DAYANANDA SAGAR COLLEGE OF ENGINEERING

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DEPARTMENT OF TELECOMMUNICATION ENGINEERING

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COURSE MATERIAL

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Course:	**Engineering Economics**
Course Code:	**17HS6ICEEM**
Semester:	**VI**
Module:	**II**
Title of Module:	**Present Worth Comparison**

12.02.20. MODULE-2.

Present worth comparision.

Present worth (PW):-

option 1 PW = 50,000.

-2 PW = ₹(A (P/F, 12, 10)

= 8000 × 5.65

P = 45,200.

option 1 is better.

opti Future worth: →

= 50,000 (F/P, 12, 10)

= 1,55,300.

option -2 ⇒ F = A (F/A, 12, 10)

F = 1,40,300.

Following are the different methods of comparison of alternatives:

(a) Equivalent worth: Two types M-2

(b) (i) Present worth M-2 (ii) Annual worth.

(iii) Future worth. M-3

(b) Rate of return

(i) Internal M-3 (ii) Extend rate of return.

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In the present worth comparision method, the cashflow of all the alternatives is reduced to time zero - i.e - now.

For some rate of interest 'i'

Net PW = PW(revenue) − PW(costs)

The ~~a~~ At the end, the alternative with high net present worth is choosen.

If all the alternatives have +ve value, the alternative with least negative value is choosen.

Conditions for present worth comparision

Ingredients

1. Amount of Sums.
2. Time of occurance of these sums.
3. Rate of Interest.

The following are the conditions for present worth Comparision:

1. Cash flows are known: However future cash flow is anticipation.
2. Cash flows are representated in constant value Rs's
3. Rate of interest is known.
4. Comparision are made before the tax & cash flows.
5. Comparison do not include intangible consideration
6. Comparisions do not include consideration of the availability of the funds to implement the alternatives.

Basic present worth comparision:

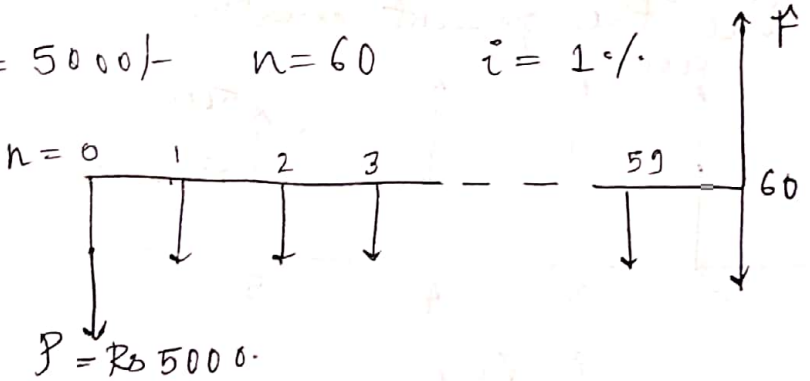
1. Present worth equivalent
2. Net present worth
3.

1. Present worth equivalence:

One pattern determines the present worth equivalence of a series of future transactions. The purpose is to secure one figure that represents all the transactions for instance, a series of expenses that will occur in the future can be discounted to obtain its P.W and decision can be made wether an investment of P.W amount can be made now to avoid the expenses.

Q1. The lease on a warehouse amounts to Rs 5000 per month for 5 years, if the payments are on the 1st of each month, what is the present worth of the agreement at the nominal interest 12% compounded monthly.

Sol: $A = 5000/-$ $\quad n = 60$ $\quad i = 1\%$



$$P = A\left(\frac{(1+i)^n - 1}{i\cdot(1+i)^n}\right) =$$

$$P/A = \left(\frac{(1+0.01)^{60} - 1}{0.01(1+0.01)^{60}}\right) = \frac{0.81669}{0.0181669} \Rightarrow 44.954.$$

$$P = A(P/A, i, n) = Rs\,2,24,773.34$$

$$\Rightarrow \quad P = Rs\ 2,24,773.34.$$

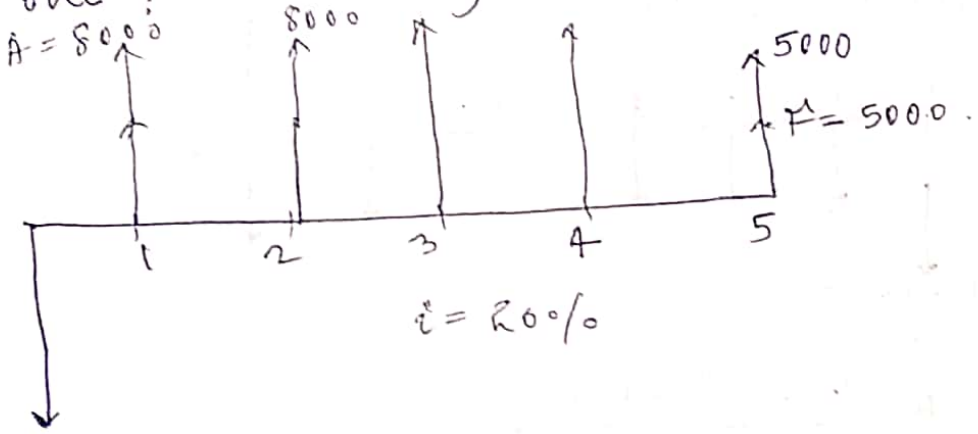
2. Net present worth:

The second general pattern for present worth calculations has an initial outlay at time 0

followed by a series of receipts and disbursements.

Net present worth = (present worth revenues) - (present worth or cost).

Q1. A piece of piece of new equipment was proposed by engineers to increase the productivity of a certain manual welding operation, the investment is Rs 25,00,000 and the equipments will have salvage value of Rs 5000 at the end of 5 years. Increased productivity will gain Rs 8000 per year, after extra operating cost has been subtracted from the additional production. Draw the a cash flow diagram if the minimum attractive rate of return is 20% per year. In this proposal a sound one? Use the present worth.



P = Rs 25,000

Net PW = PW (revenue) - (present worth or cost)

$\Rightarrow A\left(P/A, 20, 5\right) + F\left(P/F, 20, 5\right) - 25,000.$

$\Rightarrow 8000\left(2.991\right) + 5000\left(0.4019\right) - 25,000$

$\rightarrow 23928 + 2009.5 - 25000$

$\Rightarrow$ Rs 937.5

$(P/A, i, n) \Rightarrow \frac{(i+1)^n - 1}{i(1+i)} \Rightarrow$

Following table gi

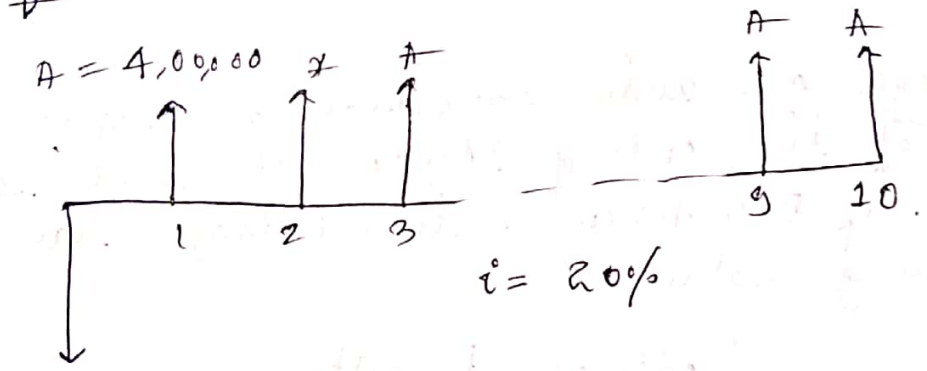
15.02.20

1. Following table gives an initial outlay and annual revenue of a production firm using two different technologies. Find the best alternative using present worth method. If the interest rate is 20% compounded annualy.

Sol:

	Initial outlay (Rs)	Annual revenue (Rs)	Life (years)
Alternative 1	13,00,000	Rs 4,00,000	10
Alternative 2	23,00,000	8,60,000	10

CFD for Alternative 1



Net PW = PW (revenue) − (present worth of cost).

