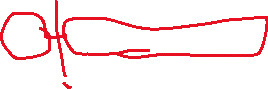
Question 1.

Company SZ is considering the purchase of a new machine today. The machine costs $16000 plus $4000 for shipping and installation and falls under the 3-year MACRS asset class. If the company takes this project of asset expansion, revenues will increase by $45000 and operating costs will increase by $5000 for each of the next 4 years compared to the case of no expansion. When the project ends in the fourth year, the machine will be sold for $1000. If the project is taken, net working capital will rise by $10000 at the time of purchase and will be reversed at the time of sale. The corporate income tax rate is 40% and the tax rate on capital gain is 25%. Find the relevant incremental cashflow associated with the project in each of the years from Year 0 through Year 4.



MACRS schedule:

|  |  |  |  |
| --- | --- | --- | --- |
| Year 1 | Year 2 | Year 3 | Year 4 |
| 33.33% | 44.45% | 14.81% | 7.41% |

Q1-1) Incremental cashflow in Year 0: -30000

Q1-2) Incremental cashflow in Year 1: 26666

Q1-3) Incremental cashflow in Year 2: 27556

Q1-4) Incremental cashflow in Year 3: 25185

Q1-5) Incremental cashflow in Year 4: 35343

Depreciable basis = 16000 + 4000 = 20000



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Year 0 | Year 1 | Year 2 | Year 3 | Year 4 |
| Incremental Revenue |  | 45000 | 45000 | 45000 | 45000 |
| Incremental Operating Costs |  | 5000 | 5000 | 5000 | 5000 |
| Incremental Depreciation |  | 6666 | 8890 | 2962 | 1482 |
| Incremental EBIT |  | 33334 | 31110 | 37038 | 38518 |
| Incremental EBIT(1-0.4) |  | 20000 | 18666 | 22223 | 23111 |
| Incremental EBIT(1-0.4)+Incremental Depreciation |  | 26666 | 27556 | 25185 | 24593 |
|  |  |  |  |  |  |
| Change in NWC | -10000 |  |  |  | 10000 |
|  |  |  |  |  |  |
| Cost of Machine | -20000 |  |  |  |  |
|  |  |  |  |  |  |
| Sale of Machine |  |  |  |  | 1000 |
| Tax on Sale: (Sale of Machine - NBV)\*0.25 |  |  |  |  | -250 |
|  |  |  |  |  |  |
| Total CF | -30000 | 26666 | 27556 | 25185 | 35343 |

Question 2.

Company ABC wants to decide whether to take on the project of asset replacement; it wants to get rid of two old machines and purchase a new machine today. Here is the information about these machines:

<First Old Machine>  
When the company purchased the first old machine at $14,000 five years ago, it planned to use the machine for 7 years. The company has been recording the depreciation expense using straight-line method over the five years. Today, the company can sell this machine at $2,000. When this machine fully depreciates, it has no salvage value, which means the firm cannot sell this machine at a positive price at the end of the second year.

<Second Old Machine>  
When the company purchased the second old machine at $15,000 four years ago, it planned to use the machine for 5 years. The company has been recording the depreciation expense using straight-line method over the four years. Today, the company can sell this machine at $6,000. When this machine fully depreciates, it has no salvage value, which means the firm cannot sell this machine at a positive price at the end of the first year.

<New Machine>  
One month ago, the company paid $2,000 to consultants to figure out which brand of machine is the best for a purchase and the company has found this new machine. The company can buy the new machine at $18,000 today and the shipping costs are $2,000. The new machine can last for four years and the company will record depreciation expense using the straight-line method over the next four years. Because a more advanced machine may come out in the market two years later, the company will stop using the new machine after two years, at which point the company can sell the new machine at $9,000. In addition, because the new machine is more efficient than the old machines, if the company takes on the project, the revenues will increase by $10,000 and operating costs will decrease by $5,000 each year over the next two years in comparison the case of not taking the project. In order to prevent suppliers from being worried about not receiving the raw materials costs purchased by Company ABC, it will speed up the rate of making payments to the suppliers by reducing accounts payable by $1,000 today and will increase the accounts payable by $1,000 in Year 2 when the project terminates.

