Chapter 13 Homework Solutions

13.2  (a)  Doubleday:  \[ T_e = 9.2 + (1-0.092)(34) = 40.07\% \]
      TI (in millions) = 2.8 + 0.9 – 1.4 – 0.85 = $1.45

      Merritt-Douglas:  \[ T_e = 7.5 + (1-0.075)(34) = 38.95\% \]
      TI (in millions) = 4.7 + 0.25 – 3.1 – 0.97 = $0.88

      (b) Use the average federal tax rate of 34%, not the total effective rate \( T_e \).

      Doubleday:  Federal tax estimate = 1,450,000(0.34) = $493,000
      Merritt-Douglas: Federal tax estimate = 880,000(0.34) = $299,200

      (c)  Doubleday:  Taxes = 113,900 + 0.34(1,450,000 – 335,000)
            = $493,000
      Percent of revenue = 493,000/3.7 million = 13.3%

      Merritt-Douglas: Taxes = 113,900 + 0.34(880,000 – 335,000)
            = $299,200
      Percent of revenue = 299,200/4.95 million = 6.0%

<table>
<thead>
<tr>
<th></th>
<th>Doubleday</th>
<th>M-D</th>
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<tbody>
<tr>
<td>( T_e )</td>
<td>40.07%</td>
<td>38.95%</td>
</tr>
<tr>
<td>TI</td>
<td>$1,450,000</td>
<td>$880,000</td>
</tr>
<tr>
<td>Tax estimate</td>
<td>$493,000</td>
<td>$299,200</td>
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<tr>
<td>Tax (table)</td>
<td>$493,000</td>
<td>$299,200</td>
</tr>
<tr>
<td>% revenue</td>
<td>13.3%</td>
<td>6.0%</td>
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</tbody>
</table>

13.3  (a)  \[ T_e = 9.8 + (1 – 0.098)(31\%) = 37.76\% \]
      TI = 4.9 – 2.1 – 1.4 = $1.4 million
      Tax estimate = 1.4 million(0.3776) = $528,640

      (b) 528,640/4.9 million = 10.8%

13.4  (a) TI = 320,000 – 149,000 – 95,000 = $76,000

      (b) Use Table 13-1
      Taxes = 13,750 + 0.34(76,000-75,000)
            = $14,090

      (c)  \[ T_e = 10.5 + (1 – 0.105)(18.5 = 27.06\% \]
      Tax estimate = 76,000(0.2706) = $20,566
      Percent of GI = 20,566/320,000
                     = 6.43\%
13.9 Estimate before-tax MARR by Equation [13.9]. Tabulate CFBT; calculate AW.

Before-tax MARR = 10%/\(1-0.35\) = 15.4%. (All $ values are in $1000 units.)

<table>
<thead>
<tr>
<th>Year</th>
<th>GI</th>
<th>E</th>
<th>P and S</th>
<th>CFBT</th>
</tr>
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<td>0</td>
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<td>-1900</td>
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<td></td>
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<tr>
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<td>700</td>
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<tr>
<td>2</td>
<td>950</td>
<td>-150</td>
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<td>3</td>
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<tr>
<td>4</td>
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<td>-250</td>
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<td>700</td>
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</tbody>
</table>

\[
PW = -1900 + 700(P/F,15.4\%,1) + \ldots + 750(P/F,15.4\%,4)
= -1900 + 700(0.867) + 800(0.751) + 400(0.651) + 750(0.564)
= -9
\]

\[
AW = -9(A/P,15.4\%,4) = -9(0.3531)
= -3
\]

Equipment is (marginally) not justified using CFBT values.

13.10 Determine MACRS depreciation, taxes and CFAT. Assume negative tax will increase CFAT and AW.(All $ values are in $1000 units.)

\[
TI = GI – E - Depr
CFAT = CFBT - taxes
\]

<table>
<thead>
<tr>
<th>Year</th>
<th>GI</th>
<th>E</th>
<th>P and S</th>
<th>CFBT</th>
<th>Depr</th>
<th>TI</th>
<th>Taxes</th>
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<tr>
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<td>-91</td>
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13.11 Determine AW of CFAT at 10%.

\[
AW = [-1900 + 677(P/F,10\%,1) + \ldots + 782(P/F,10\%,4)](A/P,10\%,4)
= [-1900 + 677(0.9091) + 816(0.8264) + 358(0.7513)
+ 782(0.6830)](0.31547)
= 192(0.31547)
= 61
\]