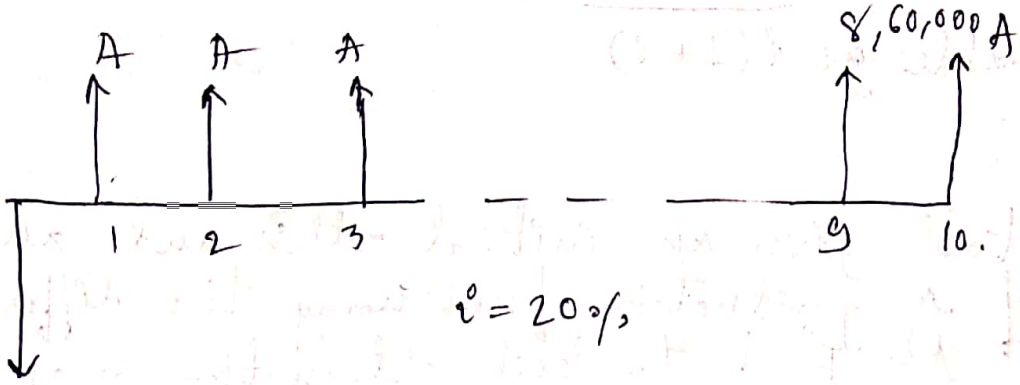
$= A(P/A, i, n) - 13,00,000$

$= A(4.192) - 13,00,000$

$= 4,00,000(4.192) - 13,00,000$

Net PW. = Rs. 3,76,800

CFD Alternative 2



Net PW = PW (revenue) - PW (costs)

$\Rightarrow A(P/A, i, n) - 23,00,000$

$\Rightarrow 8,60,000(4.192) - 23,00,000$

Net PW. $\Rightarrow$ Rs 13,05,120

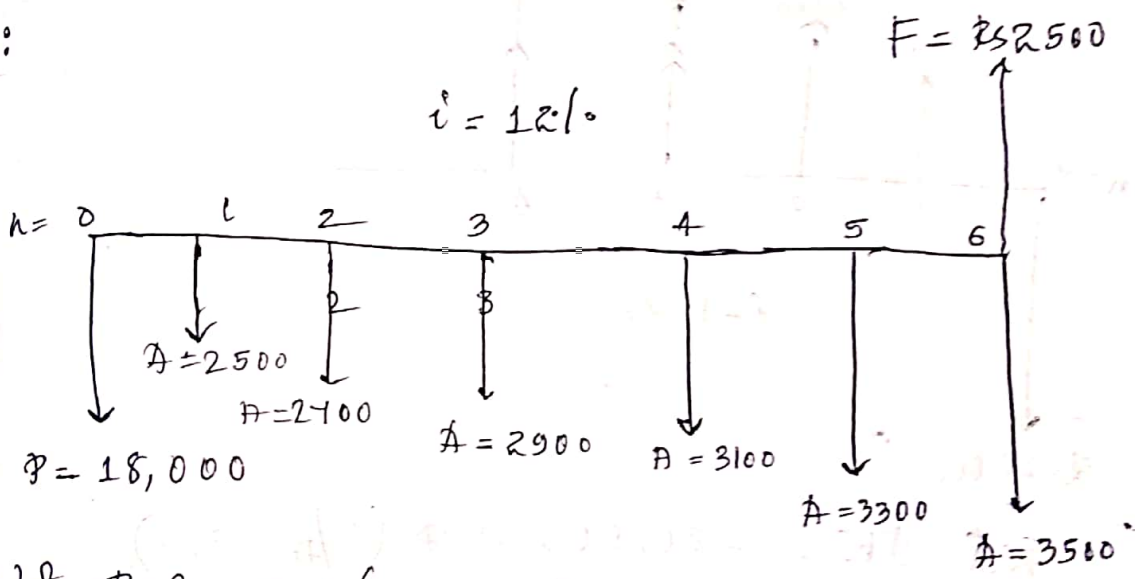
Comparing two alternatives alternative 2 is best one.

Q2. Two cottages are under consideration compare the present worth of the cost of 24 years service at a interest rate of 5% when neither cottage has realizable salvage value.

	cottage 1	cottage 2.
First cost	Rs 4500	Rs 10,000.
Estimated life	12 years	24 years
Annual maintenance cost	Rs 1000.	Rs 720.

Q3. A Bakery is thinking of purchasing a delivery truck, initial cost of Rs 18,000 and service life of 6 years with salvage value Rs 2500. Maintainence and operating cost are estimated to be Rs 2500 for first year and will increase at a rate Rs 200 per year. Determine the present worth of this vechicle using $i = 12\%$.

Sol:



Net PW = PW(revenue) - PW(costs).

$$A = A_1 + G\left[\frac{A}{G}, 12, 6\right]$$

$$= 2500 + 200\,(2.42) = \text{Rs } 2934.4.$$

$$P = A\,(P/A, 12, 6). \Rightarrow 2934.4\,(4.111)$$

$$= \text{Rs } 12,063.31$$

or

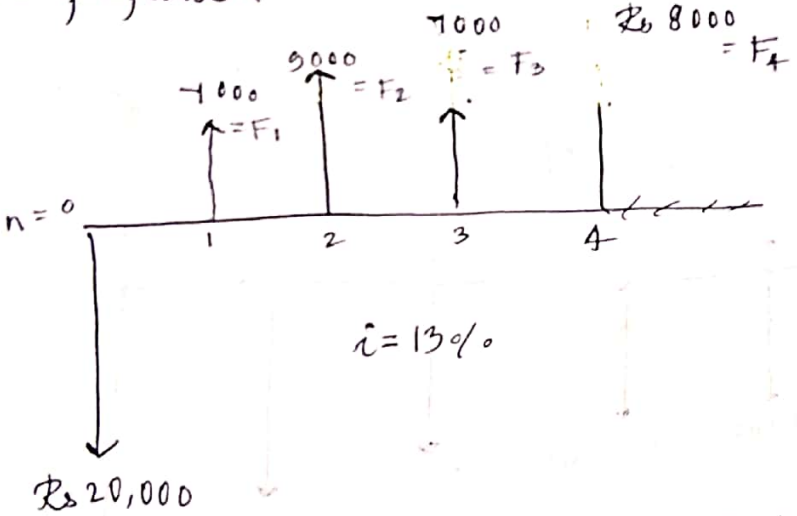
$$PW = -18,000 - [2500 + 200\,(A/G, 12, 6)]\,(P/A, 12, 6) + 2500$$

$$= -18,000 - 12,063.31 + 2500 = \text{Rs } -27,563.318$$

Q4. A businessman has two investment proposals to help in expand his operations. Cash flows for each proposals are as follows, using i = 13%. Select which proposal is better?

Proposal	yearly cash flows				
	0	1	2	3	4
X	-20,000	7000	9000	7000	8000
Y	-20,000	10,000	6000	7000	6000

CFD for proposal X



Net PW = -20,000 + A (P/A, 13, 1).

+ 9000(P/A, 13, 2) + 7000(P/A, 13, 3) + 8000(P/A, 13, 4)

$$(P/A, 13, 4) = \frac{(1+i)^n - 1}{i(1+i)^n} = 0.884955$$

Net PW = -20,000 + F1(P/F, 13, 1) + 9000(P/F2, 13, 2)

+ 7000(P/F3, 13, 3) + 8000(P/F4, 13, 4).

$$(P/F, 13, 1) = \frac{(F)}{(1+i)^n} = 6194.690$$

$$(P/F_2, 13, 2) = \frac{F}{(1+i)^n} = \frac{9000}{(1+i)^2} = 7048.32$$

$$(P/F_3, 13, 3) = \frac{F}{(1+i)^n} = \frac{7000}{(1+i)^3} = 4851.351$$

$$(P/F_4, 13, 4) = \frac{F}{(1+i)^n} = \frac{8000}{(1.13)^4} = 4906.54$$

Net PW = 3000.901.

$$PW_y = -20000 + 10,000(P/F, 13, 1) + 6000(P/F, 13, 2) + 7000(P/F, 13, 3) + 6000(P/F, 13, 4)$$

$$PW = 2079.44$$

Comparitively proposal X is better.

17.02.20

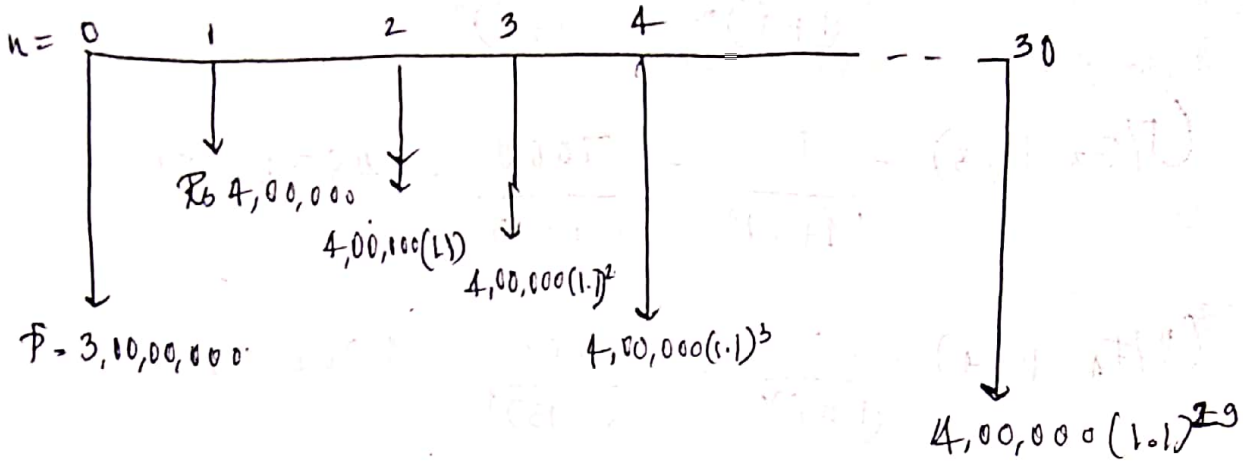
Q1. A small dam and an irrigation system are expected to cost Rs 3,00,00,000. Annual maintainance and operating cost are expected to be 4,00,000 for 1st year will increase at of interest 10% per year. Determine the equivalent present worth of building dam and operating the system with interest of 10% over a 30 years life.