Supposing that the tax rate on the capital gain/loss is 10% and the corporate income tax is 20%, find the relevant incremental cashflow associated with the project in each of the years from Year 0 through Year 2.

Q2-1) Incremental cashflow in Year 0: -13100

Q2-2) Incremental cashflow in Year 1: 12000

Q2-3) Incremental cashflow in Year 2: 22700

Payment to the consultants is a sunk cost; we ignore this cost.

Net book value of the first old machine in Year 0 = 2/7\*14000 = 4000



Depreciation expense for the first old machine in Year 1 and Year 2= 1/7\*14000 = 2000



Net book value of the second old machine in Year 0 = 1/5\*15000 = 3000

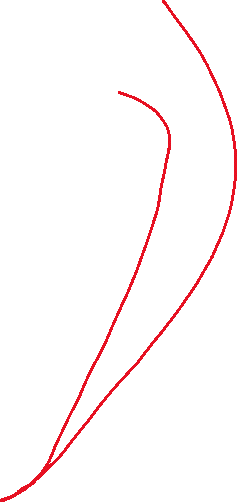
Depreciation expense for the second old machine in Year 1 = 1/5\*15000 = 3000



Depreciation expense for the second old machine in Year 2 = 0

Depreciable basis for the new machine = 18000+2000 = 20000

Depreciation expense for the new machine in Year 1 and Year 2: 1/4\*20000 = 5000



Net book value of the new machine in Year 2 = 2/4\*(18000+2000) = 10000

Positive change in NWC in Year 0 suggests cash outflow of 1000 in Year 0

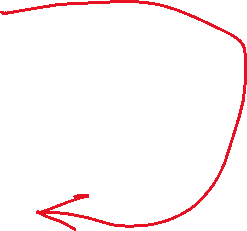
Negative change in NWC in Year 2 suggests cash inflow of 1000 in Year 2

<Incremental Depreciation Expense>



|  |  |  |
| --- | --- | --- |
|  | year 1 | year 2 |
| new asset | 5000 | 5000 |
| old assets | 2000+3000 | 2000+0 |
| change of depreciation | 0 | 3000 |

<Incremental Cashflows in Interim Years>



|  |  |  |  |
| --- | --- | --- | --- |
|  | year 0 | year 1 | year 2 |
| incremental revenues |  | 10000 | 10000 |
| incremental operating costs |  | -5000 | -5000 |
| -depreciation |  | 0 | 3000 |
| Pre-tax Income |  | 15000 | 12000 |
| -tax @ 20% |  | 3000 | 2400 |
| Net income |  | 12000 | 9600 |
| +depreciation |  | 0 | 3000 |
| cashflow |  | 12000 | 12600 |
|  |  |  |  |

<Cashflows associated with the project>

|  |  |  |  |
| --- | --- | --- | --- |
|  | year 0 | year 1 | year 2 |
| Machine Purchase including Shipping Costs | -20000 |  |  |
| Adjustment for NWC | -1000 |  | 1000 |
| Sales of new machine |  |  | 9000 |
| Net Book Value of New Machine |  |  | 10000 |
| -capital tax @10% |  |  | 100 |
| Sales of old machines | 8000 |  |  |
| Net Book Value of Old Machines | 7000 |  |  |
| -capital tax @10% | -100 |  |  |
|  |  |  |  |
|  |  |  |  |
| Incremental cashflow from interim Years (previous table) |  | 12000 | 12600 |
|  |  |  |  |
| Total cash flow | **-13100** | **12000** | **22700** |

Question 3.

Company ABC is thinking about initiating a project in which it will expand its produce lineups. For that matter, it needs to incur an initial cash outlay of $700 today, whereas the forecasted future cashflows are an inflow of $200 at the end of the first year, an inflow of $300 at the end of the second year, and an inflow of $400 at the end of the third year.

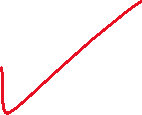


Question 3-1) If the maximum payback period (PBP) policy set by Company ABC is 2.7 years, determine whether Company ABC should take on the project using payback period as the criterion. Take vs. Reject



Over the next two years, Company ABC will collect $500. It takes another 0.5 year to collect the remaining $200.

