**Solutions to Quiz Problems – Chapters 5 and 6**

1. Pre-tax profit per unit in year one is 70 cents.

($0.70) (1.5 million) (1-.21) = $829,500 = total profit at t=1

Since both the price and the costs grow at 3% per year, the profits grow at 3% per year for 10 years.

$$PV of Profits=\$829,500\left[\frac{1}{.13-.03}-\frac{1}{.13-.03}\left(\frac{1.03}{1.13}\right)^{10}\right]=\$5,010,992.03$$

After-tax initial cost = $10,000,000 (1-.21) = $7,900,000

NPV = -$7,900,000 + $5,010,992.03 = -$2,889,007.97

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Sales |  | $200,000 | $210,000 | $220,500 | $231,525 | $243,101 |
| Expenses |  | $100,000 | $103,000 | $106,090 | $109,273 | $112,551 |
| Depreciation |  | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 |
| EBIT |  | $50,000 | $57,000 | $64,410 | $72,252 | $80,550 |
| Taxes |  | $10,500 | $11,970 | $13,526 | $15,173 | $16,916 |
| Net Income |  | $39,500 | $45,030 | $50,884 | $57,079 | $63,635 |
| Depreciation |  | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 |
| OCF |  | $89,500 | $95,030 | $100,884 | $107,079 | $113,635 |
| Capital Exp. | -$250,000 |  |  |  |  |  |
| Δ NWC | -$10,000 | -$5,000 |   |   |   | $15,000 |
| Project CF | -$260,000 | $84,500 | $95,030 | $100,884 | $107,079 | $128,635 |
|  |  |  |  |  |  |  |
| Tax Rate | 21% |  |  |  |  |  |
| IRR | 26.06% |  |  |  |  |  |

1. At t=0

PV Revenues = $150,000 / (.1 - .05) = $3,000,000.00

PV Labor Costs = $75,000 / (.1 - .03) = $1,071,428.57

PV Other Costs = $20,000 / (.1 - .01) = $222,222.22

PV Lease = $10,000 / .02 = $500,000.00

NPV = $3,000,000.00 - $1,071,428.57 - $222,,222.22 - $500,000.00 = $1,206,349.21

1. New: ($2,000,000) (1-.21) = $1,580,000 after tax revenue

($10,000,000/10) (.21) = $210,000 depreciation tax shield

$1,790,000 = OCF

NPV = 0 = -$10,000,000 + $\$1,790,000\left[\frac{1}{r}-\frac{1}{r\left(1+r\right)^{10}}\right]$

IRR = 12.28%

Add-on: ($150,000) (1-.21) = $118,500 after tax revenue

($500,000/10) (.21) = $10,500 depreciation tax shield

$129,000 = OCF

NPV = 0 = -$500,000 + $\$129,000\left[\frac{1}{r}-\frac{1}{r\left(1+r\right)^{10}}\right]$

IRR = 22.37%

Incremental: NPV = 0 = -$9,500,000 + $\$1,661,000\left[\frac{1}{r}-\frac{1}{r\left(1+r\right)^{10}}\right]$

IRR = 11.70%

Recommend the new building

Cash Flows ($million)

 Yr. 1 Yr. 2 Yr. 3 Yr. 4

Revenues 6 6.6 7.26 7.4778

Var. Costs 3 3.09 3.1827 3.278181

Year 1: (6 – 3) (.79) + (.5) (.21) = 2.218013

 1.12 1.03

Year 2: (6.6 – 3.09) (.79) + (.5) (.21) = 2.309511

 (1.12)2 (1.03)2

Year 3: (7.26 – 3.1827) (.79) = 2.29269187

 (1.12)3

Terminal Value of Rev – VC = (7.4778 – 3.2778181) (.79) = 36.8633223

 .12 - .03

PV of Terminal Value = 36.8633223 = 26.2385847

 (1.12)3

Present Value of FC = (1.5) (.79) = 9.875

 .12

Value of Robinstats = 2.218013 + 2.309511 + 2.29269187 + 26.2385847 – 9.875

 = 23.18380122 = $23,183,801.22

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Cost of New | -$72,000 |  |  |  |  |  |
| Sale of Old | $20,000 |  |  |  |  |  |
| Expense Savings |  | $18,960 | $18,960 | $18,960 | $18,960 | $18,960 |
| Tax Shield Lost |  | -$2,100 | -$2,100 |  |  |  |
| Tax Shield Gained |   | $3,024 | $3,024 | $3,024 | $3,024 | $3,024 |
| Project Cash Flow | -$52,000 | $19,884 | $19,884 | $21,984 | $21,984 | $21,984 |
|  |  |  |  |  |  |  |
| Tax Rate | 21% |  |  |  |  |  |
| Cost of Cap | 12% |  |  |  |  |  |
| NPV | $23,698.29  |  |  |  |  |  |