Sol: $A_1 = 4,00,000 \quad n = 30 \quad P = 3,00,00,000.$

$$i = 10\% = g.$$

Geometric series problem, $i = g$.

$$P = A_1 \left[\frac{n}{1+g}\right] = A_1 (P/A, g, i, n)$$



$$P = A_1 (P/A, g, i, n)$$

$$= A_1 \left(\frac{n}{1+g}\right)$$

$$= \text{Rs } 1,09,09,090$$

$$PW = PW(\text{revenue}) - PW(\text{cost})$$

$$= 0 - 3,00,00,000 - 1,09,09,090$$

$$\Rightarrow -\text{Rs } 4,09,09,090$$

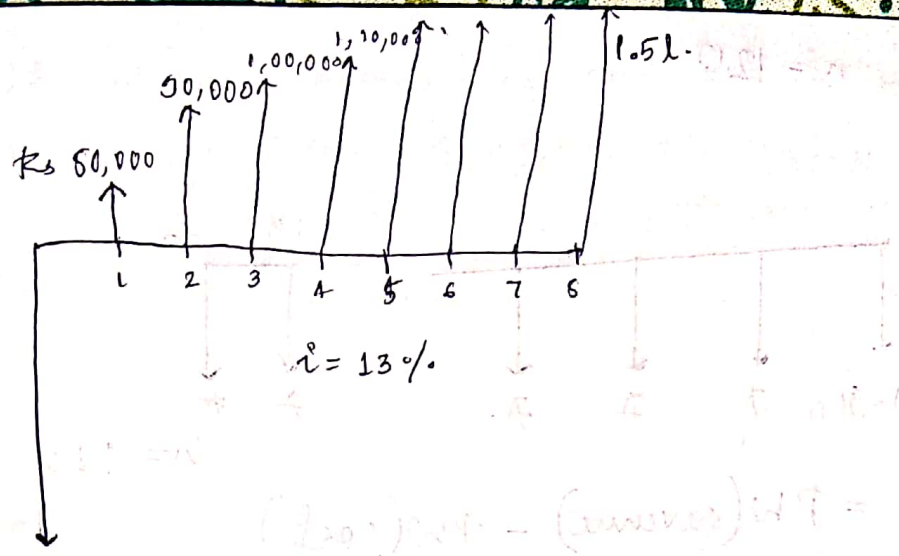
This is the equivalent present worth.

Q2. A xerox machine in new area with an initial outlay of Rs 1,00,000 yields Rs 80,000 during 1st year of its operation and the yield increases by Rs 10,000 from 2nd year upto 8 years of operation. At the end of life of business the machine becomes scrap and has zero salvage value. Find the PW of the busine assuming the r.o.i 13% compounded annually.

Sol: $n = 8 \quad i = 13\% \quad P = 1,00,000$

$$PW = PW(\text{revenue}) - PW(\text{cost})$$

$$= -1,00,000 -$$



P = Rs 1,00,000

$$PW = -[1,00,000 + [A_1 + G_1 (A_1/G, 13, 8)]]$$

$$A = A_1 \pm G_1 \left[\frac{(1+i)^n - i.n - 1}{i(1+i)^n - i}\right]$$

$$= A_1 + G_1[A_1/G_1, 13, 8] = 80,000 + 10,000\left(\frac{0.6184}{0.21559}\right)$$

$$\Rightarrow 80,000 + 10,000(2.8683)$$

$$\Rightarrow 1,0,8,6\,8\,3.0458$$

$$P = A(P/A, i, n) \Rightarrow A\left[\frac{(1+i)^n - 1}{i.(1+i)^n}\right]$$

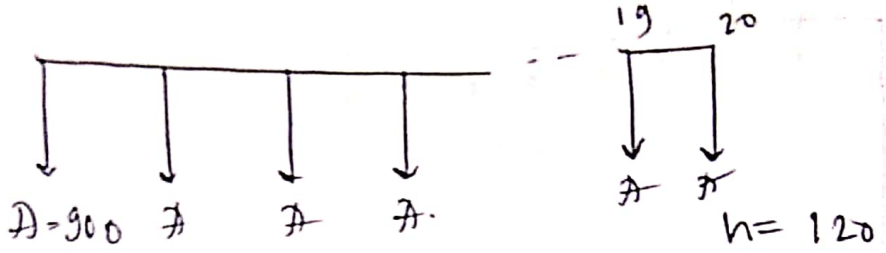
$$\Rightarrow A\left[\frac{1.65844}{0.345597}\right] \Rightarrow Rs\,521544.7497$$

$$PW = -Rs\,421554.1553$$

Q3. A person wanted to buy a motor bike, the upon down payment. The motor bike cost Rs 55,000 in the installment scheme. He had to pay an EMI of Rs 900 for 10 years at roi .14% compounded monthly. Suggest whether this scheme is economical or not using PW& comparison method.

Sol: $A = Rs\,900$ $i = 14\%$ $i = \frac{14}{12} = 1.166\%$

n = 10 years n = 120



Net PW = PW(revenue) − PW(cost)

= 0 − PW(cost)

$PW(cost) = A(F/A, i, n)$

$= 900\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]\left[\frac{(1+i)^n - 1}{\frac{i}{(1+i)^n}}\right]$

$\Rightarrow 900(23.6397) =$

$\Rightarrow 900(6.4.42537) = Rs.57,982.839$

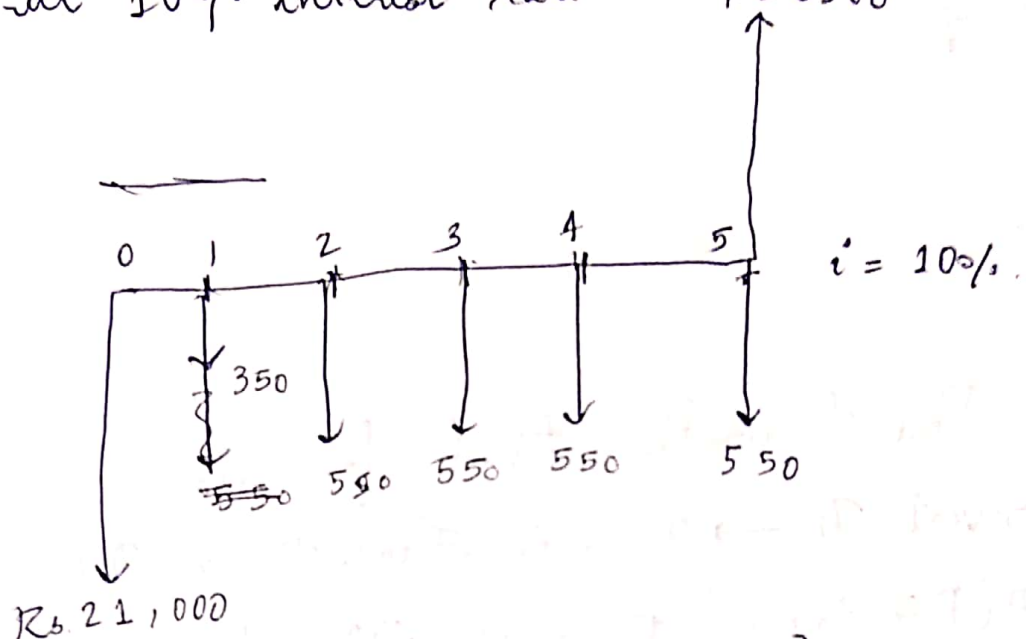
EMI option is not economical for the present person.
So downpayment method is economical.

Q4. A newly developed electric car will cost Rs 21,000 operating & maintainance cost are estimated to be Rs 350 for 1st year with an annual increase of Rs50 per year, Salvage value after 5 years is estimated to be Rs 6,500.

A new gasoline, run about will cost Rs 16,000 and will average 30 miles / gallon. Gasoline costs Rs 1.26 per gallon and is expected to increase 0.05 per year each of the next 4 years. Maintainance cost are estimated to Rs 300 / year and Salvage value is estimated to be

Rs 25000 for after 5 years. If the vehicles are expected to be driven for next 20,000 ℓ. miles/per year. Determine the which option has lower cost over 5 years by PW analysis at 10% interest rate.