In other words, the payback period for the project is 2.5 years, which is lower than 2.7 years. Hence, Company ABC should take the project.



Question 3-2) Compute the internal rate of return (IRR) of the project. 0.1218

You can use Excel’s Solver to compute this number.



i.e. 0 = -700 + 200/(1+IRR) + 300/(1+IRR)^2 + 400/(1+IRR)^3

Question 3-3) Determine whether Company ABC should pursue this project using IRR as the criterion if the required rate of return associated with the project is 20% per year. Take vs. Reject

Initial cashflow in Year 0 is outflow and IRR is smaller than discount rate of 20%



In other words, NPV is negative. Thus, we should reject the project.



Question 3-4) The required rate of return associated with the project is 20% per year. Determine whether Company ABC should invest in the project using net present value (NPV) as the criterion. Take vs. Reject

NPV = -700 + 200/(1+0.2) + 300/(1+0.2)^2 + 400/(1+0.2)^3 = -93.52 < 0

Question 3-5) The required rate of return associated with the project is 20% per year. Determine whether Company ABC should invest in the project using profitability index (PI) as the criterion. Take vs. Reject

PI = [200/(1+0.2) + 300/(1+0.2)^2 + 400/(1+0.2)^3]/700 = 0.8664 < 1

Since the project has PI smaller than 1, Company ABC should reject the project.

Question 4.

|  |  |  |  |
| --- | --- | --- | --- |
| Company XYZ is considering the following projects, which are mutually exclusive because of budget constraint. |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Project | Cash Needed Today ($) | NPV ($) | PI |
| Project A | 1000 | 50 | 1.05 |
| Project B | 500 | 200 | 1.4 |
| Project C | 800 | 840 | 2.05 |
| Project D | 200 | 20 | 1.1 |
| Project E | 500 | 400 | 1.8 |
| Project F | 500 | 500 | 2 |

Question 4-1) Determine which projects Company XYZ should choose if it only has $1800 today and cannot raise additional capital. C,E,F



You want to maximize the NPV subject to the budget constraint. You should rank the projects by PI and then pick the projects from the top choice and see whether you are fully using the budget of $1800.

|  |  |  |  |
| --- | --- | --- | --- |
| Project | Cash Needed Today ($) | NPV ($) | PI |
| Project C | 800 | 840 | 2.05 |
| Project F | 500 | 500 | 2 |
| Project E | 500 | 400 | 1.8 |
| Project B | 500 | 200 | 1.4 |
| Project D | 200 | 20 | 1.1 |
| Project A | 1000 | 50 | 1.05 |



In this case, you may exhaust the budget by picking Project C,F, and E in the order of decreasing PI and the maximum NPV subject to the budget of $1800 is $1740.

Hence, Company XYZ should choose Project C, Project F, and Project E.

Question 4-2) Determine which projects Company XYZ should choose if it only has $1500 today and cannot raise additional capital. C,D,F



Now the situation is a little tricky. We want to exhaust the budget while maximizing the total NPV.



Choice 1) I must include Project C, which is the project with the highest PI.



Based on the decreasing order of PI, let’s suppose we choose to include Project C and Project F. Once we start to include Project E, the initial cash outlay exceeds our budget. Similarly, once we start to include Project B, the initial cash outlay exceeds our budget. Yet, as we include Project D, we do not go over the budget but still can increase NPV. In other words, on per-dollar basis, Project E and Project B are more attractive than Project D, we just don’t have the money to make investment in them.



To summarize, by choosing Project C, F, and D, our initial cash outlay is 1500 (within our budget) and total NPV is 1360 (840 + 500 + 20)

Choice 2) I must include Project F, which is the project with the second highest PI, and I skip Project C, which is the project with the highest PI.



In this case, by choosing Project F,E,B, we can exhaust the budget and get the total NPV of 1100 (500+400+200)

As you can see, Choice 1 will maximize the NPV. Hence, Company XYZ should choose Project C, D, and F.

Also, you can rely on Excel solver to find the optimal combination. Please refer to the Excel attachment.