ISE 307: Engineering Economic Analysis (Term 253)

In-Class Activity-21

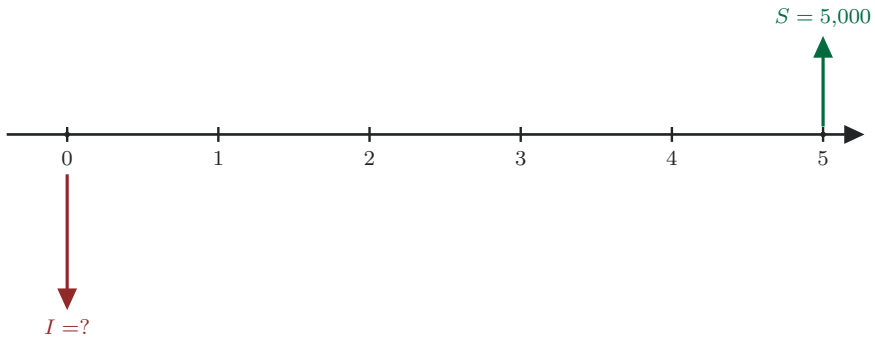
Depreciation and After-Tax Analysis

Name: _____ **Student ID:** _____

Section: _____ **Date:** _____

Problem 1: Depreciation Schedules

A mineral-concentrate packaging machine is placed in service. The firm pays **36,000 SAR** for the machine, **1,600 SAR** for freight, and **2,400 SAR** for installation. The estimated salvage value is $S = 5{,}000$ SAR and the depreciable life is $N = 5$ years.



We will compare three depreciation schedules: straight line, double declining balance, and MACRS. Complete the missing entries **(i)**–**(iii)** in each schedule; show your computation next to each blank.

(a) (6 pts) **Straight line.** First compute the cost basis $I =$ _____ **(i)**, then find **(ii)** and **(iii)**.

year n	0	1	2	3	4	5
D_n	—	**(ii)**	**(ii)**	**(ii)**	**(ii)**	**(ii)**
B_n	I	33,000	26,000	**(iii)**	12,000	5,000

(b) (7 pts) **Double declining balance** ($\alpha = 2/N = 40\%$), **with the salvage adjustment**. Fill **(i)** and **(ii)**; for **(iii)**, the year-5 entry.

n	$D_n = 0.40\, B_{n-1}$	B_n
1	16,000	24,000
2	**(i)**	**(ii)**
3	5,760	8,640
4	3,456	5,184
5	**(iii)**	5,000

(c) (7 pts) **MACRS, 5-year class**. Find **(i)**, **(ii)**, and **(iii)**.

n	p_n	$D_n = I \times p_n$	B_n
1	20.00%	8,000	32,000
2	32.00%	**(i)**	19,200
3	19.20%	7,680	**(ii)**
4	11.52%	4,608	6,912
5	11.52%	4,608	2,304
6	5.76%	2,304	0

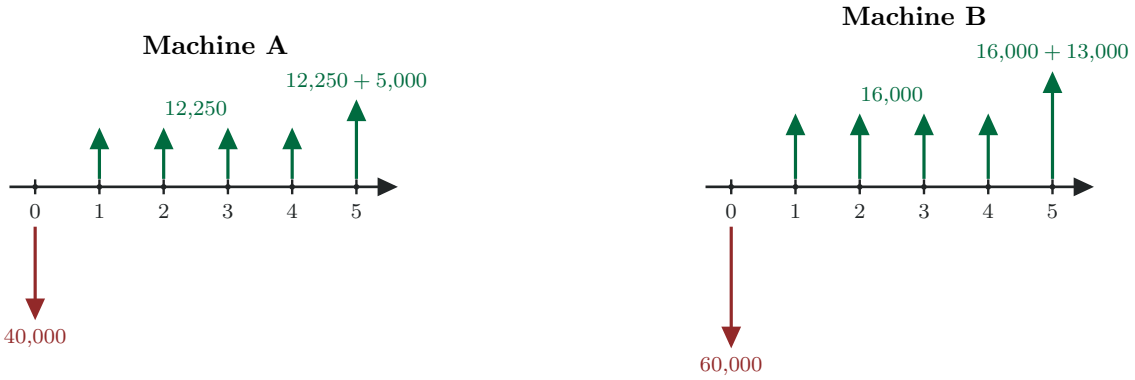
(d) (4 pts) **If you could choose which depreciation schedule to use for the company, which one would you choose?** Also explain why.

Problem 2: Comparing Two Machines

The packaging machine of Problem 1 (**Machine A**, straight-line depreciation) is now evaluated as a project, next to a larger competing machine (**Machine B**) that would do the same job. The two machines are **mutually exclusive**. The marginal tax rate is $t = 25\%$ and the MARR is 10%. Both income statements, both after-tax cash flows, both disposal settlements, and both stand-alone verdicts are given below — every number has already been computed for you.

	Machine A	**Machine B**
Investment (year 0)	−40,000	−60,000
Each of years 1–5:		
Revenues R	30,000	38,000
Cash expenses E	16,000	20,000
Depreciation D (SL)	7,000	10,000
Taxable income TI	7,000	8,000
Income tax (25%)	1,750	2,000
Net income	**5,250**	**6,000**
ATCF = NI $+D$	**12,250**	**16,000**
Disposal at end of year 5:		
Selling price	5,000	14,000
Book value B_5	5,000	10,000
Taxable gain	0	4,000
Gains tax (25%)	0	1,000
Net proceeds	**5,000**	**13,000**
$PW(10\%)$ $[(P/A, 10\%, 5) = 3.7908;\ (P/F, 10\%, 5) = 0.6209]$	+9,542	+8,725
Stand-alone verdict	accept	accept

The after-tax cash flow diagrams assembled from the table (year-5 arrows combine the operating ATCF with the net proceeds):



(a) (3 pts) A student objects: *"Machine B's table subtracts 10,000 of depreciation and then adds the same 10,000 straight back in the ATCF row. If it cancels out anyway, depreciation clearly has no effect — the table would end at the same cash flow without it."* Is the student right? *Hint: Use Machine B's tax row to support your answer.*

(b) (3 pts) Machine B is sold for 14,000 SAR, yet only 13,000 appears as the year-5 arrow on its diagram. Explain why! Also, state what the year-5 arrow would have been had B sold for exactly its book value of 10,000. *Hint: you can explain this in terms of what depreciation claimed versus what the sale revealed along with their consequences.*

(c) (10 pts) A junior engineer studies the table and writes: *"Machine B posts the higher net income (6,000 vs. 5,250)* ***and*** *the higher after-tax cash flow (16,000 vs. 12,250) in every single operating year, and it passes the MARR test on its own. B is obviously the better buy."*

Do you agree? Why or why not?