV_4 = \$1,123,200
\]

The asset is sold at a gain to book value, so this gain is taxable.

\[
\text{Aftertax salvage value} = \$1,600,000 + (\$1,123,200 - 1,600,000)(0.35)
\]

\[
\text{Aftertax salvage value} = \$1,433,120
\]

9. Using the tax shield approach to calculating OCF (Remember the approach is irrelevant; the final answer will be the same no matter which of the four methods you use.), we get:

\[
OCF = (Sales - Costs)(1 - T_C) + T_C \times \text{Depreciation}
\]

\[
OCF = (\$2,190,000 - 815,000)(1 - 0.35) + 0.35(\$2,900,000/3)
\]

\[
OCF = \$1,232,083
\]

10. Since we have the OCF, we can find the NPV as the initial cash outlay plus the PV of the OCFs, which are an annuity, so the NPV is:

\[
NPV = -\$2,900,000 + \$1,232,083 \times (PVIFA_{12\%}, 3)
\]

\[
NPV = \$59,256.28
\]

13. First we will calculate the annual depreciation of the new equipment. It will be:

\[
\text{Annual depreciation} = \frac{\$540,000}{5}
\]

\[
\text{Annual depreciation} = \$108,000
\]

Now, we calculate the aftertax salvage value. The aftertax salvage value is the market price minus (or plus) the taxes on the sale of the equipment, so:

\[
\text{Aftertax salvage value} = MV + (BV - MV)T_C
\]

Very often the book value of the equipment is zero as it is in this case. If the book value is zero, the equation for the aftertax salvage value becomes:

\[
\text{Aftertax salvage value} = MV + (0 - MV)T_C
\]

\[
\text{Aftertax salvage value} = MV(1 - T_C)
\]

We will use this equation to find the aftertax salvage value since we know the book value is zero. So, the aftertax salvage value is:

\[
\text{Aftertax salvage value} = \$80,000(1 - 0.34)
\]

\[
\text{Aftertax salvage value} = \$52,800
\]
Using the tax shield approach, we find the OCF for the project is:

\[ OCF = 170,000(1 - 0.34) + 0.34(108,000) \]
\[ OCF = 148,920 \]

Now we can find the project NPV. Notice we include the NWC in the initial cash outlay. The recovery of the NWC occurs in Year 5, along with the aftertax salvage value.

\[ \text{NPV} = -540,000 - 29,000 + 148,920 \times (PVIFA_{10\%,5}) + \left[ \frac{(52,800 + 29,000)}{1.10^5} \right] \]
\[ \text{NPV} = 46,315.33 \]

14. First we will calculate the annual depreciation of the new equipment. It will be:

Annual depreciation charge = $425,000/5
Annual depreciation charge = $85,000

The aftertax salvage value of the equipment is:

Aftertax salvage value = $30,000(1 - 0.35)
Aftertax salvage value = $19,500

Using the tax shield approach, the OCF is:

\[ OCF = 130,000(1 - 0.35) + 0.35(85,000) \]
\[ OCF = 114,250 \]

Now we can find the project IRR. There is an unusual feature that is a part of this project. Accepting this project means that we will reduce NWC. This reduction in NWC is a cash inflow at Year 0. This reduction in NWC implies that when the project ends, we will have to increase NWC. So, at the end of the project, we will have a cash outflow to restore the NWC to its level before the project. We also must include the aftertax salvage value at the end of the project. The IRR of the project is:

\[ \text{NPV} = 0 = -425,000 + 60,000 + 114,250 \times (PVIFA_{\text{IRR\%,5}}) + \left[ \frac{(19,500 - 60,000)}{(1 + \text{IRR})^5} \right] \]
\[ \text{IRR} = 14.74\% \]

15. To evaluate the project with a $150,000 cost savings, we need the OCF to compute the NPV. Using the tax shield approach, the OCF is:

\[ OCF = 150,000(1 - 0.35) + 0.35(85,000) = 127,250 \]

\[ \text{NPV} = -425,000 + 60,000 + 127,250 \times (PVIFA_{11\%,5}) + \left[ \frac{(19,500 - 60,000)}{(1.11)^5} \right] \]
\[ \text{NPV} = 81,268.12 \]