Sol:



$$PW = -PW(\text{cost}) + PW(\text{revenue})$$

$$= -21,000 - \Big([350 + 50(A/G, i, n)](P/A, 10, 5) + F(P/F, 10, 5)\Big)$$

$$= -21,000 - \Big([350 + 50(1.81013)](3.791) + 6500(0.62092)\Big)$$

$$\Rightarrow \quad 18,633.955$$

28.02.20 Present worth method formula.

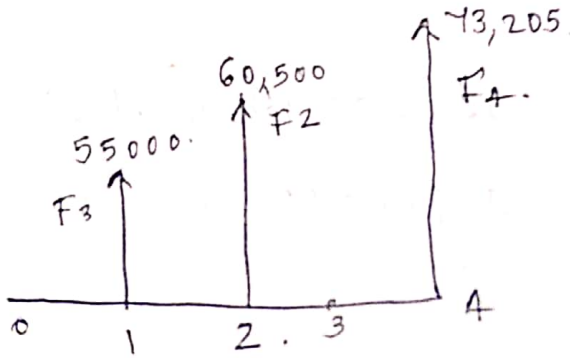
1. To convert A → P. (i.e, Find P given A).

2. $P = A(P/A, i, n)$ $\quad P = A\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$

2. To convert F → P. (To find p given F)

$$P = F\left(\frac{1}{(1+i)^n}\right).$$

Q3(a)



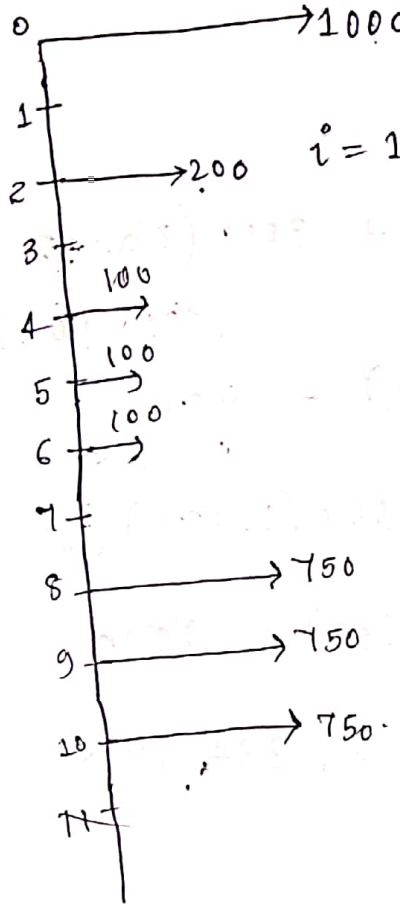
$$PW = F_1(P/F_1, 10, 1) + F_2(P/F_2, 10, 2) + 0$$
$$+ F_4(P/F_4, 10, 4) = ₹\ 1,49,991.$$

(i) Principles of equivalence.

1. Revenue / costs can be directly added only if they occur at some point in time.

2. When cash flows are converted to their equivalence from one period to another interest rate during each period must be taken into consideration.

Q1.



Present worth equivalence.

$PW = 1000 + 200(P/F,12,2) + 100(P/A,12,3)(P/F,12,4) + 750(P/A,12,3)(P/F,12,8)$

$\Rightarrow 1000 + 200(0.7972) + 100(2.402)(0.6355)(0.5066) + 750(2.402)(0.3220)$

$PW = Rs\ 1861.208$

$= 1247.419$

$PW = 1000 + 200(P/F,12,2) + 100(P/A,12,3)(P/F,12,6) + 750(P/A,12,3)(P/F,12,8) \Rightarrow$

$\Rightarrow 1000 + 200(0.7972) + 100(3.374)(0.5066) + 750(3.374)(0.3220) = Rs\ 2145.187.$

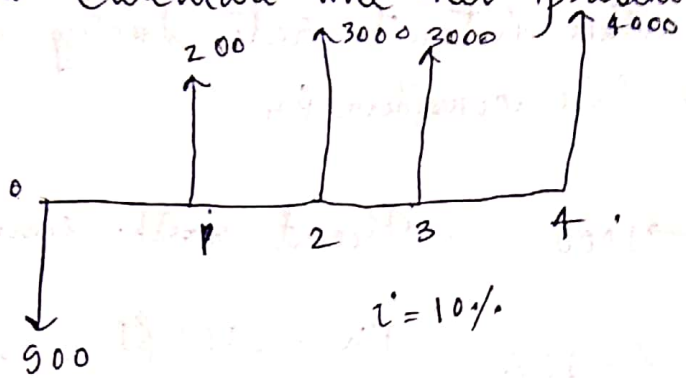
(OR)

$PW = 1000 + 200(P/F,12,12) + 100(P/A,12,3)(P/F,12,3) + 750(P/A,12,3)(P/F,12,7)$

$= 1000 + 200(0.7972) + 100(2.402)(0.7118)(0.6355) + 750(2.402)(0.4523)$

$= Rs\ 2145.2328.$

Q2. Calculate the net present worth.

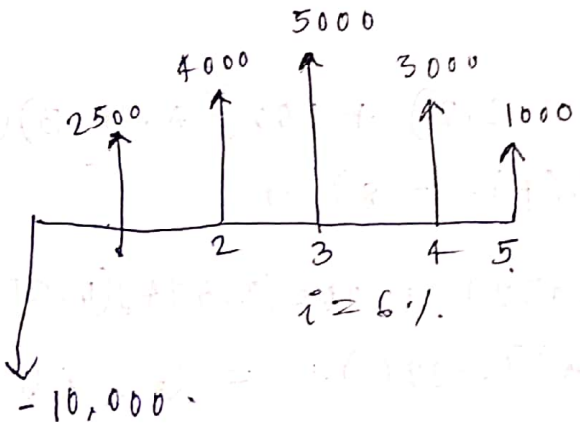


$$\text{Net PW} = 2000(P/F, 10, 1) + 3000(P/A, 10, 2)(P/F, 10, 1) + 4000(P/F, 10, 4) - 900$$

$$= 2000(0.9091) + 3000(1.736)(0.9091) + 4001(0.6830) - 9000.$$

$$= \text{Rs. } 6748.4728 \quad \text{Rs } 284.7928.$$

Q3.



$$\Rightarrow 2500(P/F, 6, 1) + 4000(P/F, 6, 2) + 5000(P/F, 6, 3) + 3000(P/F, 6, 4) + 1000(P/F, 6, 5)$$

$$\Rightarrow 2500(0.9091) + 4000$$

$$\Rightarrow 2500(0.9434) + 4000(0.89) + 5000(0.8396) + 3000(0.7921) + 1000(0.7473)$$

$$\Rightarrow 34 \text{ Rs } 3240.1$$

The project is accepted.

29.12.20 Assets with Unequal lives.

Comparison have to be made among alternatives which may have unequal lifes in such cases two prominent cases are described:

1. Common multiple method
2. Study period method.

1. Common multiple method:

Alternatives are co-terminated by selecting an analysis period that spans a common multiple of lives of involved assets.

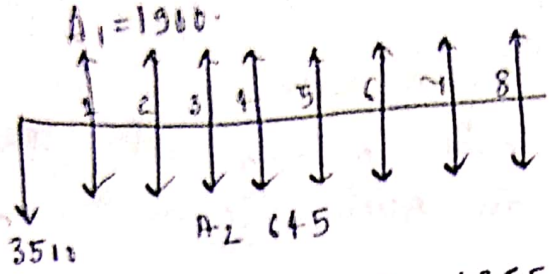
2. Study period method:

A more justifiable analysis based on a specified duration that corresponds to the length of a project or the period of time the assets are expected to be in service. An appropriate study reflects the replacement circumstance which could be:

(i) The shortest life of all competing alternatives.
(ii) The known duration of required services.
(iii) The time before a better replacement becomes available.

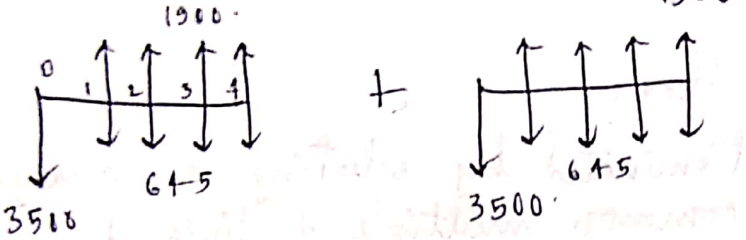
Q1. The following data represents for two feasible alternatives A and B for which revenues and cost are onon and which have different lives - If MARR 10%. Show which feasible alternative is more desirable by using present worth.

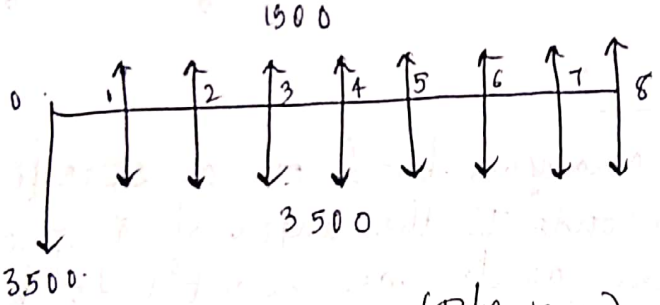
	A	B
Investment	₹3500	5000.
Annual Revenue	1900	2500
Annual cost	645	1383
useful life	4	8
Salvage value	0	0.



