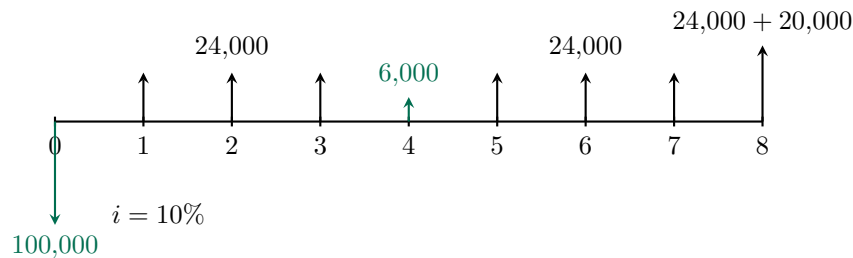


In-Class Activity 14 (Version A)

Name: _____ ID: _____ Section: _____

(Total points: 25) *Najd Copper* runs a concentrate supply chain: ore is crushed and milled, floated into copper concentrate, and hauled from the mill to a rail siding for shipment. The firm's MARR is **10%** per year throughout. The CEO asks you to help in two engineering-economic decisions:

(a) Debottlenecking the flotation circuit (13 points). An **8-year** debottleneck of the flotation circuit costs **100,000 SAR** today and raises net concentrate revenue by **24,000 SAR per year** in years 1–8. A scheduled **mid-life reline** at the **end of year 4** costs **18,000 SAR** (so the net flow that year is $24,000 - 18,000 = 6,000$ SAR). The equipment is resold for **20,000 SAR** at the end of year 8.



Useful factors at $i = 10\%$:

$(P/A, 10\%, 8)$	$(P/F, 10\%, 4)$	$(P/F, 10\%, 8)$	$(F/P, 10\%, 8)$
5.3349	0.6830	0.4665	2.1436

- (i) **(6 pts)** Compute the **net present worth** at the MARR. State the accept/reject decision **and** explain in one sentence what the NPW number means to *Najd Copper* (relative to what alternative).

- (ii) **(7 pts)** A vendor offers an alternative to option (i): for the **same 100,000 SAR** upfront, buy a **perpetual** debottleneck service that yields a net benefit of **12,000 SAR every year forever**. Find the **capitalized equivalent** of that perpetual benefit and state which option — the 8-year retrofit in (i) or this perpetual service in (ii) — creates more value for *Najd Copper* today.

(b) **Choosing the mill-to-siding haulage system (12 points).** Concentrate **must** be moved from the mill to the rail siding regardless of choice. The firm must choose one of two systems (MARR = 10%):

Alternative	First cost	Annual O&M	Service life	Salvage
T — Truck fleet	60,000	22,000	5 yrs	8,000
C — Belt conveyor	140,000	9,000	10 yrs	20,000

Useful factors at $i = 10\%$:

$(P/A, 10\%, 10)$	$(P/F, 10\%, 5)$	$(P/F, 10\%, 10)$
6.1446	0.6209	0.3855

- (i) **(7 pts)** Draw the cash flow diagram, compute the **present worth** of each alternative (replicate the shorter-lived system as needed) and state which option (T, C, or Do Nothing) is better today.

- (ii) **(5 pts)** Suppose instead the government requires the mine to **close in exactly 6 years**. **Without recomputing**, discuss how the analysis would change:

- what the new horizon is,
- how the first cost, O&M cost, and salvage value of each alternative change,
- why the truck fleet's salvage credit at the new cutoff would be unusually high.