1. Project A: NPV = -$90,000 + $70,000 + $70,000 = $28,303.57

 1.12 (1.12)2

 NPV = 0 = -$90,000 + $70,000 + $70,000 IRR = r = 35.27%

 1+r (1+r)2

Project B: NPV = -$190,000 + $130,000 + $130,000 = $29,706.63

 1.12 (1.12)2

 NPV = 0 = -$190,000 + $130,000 + $130,000 IRR = r = 23.72%

 1+r (1+r)2

Project C: NPV = -$90,000 + $75,000 + $60,000 = $24,795.92

 1.12 (1.12)2

 NPV = 0 = -$90,000 + $75,000 + $60,000 IRR = r = 33.33%

 1+r (1+r)2

Do Project B since it has the highest NPV

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Revenues |  | $500,000 | $520,000 | $540,800 | $562,432 | $584,929 |
| Expenses |  | $125,000 | $130,000 | $135,200 | $140,608 | $146,232 |
| EBIT |  | $375,000 | $390,000 | $405,600 | $421,824 | $438,697 |
| Taxes |  | $78,750 | $81,900 | $85,176 | $88,583 | $92,126 |
| Net Income |  | $296,250 | $308,100 | $320,424 | $333,241 | $346,571 |
| OCF |  | $296,250 | $308,100 | $320,424 | $333,241 | $346,571 |
| Cap Expend | -$671,500 |  |  |  |  |  |
| Δ NWC | -$25,000 |   |   |   |   | $25,000 |
| Project CF | -$696,500 | $296,250 | $308,100 | $320,424 | $333,241 | $371,571 |
|  |  |  |  |  |  |  |
| Tax Rate | 21% |  |  |  |  |  |
| Cost of Cap | 18% |  |  |  |  |  |
| NPV | $305,150.80 |  |  |  |  |  |
| IRR | 35.42% |  |  |  |  |  |

1. PVAfter-tax Revenues = $500,000 (1 - .21)  = $2,012,628.24

PVAfter-tax Cost  = $200,000 (1 - .21)  = $744,527.01

 PVDepreciation Tax Shield = [($1,200,000 / 7) (.21)]  = $232,991.68

 NPV = -$1,200,000 + $2,012,628.24 - $744,527.01 + $232,991.68

 = $301,092.90

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 |
| Sales |  | $100,000 | $120,000 | $144,000 | $172,800 | $207,360 | $213,581 |
| Expenses |  | $40,000 | $41,200 | $42,436 | $43,709 | $45,020 | $46,371 |
| Depreciation |  | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $0  |
| EBIT |  | $20,000 | $38,800 | $61,564 | $89,091 | $122,340 | $167,210 |
| Taxes |  | $4,200 | $8,148 | $12,928 | $18,709 | $25,691 | $35,114 |
| Net Income |  | $15,800 | $30,652 | $48,636 | $70,382 | $96,648 | $132,096 |
| Depreciation |  | $40,000 | $40,000 | $40,000 | $40,000 | $40,000 | $0 |
| OCF |  | $55,800 | $70,652 | $88,636 | $110,382 | $136,648 | $132,096 |
| Capital Exp. | -$200,000 |  |  |  |  |  |  |
| Δ NWC |   |   |   |   |   |   |  |
| Project CF | -$200,000 | $55,800 | $70,652 | $88,636 | $110,382 | $136,648 |  |
| Terminal Value |   |   |   |   |   | $880,638 |  |
| Total CF | -$200,000 | $55,800 | $70,652 | $88,636 | $110,382 | $1,017,287 |  |
|  |  |  |  |  |  |  |  |
| Tax Rate | 21% |  |  |  |  |  |  |
| Discount Rate | 18% |  |  |  |  |  |  |
| Term. Growth  | 3% |  |  |  |  |  |  |
| NPV | $453,574.79  |  |  |  |  |  |  |