Net A = 1900 − 645 = 1255

Net PWA = 1255 (P/A, 10, 8).

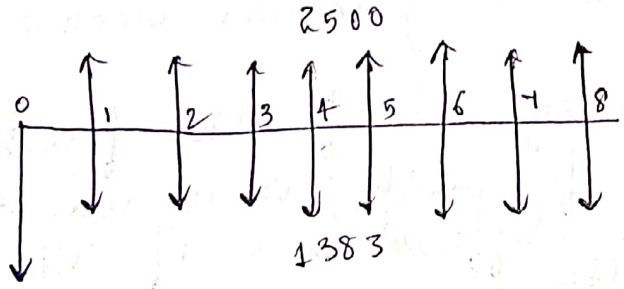




Net PW_A = −3500 − 3500 (P/F, 10, 4) + 1255 (P/A, 10, 8)

= −3500 − 3500 (0.6830) + 1255 (5.335)

Net PW_A = Rs 804.925



A_1 = 2500 − 1383 = 1117.

PW_B = −5000 + 1117 (P/A, 10, 8).

= −5000 + 959.195.

PW_B = Rs 959.195

∴ $NPW_B > NPW_A$

∴ B is more feasible.

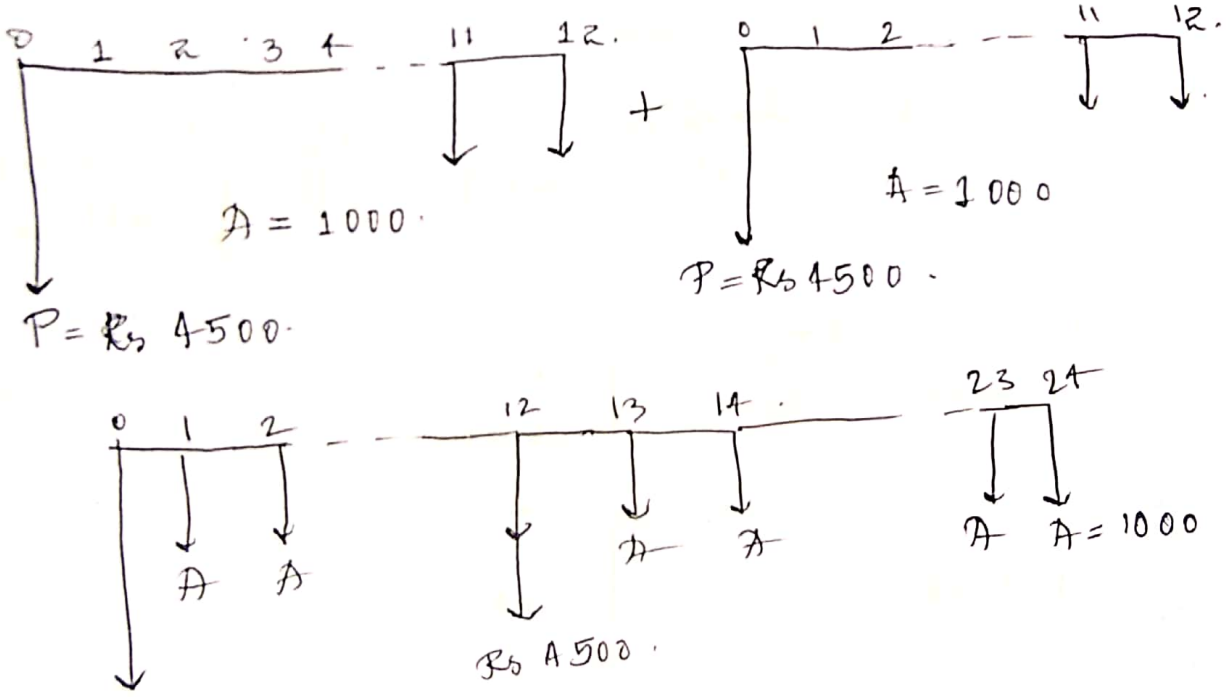
02.03.20

Q. Continued.

	Cottage 1	Cottage 2
First cost	₹ 4500	₹ 10,000
Estimate years	12 years	24 years
Annual maintainance cost.	₹ 1000	₹ 720

$i = 5\%$.

Common life of 12 and 24 years = 24 (LCM)



Net PW = PW(R) − PW(C)

$\Rightarrow -4500 - F(P/F, i, n) - A(P/A, i, n)$

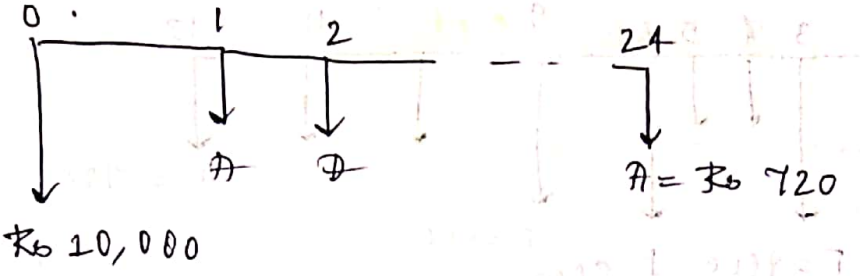
$\Rightarrow -4500 - 4500(P/F, 5, 12) - 1000(P/A, 5, 24)$

$\Rightarrow -4500 - 4500(0.5568) - 1000(13.799)$

~~$\Rightarrow$ Rs 20804.6~~

$\Rightarrow$ Rs − 20804.8

Cottage 2.



Net PW ⇒ $-10,000 - A(P/A, 5, 24)$

⇒ $-10,000 - 720\,(13.799)$

⇒ $-Rs\ 19935.28$.

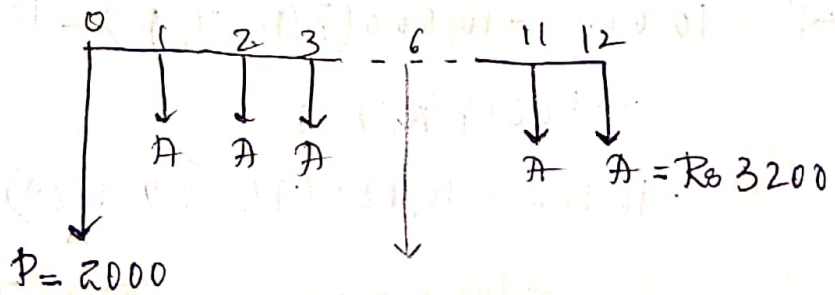
Cottage 2 is ~~to~~ choosen.

Q1. The following alternatives are available to accomplish an objective, compare the present worth of alternatives using rate of interest 7%.

	Plan A	Plan B	Plan C.
First cost	Rs 2000	8000	10,000.
Estimate year.	6	3	4
Annual. maintainance cost	Rs 3200	700	500.

Sol: common life = 12.

Plan A

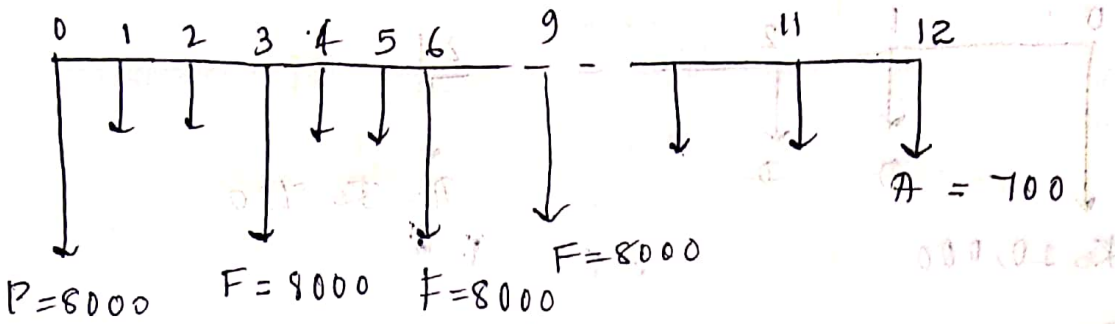


⇒ Net PW ⇒ $-2000 - 3200(P/A, 7\%, 12) - 2000\,(P/F, 7, 6)$

⇒ $-2000 - 3200\,(7.943) - 2000\,(0.6665)$

⇒ Rs 28750.2

Plan B



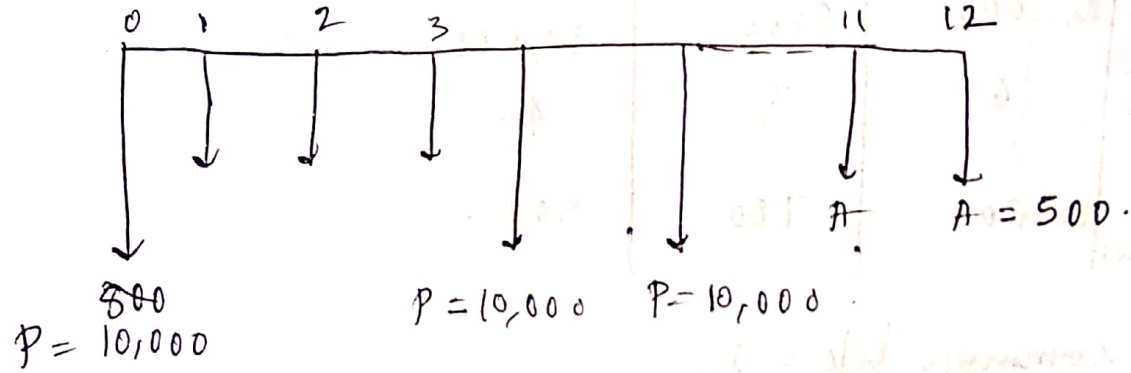
Net PW = $-8000 - 8000(P/F, 7, 3) - 8000(P/F, 7, 6) - 8000(P/F, 7, 9) - 700(P/A, 7, 12)$

