E355 Engineering Economics Spring 2022
Homework #5

"I pledge my honor that I have abided by the Stevens Honor System"

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5.1 Acai, a company specializing in developing AI technology in food transportation systems, wants to invest in a hardware system for their new office. Listed below is the economic data for the investment:

1	Depreciable Capital - year 0	$	500,000
2	Salvage Value (FMV) (at the end of project life)	$	90,000
3	Non-depreciable Capital - year 0	$	90,000
4	Non-depreciable Capital (at the end of project life)	$	170,000
5	Expected Revenue ($ / yr.)	$	1,800,000
6	O&M Cost ($ / yr.)	$	300,000
7	Useful life (years)		2
8	Working Capital - year 0	$	250,000
9	Working Capital - (at the end of the project life)	$	250,000
10	Loan Proceeds - year 0	$	650,000
11	Interest on Loan - per year		10%
12	Loan Period - years		2
13	Tax rate - per year		25%
14	ITC - year 1	$	90,000
15	ITC - year 2	$	120,000
16	MARR per year		20%

This system qualifies as a special 2-year MACRS Depreciation (with factors 0.6 and 0.4). Assume that the working capital is returned in year 2. Assume that the company has income from other projects and this system is sold at the end of year 2.

Note: Use the following tables to calculate the above values.

a) Calculate the interest and principal repayments for the loan. [6 points]

Year	Beginning Balance	Annual Payment	Interest (10%)	Principal Repayment	Ending Balance
1	$650,000	$374,530	650000*0.10 =**$65,000**	374530-65000 =**$309,530**	650000-309530 =**$340,470**
2	$340,470	$374,530	340470*0.10 =**$34,047**	374530-34047 =**$340,483**	340470-340483 = -**$13**
Total			$99,047	$650,013	

$$A = 650000 \left(\frac{A}{P}, 10\%, 2\right) = 650000 \left(0.5762\right) = 374530$$

b) Find the depreciation expenses and accumulated depreciation expenses (using the special MACRS rate) for this system. [5 points]

Year	Initial Cost	Depreciation Rates	Depreciation Expenses	Accumulated Depreciation	Ending BV
0	$500,000	-	-	-	-
1	↓	60%	500000*0.60 =$300,000	$300,000	500000-300000 =$200,000
2		40%	500000*0.40 =$200,000	$500,000	200000-200000 =$0
Total			$500,000		

c) Calculate the after-tax cash flows from salvage of depreciable and non-depreciable capital. [6 points]
Depreciable

$Tax\ Rate\ (TR) = 25\% = 0.25$

Depreciable:
$End\ of\ life\ (FMV) = 90000$
$Year\ 0\ (IC) = 0$

$Tax = (FMV - IC)(TR) = (90000 - 0)(0.25)$
$Tax = \$22,500$

$After\ Tax\ Cash\ Flow = (FMV - Tax) = (90000 - 22500)$
$After\ Tax\ Cash\ Flow = \$67,500$

Non-Depreciable:
$End\ of\ life\ (FMV) = 170000$
$Year\ 0\ (IC) = 90000$

$Tax = (FMV - IC)(TR) = (170000 - 90000)(0.25)$
$Tax = \$20,000$

$After\ Tax\ Cash\ Flow = (FMV - Tax) = (170000 - 20000)$
$After\ Tax\ Cash\ Flow = \$150,000$

d) Calculate the Net Cash Flow from operating income. [8 points]

	CASH FLOWS	0	1	2
1	Operating Revenue	-	$1,800,000	$1,800,000
2	Cash Expenses	-	$300,000	$300,000
3	Oper. Income Before Depr.	-	1800000-300000 =$1,500,000	1800000-300000 =$1,500,000
4	Depreciation (From Part B)	-	$300,000	$200,000
5	Oper. Income	-	1500000-300000 =$1,200,000	1500000-200000 =$1,300,000
6	Interest Expense (From Part A)	-	$65,000	$34,047
7	Pretax Net Income	-	1200000-65000 =$1,135,000	1300000-34047 =$1,265,953
8	Income Taxes (25%)	-	1135000*0.25 =$283,750	1265953*0.25 =$316,488.25
9	Investment Tax Credit	-	ITC Year 1 $90,000	ITC Year 2 $120,000
10	Net Income AT	-	(1135000-283750) +90000 =$941,250	(1265953-316488.25) +120000 =$1,069,464.75
11	Depreciation (From Box 4)	-	$300,000	$200,000
12	Net C.F. from Oper. (Box 10 + Box 11)	-	941250+300000 =$1,241,250	1069464.75+200000 =$1,269,464.75

e) Calculate the Net Capital Cash Flow. [6 points]

13	Principal Repayment (From Part A)	-	$309,530	$340,483
14a	Depreciable Capital	$500,000	-	$67,500
14b	Non-Depreciable Capital	$90,000	-	$150,000
14c	Loan Proceeds	$650,000	-	-
15	Capital Gains/Losses (Using Part C)	-	-	67500+150000 =$217,500
16	Working Capital	$250,000	-	$250,000
17	Net Capital Cash Flow	(590000-650000) +250000 =$190,000	-$309,530	[(340483-217500) -250000] =$127,030

f) Calculate the Net Present Value. [2 points]

18	Total Cash Flow (Box 12 - Box 17)	[(0-190000)] = -$190,000	(1241250-309530) =$931,720	(1269464.75+127030) =$1,396,494.75
19	Discount Factor [P(T)]	1	0.8333	0.6944
20	Net Present Value (NPV)	190000*1 = -$190,000	931720*0.8333 =$776,402.28	1396494.75*0.6944 =$969,725.95
21	Cumulative NPV	-$190,000	[(776402.28-190000)] =$586,402.28	[(586402.28+969725.95)] =$1,556,128.23

Discount Factor:
$P(T) = 1 / (1 + r)^T$
r = MARR = 20%

$$P(0) = \frac{1}{(1+0.20)^0} = 1 \quad P(1) = \frac{1}{(1+0.20)^1} = 0.8333 \quad P(0) = \frac{1}{(1+0.20)^2} = 0.6944$$

g) Should the investment be undertaken? Why or why not, explain. [1 point]

The investment should be undertaken because the net present value of the investment is positive.