Equipment is justified using CFAT values.
13.12 CFBT approximation: Determine before-tax $i^* = 15.1\%$. PW relation is

$$0 = -1900 + 700(P/F,i,1) + 800(P/F,i,2) + 400(P/F,i,3) + 750(P/F,i,4)$$

After-tax estimated ROR is from Equation [13.8].

$$15.1(1-0.35) = 9.8\%$$

CFAT ROR: Determine after-tax $i^* = 14.7\%$, which is considerably higher than the 9.8% approximation from the CFBT values. PW relation is

$$0 = -1900 + 677(P/F,i,1) + 816(P/F,i,2) + 358(P/F,i,3) + 782(P/F,i,4)$$

Spreadsheet solution for 13.9 to 13.12 follows.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
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<tbody>
<tr>
<td>1</td>
<td>AT MARR = 10%</td>
<td>BTT MARR = 15.30%</td>
<td>-10%(1-0.35)</td>
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13.17 (a) When the asset is salvaged for $100,000 after 5 years, there will be a capital gain, since MACRS will depreciate it to zero after 4 years.

(b) TI will increase by the depreciation recapture of $100,000

$$DR = SP - BV = 100,000 - 0 = 100,000$$

Taxes will increase by $TI(T_c) = 100,000T_c$
13.28 Find after-tax PW of costs over 4-year study period. DR is involved on the defender trade.

**Defender**

SL depreciation is \((45,000-5000)/8 = $5000\)

Annual tax = \((-E – Depr)(T_e)\)
= \((-7000 – 5000)(0.35)\)
= $-4200 (savings)

\[CFAT = CFBT – taxes\]
= -7000 – (-4200)
= $-2800

\[PW_D = -35,000 + 5000(P/F,12\%,4) – 2800(P/A,12\%,4)\]
= -35,000 + 5000(0.6355) – 2800(3.0373)
= $-40,327

**Challenger**

MACRS depreciation over \(n = 5\), but only 4 years apply

Defender trade depreciation recapture must be included.
Defender BV\(_3\) = 45,000 – 3(5000) = $30,000
SP = $35,000
DR = SP – BV = 5,000
Tax on DR = 5,000(0.35) = $1750

Challenger first cost = -24,000 - 1750 = $-25,750
MACRS depreciation is based on $24,000 first cost

<table>
<thead>
<tr>
<th>Year</th>
<th>Exp</th>
<th>P and S</th>
<th>Rate</th>
<th>Depr</th>
<th>TI</th>
<th>Taxes</th>
<th>CFAT</th>
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<td>-9,778</td>
<td>-3,422</td>
<td>-4,578</td>
<td></td>
</tr>
</tbody>
</table>

\[PW_C = -25,750 – 2400(P/F,12\%,1) - \ldots - 4578(P/F,12\%,4)\]
= $-34,787

Select the challenger with a lower PW of cost. Spreadsheet solution follows
13.31 (a) Amanda: debt Charlotte: equity

(b) Find FW at end of year.

Amanda: \( i = \frac{18}{12} = 1.5\% \) per month
FW = \( 2000(F/P, 1.5\%, 12) \)
= \( 2000(1.1956) \)
= $2391.20

Charlotte: effective \( i = 8\% \) per year
FW = \( 2000(F/P, 8\%, 1) \)
= \( 2000(1.08) \)
= $2160

13.32 (a) Equity
(b) Debt
(c) Equity
(d) Debt
(e) Equity
13.36 (a) MARR = WACC + 4%. Total equity and debt fund is $15 million.

\[
\text{Equity WACC} = \text{retained earnings fraction (cost)} + \text{stock fraction (cost)} \\
= \frac{4}{15}(7.4\%) + \frac{6}{15}(4.8\%)
\]
\[
= 3.893\%
\]

\[
\text{Debt WACC} = \frac{5}{15}(9.8\%)
\]
\[
= 3.267\%
\]

\[
\text{WACC} = 3.893 + 3.267 = 7.16\%
\]

MARR = 7.16 + 4.0 = 11.16%

(b) Debt capital gets a tax break; equity does not. From Equation [13.16]

\[
\text{After-tax cost of debt} = 9.8\%(1-0.32) = 6.664\%
\]

\[
\text{After-tax WACC} = \text{equity cost} + \text{debt cost} \\
= \frac{4}{15}(7.4\%) + \frac{6}{15}(4.8\%) + \frac{5}{15}(6.664\%)
\]
\[
= 6.11\%
\]

After-tax MARR = 6.11 + 4.0 = 10.11%