$\Rightarrow -8000 - 8000(0.8163) - 8000(0.6663) - 8000(0.5439) - 700(7.943)$

$\Rightarrow$ - Rs 29772.1

Plan C

27,729



Net PW $\Rightarrow$ $-10,000 - 10,000(P/F, 7, 4) - 10,000(P/F, 7, 8) - 500(P/A, 7, 12)$

$\Rightarrow -10,000 - 10,000(0.7629) - 10k(0.5820) - 500(7.943)$

$\Rightarrow$ - Rs 27,420.5

Plan C is to choosen.

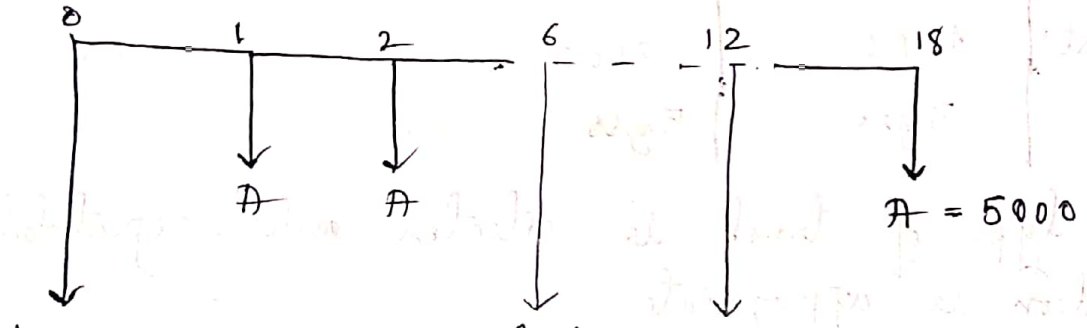
Ex.

	M/C A	M/C B
First cost	9000	16,000
Estimate years	6	9
Annual maintainance cost	5000	4000
Salvage value	0	4000

choose the Best alternative.

$i = 10\%$. Common years = 18 years

Sol: Machine A :

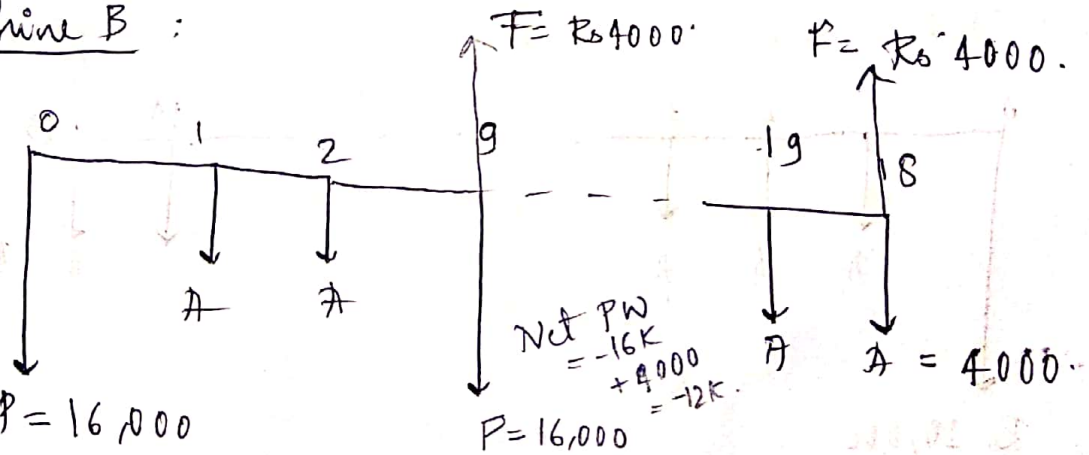


$\Rightarrow$ Net PW $\Rightarrow$ $-9000 - 9000(P/F, 10, 6) - 9000(P/F, 10, 12) - 5000(P/A, 10, 18)$

$\Rightarrow -9000 - 9000(0.5645) - 9000(0.3186) - 5000(8.201)$

$\rightarrow$ $-$ Rs 57952.9.

Machine B :



Net PW = $-16,000 - 4000(P/A, 10, 18) - 4000(P/F, 10, 9) - 4000(P/F, 10, 18) - 16(P/F, 10, 9)$

$\Rightarrow -16,000 + 4000(8.201) + 4000(0.4241) + 4000(0.1$

$-16,000\ (0.4241)$

$\Rightarrow$ -Rs 53,173.6.

Select M/c B.

Q3.

	Truck 1	Truck 2.	
Investment	10,000	15,000.	
Salvage value at the end of life	2000	3000.	$i = 20\%$.
Annual cost	4000	3000 ..	
usefule	3yrs	5yrs / 35592.36.	

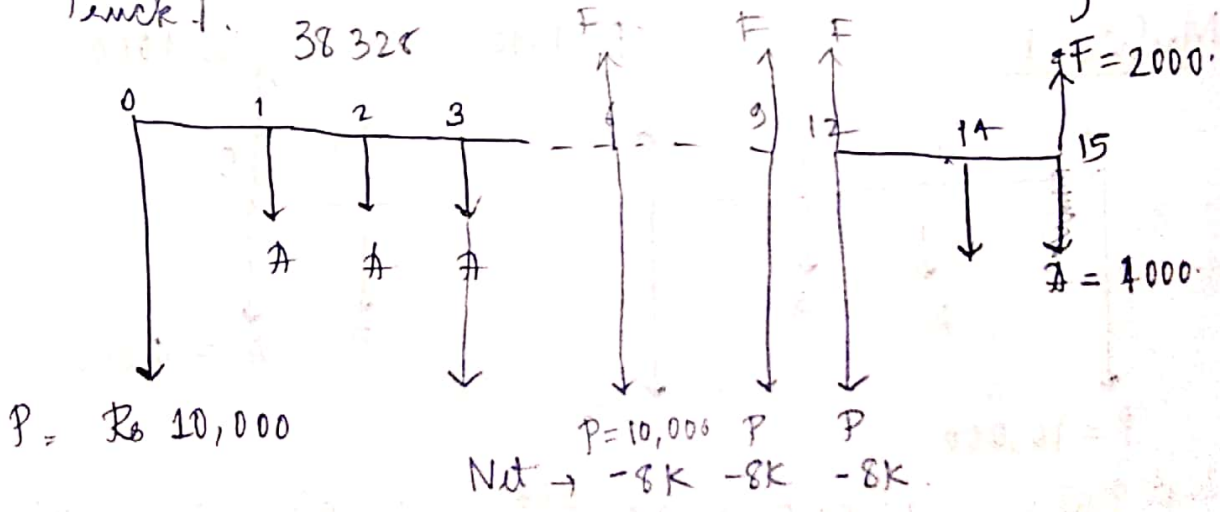
(a) Which type of truck is selected when repeatability assumption is appropriate.

(b) Which truck would you recomend if the selected analysis is 3years co-terminated assumption & estimated that Truck 2 will have salvage value of Rs 5600 at that type?

- common multiple method or repeatability assumption.
- co-terminated assumption.

Sol:

Truck 1. 38328



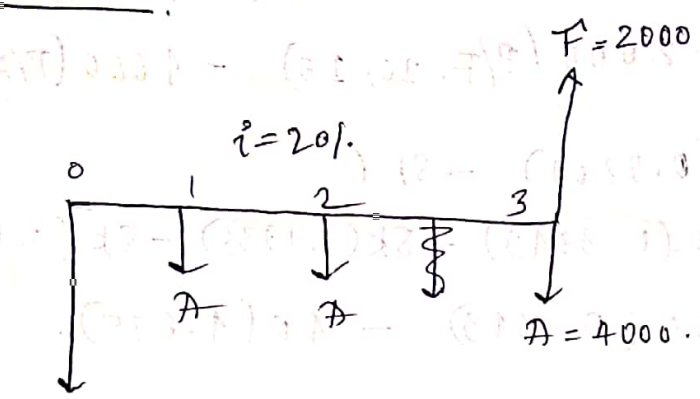
$$\Rightarrow -10{,}000 - 8000(P/F, 20, 6) - 8000(P/F, 20, 9) - 8000(P/F, 20, 12) + 2000(P/F, 20, 15) - 4000(P/A, 20, 15).$$

$$\Rightarrow -10K - 8K(0.0261) - 8K($$

$$-10K - 8K(0.3349) - 8K(0.1938) - 8K(0.1122) + 2000(0.0649) - 4K(4.675).$$

04.03.20.

