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Yr:	1	2	3	4	5	6	7	8
Running cost (₹):	200	500	800	1200	1800	2500	3200	4000

When should the machine be replaced?

Sol. To calculate the optimum time for the replacement of the machine, we calculate total average annual cost as shown in the following table:

Yr (n)	Running cost (₹) f(n)	Cumulative Running cost $\Sigma f(n)$	Depreciation cost C-S	Total cost C-S+$\Sigma f(n)$	Avg. annual cost A(n) = TC/n
1	200	200	12000	12200	12200
2	500	700	12000	12700	6350
3	800	1500	12000	13500	4500
4	1200	2700	12000	14700	3675
5	1800	4500	12000	16500	3300
6	2500	7000	12000	19000	(3167)
7	3200	10200	12000	22200	3171
8	4000	14200	12000	26200	3275

S = ₹200 C = ₹12,200

From the above table, we note that the avg. annual cost is minimum in the 6th year ∴ The machine should be replaced after every 6 years.

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Q. (a) Machine A cost ₹9000. Annual operating cost is ₹200 for first yr and then increases by ₹2000 every year. (i) Determine the least stage at which to replace the machine. (ii) Also calculate the average yearly cost of owning and operating the machine

(b) Machine B costs ₹10,000. Annual operating cost is ₹400 for 1st year and increases by ₹800 every year. Now you have a machine of type A which is 1 yr old. Would you like to replace the machine B with A? If so, when?

Sol. (a) First of all we calculate the avg total annual cost as shown in the table

Yr (n)	f(n)	Σf(n)	C-S	Total cost	A(n)
1	200	200	9000	9200	9200
2	2200	2400	9000	11400	5700
3	4200	6600	9000	15600	(5200)
4	6200	12800	9000	21800	5450
5	8200	29000	9000	30000	6000

(S-O ∵ not given)

From the above table, we see that, the min. avg. total cost is ₹5200 ∴ we must replace the machine after 3yrs.

∴ Avg yearly cost of owning & operating the machine is ₹5200

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(b) For machine B, we calculate the avg total annual cost as follows:

Yr (n)	f(n)	Σf(n)	C-S	Total cost	A(n)
1	400	400	10,000	10400	10400
2	1200	1600	10,000	11600	5800
3	2000	3600	10,000	13600	4533
4	2800	6400	10,000	16400	4100
5	3600	10000	10,000	20000	4000
6	4400	14400	10,000	24400	4066

Since the avg minimum cost of machine B is 4000 whereas of machine A is 5200

∴ Machine A should be replaced by machine B

Since the min avg cost corresponds to ₹3600 for machine B, whereas the min avg cost for machine A corresponds to ₹4200 after 3rd year, which is more than that of machine B.

∴ We must replace the machine after 2 years but since machine A is already 1 yr old ∴ We must keep machine A for 1 yr only.