

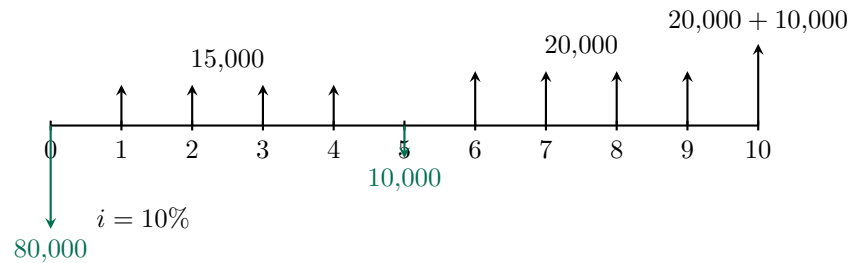
In-Class Activity 13

Name: _____

ID: _____

Section: _____

Problem 1 (25 points). A mining contractor is evaluating a **10-year automation retrofit for a haul-road conveyor**. The retrofit kit costs **80,000 SAR** today and generates net savings of **15,000 SAR per year** in years 1–4. At the **end of year 5**, a scheduled mid-life overhaul costs **25,000 SAR** (so the net flow that year is $15,000 - 25,000 = -10,000$ SAR). The overhaul boosts performance: net savings rise to **20,000 SAR per year** in years 6–10, and the kit is resold for **10,000 SAR** at the end of year 10. The firm's MARR is **10%** per year.



Useful factors at $i = 10\%$:

$(P/A, 10\%, 4)$	$(P/A, 10\%, 5)$	$(P/F, 10\%, 5)$	$(P/F, 10\%, 10)$
3.1699	3.7908	0.6209	0.3855

(a) (6 points) Compute the **net present worth** of the retrofit at the MARR. Then state the accept/reject decision **and** explain in one sentence what the NPW number means to the contractor (relative to what alternative).

(b) (12 points) The project balance table below has **three missing entries**. Complete PB_4 , PB_5 , and PB_6 (show the recursion for each), then answer:

n	0	1	2	3	4	5	6	7	8	9	10
A_n	-80,000	15,000	15,000	15,000	15,000	-10,000	20,000	20,000	20,000	20,000	30,000
PB_n	-80,000	-73,000	-65,300	-56,830				-33,340	-16,674	+1,659	+31,825

(i) In which year does the **discounted payback** occur?

- (ii) Between years 4 and 5 the balance moves **backward** (deeper into the negative) even though the project was recovering steadily before. Explain why, and what this tells a manager reading the project's **risk exposure** profile.

- (iii) Verify that the terminal balance $PB_{10} = +31,825$ SAR is consistent with your NPW from part (a), and state what this terminal value represents.

(c) (7 points) Impressed by the results, the mine owner asks the contractor to **keep the automated conveyor service running indefinitely** after year 10. Sustaining the service requires **6,000 SAR per year** of upkeep plus a **20,000 SAR overhaul every 10 years**, forever, at $i = 10\%$.

- (i) Find the **capitalized equivalent** of the perpetual service costs (convert the periodic overhaul to an equal annual cost first; show both steps).

- (ii) Interpret your CE value: what exactly does depositing this single amount guarantee, and why does the fund never run out?