The NPV with a $100,000 cost savings is:

\[ OCF = 100,000(1 - 0.35) + 0.35(85,000) \]
\[ OCF = 94,750 \]

\[ \text{NPV} = -425,000 + 60,000 + 94,750 \times (PVIFA_{11\%,5}) + \left[ \frac{(19,500 - 60,000)}{(1.11)^5} \right] \]
\[ \text{NPV} = -38,848.54 \]
We would accept the project if cost savings were $150,000, and reject the project if the cost savings were $100,000. The required pretax cost savings that would make us indifferent about the project is the cost savings that results in a zero NPV. The NPV of the project is:

\[
NPV = 0 = -425,000 + 60,000 + OCF(PVIFA_{11\%,5}) + \left[\frac{(19,500 - 60,000)}{(1.11)^5}\right]
\]

Solving for the OCF, we find the necessary OCF for zero NPV is:

\[
OCF = $105,261.26
\]

Using the tax shield approach to calculating OCF, we get:

\[
OCF = $105,261.26 = (S - C)(1 - .35) + .35($85,000)
\]
\[
(S - C) = $116,171.17
\]

The cost savings that will make us indifferent is $116,171.17.
We will begin by calculating the aftertax salvage value of the equipment at the end of the project’s life. The aftertax salvage value is the market value of the equipment minus any taxes paid (or refunded), so the aftertax salvage value in four years will be:

\[
\text{Taxes on salvage value} = (\text{BV} - \text{MV})T_c
\]
\[
\text{Taxes on salvage value} = ($0 - 350,000)(.38)
\]
\[
\text{Taxes on salvage value} = -$133,000
\]

<table>
<thead>
<tr>
<th>Market price</th>
<th>$350,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax on sale</td>
<td>–$133,000</td>
</tr>
<tr>
<td>Aftertax salvage value</td>
<td>$217,000</td>
</tr>
</tbody>
</table>

Now we need to calculate the operating cash flow each year. Using the bottom up approach to calculating operating cash flow, we find:

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$2,700,000</td>
<td>$3,225,000</td>
<td>$3,900,000</td>
<td>$2,925,000</td>
<td></td>
</tr>
<tr>
<td>Fixed costs</td>
<td>415,000</td>
<td>415,000</td>
<td>415,000</td>
<td>415,000</td>
<td></td>
</tr>
<tr>
<td>Variable costs</td>
<td>405,000</td>
<td>483,750</td>
<td>585,000</td>
<td>438,750</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td>1,166,550</td>
<td>1,555,750</td>
<td>518,350</td>
<td>259,350</td>
<td></td>
</tr>
<tr>
<td>EBT</td>
<td>$713,450</td>
<td>$770,500</td>
<td>$2,381,650</td>
<td>$1,811,900</td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td>271,111</td>
<td>292,790</td>
<td>905,027</td>
<td>688,522</td>
<td></td>
</tr>
<tr>
<td>Net income</td>
<td>$442,339</td>
<td>$477,710</td>
<td>$1,476,623</td>
<td>$1,123,378</td>
<td></td>
</tr>
<tr>
<td>OCF</td>
<td>$1,608,889</td>
<td>$2,033,460</td>
<td>$1,994,973</td>
<td>$1,382,728</td>
<td></td>
</tr>
</tbody>
</table>

| Capital spending | –$3,500,000 |        |        |        |
| Land | –2,300,000 |        |        | 2,400,000 |
| NWC | –125,000 |        |        | 125,000 |

| Total cash flow | –$5,925,000 | $1,608,889 | $2,033,460 | $1,994,973 | $4,124,728 |

Notice the calculation of the cash flow at Time 0. The capital spending on equipment and investment in net working capital are both cash outflows. The aftertax selling price of the land is also a cash outflow. Even though no cash is actually spent on the land because the company already owns it, the aftertax cash flow from selling the land is an opportunity cost, so we need to include it in the analysis. The company can sell the land at the end of the project, so we need to include that value as well. With all the project cash flows, we can calculate the NPV, which is:

\[
\text{NPV} = -\$5,925,000 + \frac{\$1,608,889}{1.13} + \frac{\$2,033,460}{1.13^2} + \frac{\$1,994,973}{1.13^3} + \frac{\$4,124,728}{1.13^4}
\]
\[
\text{NPV} = $1,003,682.32
\]

The company should accept the new product line.