(b) Truck-1.

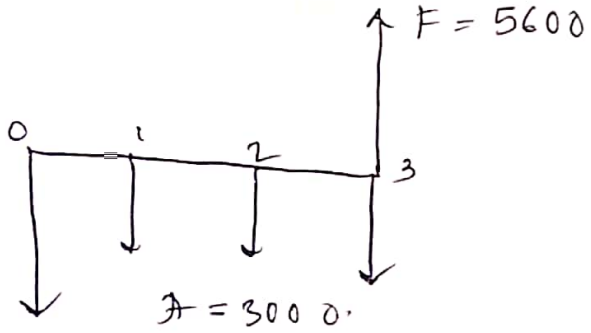


$$NPW_1 = -10,000 - 4000\,(P/A, 20, 3) + 2000\,(P/F, 20, 3)$$

$$\Rightarrow -10,000 - 4000\,(2.106) + 2000\,(0.5787)$$

$$= -17268.52$$

Truck 2.



$$NPW_2 = -15000 - 3000\,(P/A, 20, 3) + 5600\,(P/F, 20\%, 3)$$

$$\Rightarrow -15000 - 3000\,(2.106) + 5600\,(0.5787)$$

$$= -18,078.72$$

$\therefore NPW_1 > NPW_2$

Truck 1 is choosen.

Assets with infinite life.

There are many assets that we come across which may be considered to have infinite lives.

Eg: Bridges, Dam, Railway Tunnels etc.

These can provide extended service and can be assumed to last forever.

The present ~~was~~ special variation of the present worth method. Here the determination of the worth of all the revenues and cost of over an infinite length of time. This known as Capitalized worth method.

In such case long lived assets / Infinite assets capitalized cost is calculated. It is nothing but sum of initial investment P and present worth of all the operational and maintainance cost.

$$\text{Capitalized cost} = P + A(P/A, i, \overset{(n)}{\infty})$$

Capitalized cost is calculated in the same way in PW comparison ~~when~~ $n \to \infty$. where $n = \infty$.

This makes analysis to the so very sensitive to the rate of interest.

We know that,

$$(P/A, i, \underset{\infty}{n}) = \frac{(1+i)^n - 1}{i(1+i)^n}$$

$$\lim_{n \to \infty} (P/A, i, n) = \lim_{n \to \infty} \left[\frac{(1+i)^n - 1}{i(1+i)^n}\right] = \frac{1}{i}$$

$$(P/A, i, \infty) = \frac{1}{i}.$$

So, P is the ~~int~~ initial investment.

$$\text{Capitilized cost} = P + A(P/A, i, \infty)$$

$$= P + A\left(\frac{1}{i}\right) \rightarrow P + \frac{A}{i}$$

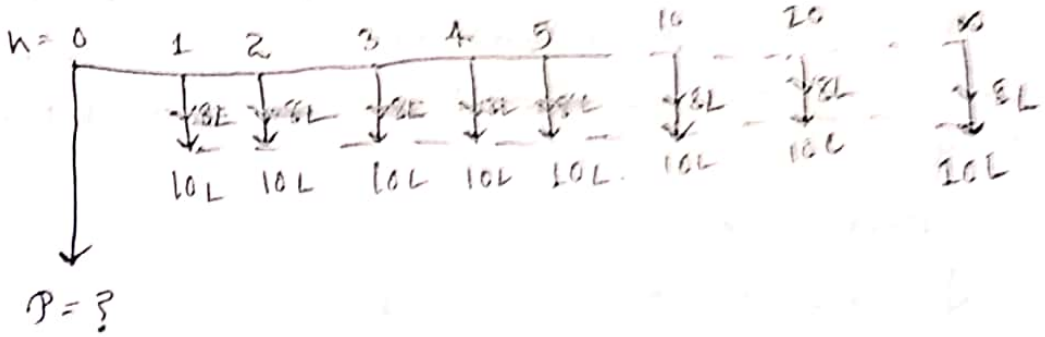
P + (Annual cost/disbursement)/i.

P = capitalized cost $\frac{A}{i}$

where A → Annual cost (disbursement)
i → rate of interest (forever).

Q1. Govt has sanctioned Rs. 5,00,00,000 to a community trust to a construct of library block. Annual maintainance is estimated to be Rs. 10,00,000. In addition Rs. 8,00,000 every 10 years will be required for cleaning and major repairs. If the budget granted has to take care of perpetual maintainance. How much amount can be used for initial construction. i=3%.

Sol:



Capitalized cost = $P + \frac{A}{i}$

P = capitalized − A/i

= 5,00,00,000 − A/i

⇒ $5,00,00,000 - \left(\frac{10,00,000 + AF(A,i,10)}{i}\right)$

$$\Rightarrow 5,00,00,000 - (10,00,000 + 8,00,000(0.0658))/0.09)$$

$$\rightarrow 5,00,00,000 - (T1696000)$$

$$= Rs\ 38304000$$

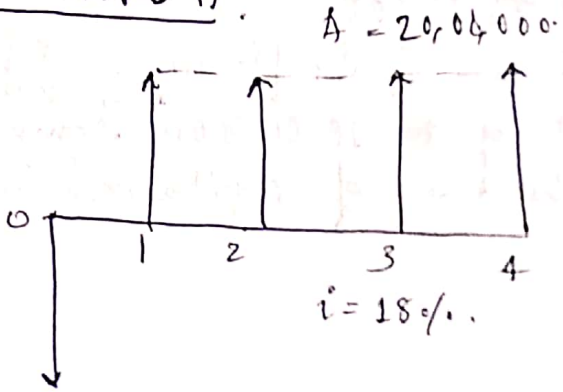
Q2. A proposed mill has two alternatives,
The ditch & funnel system will cost 5,00,000 with annual maintaince cost of Rs 2000
The flume system will cost Rs 2,00,000 and early maintainance cost of Rs 12000.
In addition the wooden portion of the flume will have to be replaced at a cost of Rs 10,00,000 every 10 years. Compare the alternative at on the basis of capitalized cost of $i = 6\%$

09.03.20 Future worth method.

Consider the following alternatives at i = 18% select the best alternative based on future worth comparis

Alternative	End of year. 0	1	2	3	4
A (Rs)	-50,00,000	20,00,000	20,00,000	20,00,000	20,00,000
B (Rs)	-45,00,000	18,00,000	18,00,000	18,00,000	18,00,000

Alternative - A



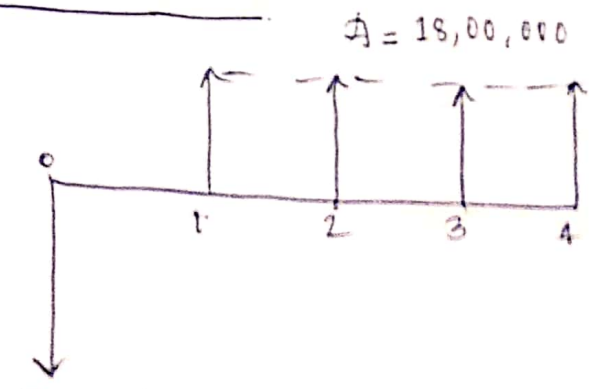
P = -50,00,000.

Net FW_A = A(F/A, 18, 4) - P(F/P, 18, 4)

⇒ 2,00,000 (5.215) - ₹ 50,00,000 (1.939)

⇒ Rs -₹ 735000.

Alternative - B



P = -45,00,000

$$\text{Net } FW_A = A(F/A, 18, 4) - P(F/P, 18, 4)$$

$$\Rightarrow 18,00,000\,(5.215) - 45,00,000\,(1.939)$$

$$\Rightarrow \text{Rs } 661500.$$

$$\text{Net } FW_A > \text{Net } FW_B$$

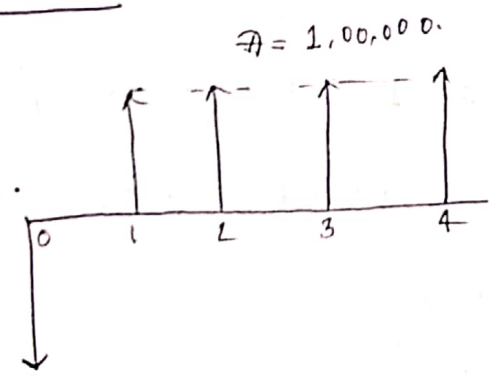
$\Rightarrow$ choose Alternative A.

Q2.

Alternative	End of year 0	1	2	3	4
X (Rs)	-2,50,000	1,00,000	1,00,000	1,00,000	1,00,000
Y (Rs)	-3,00,800	1,40,000	1,10,000	90,000	1,00,000

$$i = 9.75\%$$

Alternative - X



$$\text{Net } FW_X = A(F/A, 9.75\%, 4) - P(F/P, 9.75\%, 4).$$

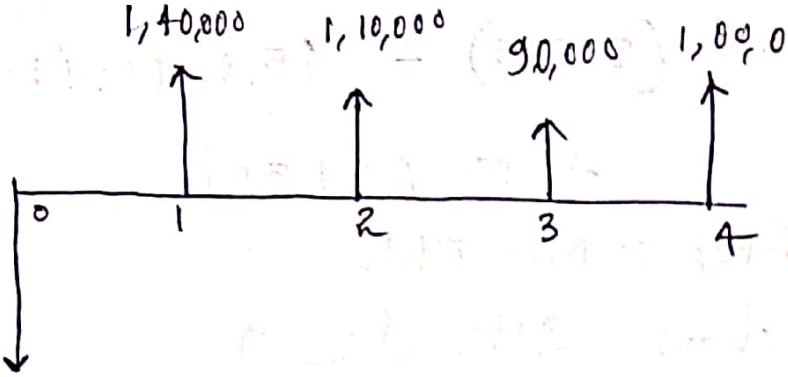
$$\Rightarrow A\left(\frac{(1+i)^n - 1}{i}\right) - P\left(1+i\right)^n.$$

$$\Rightarrow 1,00,000\left(\frac{(1+0.0975)^4 - 1}{0.0975}\right) - 2,50,000\,(1.0975)^4.$$

$$\Rightarrow 462395.1859 - 362708.826$$

$$\Rightarrow \text{Rs } 99686.359.$$

Alternative - Y.



$P = Rs\ 3,00,800.$

$$\text{Net } FW_y = P_1(F_1/P_1, 9.75\%, 4) + P_2(F_2/P_2, 9.75\%, 3) + P_3(F_3/P_3, 9.75\%, 2) + P_4(F_4/P_4, 9.75\%, 1) - 3,00,800(F/P, 9.75, 4)$$

$$\Rightarrow (1,40,000(1+0.0975)^4 + 1,10,000(1.0975)^3 + 90,000(1.0975)^4 + 1,00,000(1.0975)^4) \times$$

$$\Rightarrow 1,40,000(1+0.0975)^3 + 1,10,000(1.0975)^2 + 90,000(1.0975)^1 + 1,00,000 - 3,00,800(1.0975)^4$$

$$= Rs\ 81,093.$$

Choose Alternative X.

Q3. A person wants to buy a car he has two models in his mind petrol & diesel. The comparative data are as follows. If the person considers 10.5% has good value of money suggest him the better option.

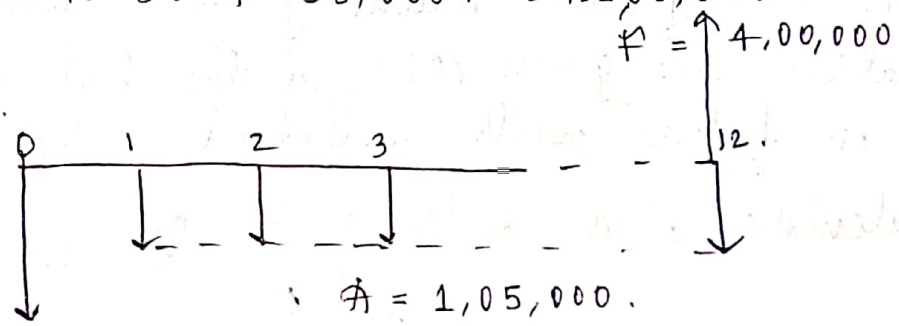
Vehicle cost

	Petrol car	Diesel car.
Vehicle cost	8,50,000	10,00,000.
Fuel cost/litre	58	36.
Mileage in Km/litre	8 Km	11 Km.
Distance travelled/year	12,000	12,000.
Annual maintainance cost ₹.	18,000	36,000.
Expected life.	12	12.
Salvage value	4,00,000	4,00,000.

Sol: $P = 8,50,000$ $n = 12$, Salvage $F = 4,00,000$.

$$A = \frac{\text{Distance travelled}}{\text{mileage/litre}} \times \text{Fuel cost} + \text{Annual maintainance.}$$

$$= \frac{12,000}{8} \times 58 + 18,000. = \text{Rs}1,05,000$$



~~Net FW = FW revenue — FW cost~~

$$FW_{revenue} = 4,00,000 - P(F/P, 10.5\%, 12) - A(F/A, 10.5\%, 12).$$

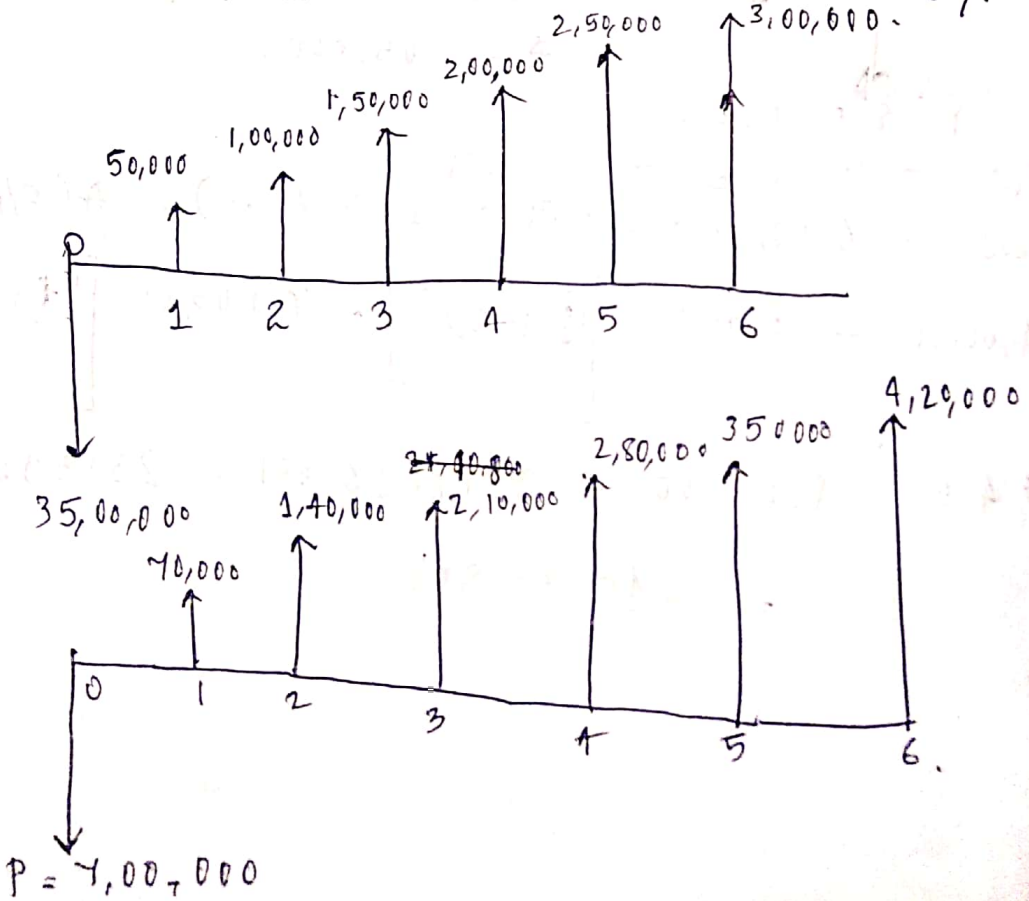
$$\Rightarrow 4,00,000 - 8,50,000\left[(1+i)^n\right] - A\,1,05,000\left[\frac{[i+i]^n - 1}{i}\right]$$

$$\Rightarrow 4,00,000 - 2816866.481 - 2313960.566.$$

$$\Rightarrow -\text{Rs}47,30,858$$

Q4. The CFD of two mutually ~~et~~ exclusive alternatives are given. (a) Select the best alternative based on future worth method at $i = 8\%$.

(b) Recalculate of (a) with $i = 9\%$ and $i = 20\%$.



First CFD : $P = 35,00,000$. $A_1 = 50,000$. $G_1 = 50,000$.

$i = 8\%$ $n = 6$.

$$FW_1 = \{A_1 + G_1[A/G, 8\%, 6]\}\{F/A, 8\%, 6\} - P(F/P, 8\%, 6).$$

$$\Rightarrow 50,000 + 50,000[2.276]\{7.336\} - 35,00,000(1.587)$$

$$\Rightarrow \text{Rs } -43,52,863.2.$$

$$FW_2 = \{A_1 + G_1[A/G, 8\%, n]][F/A, 8\%, 6] - P(F/P, 8\%, 6)$$

$$\Rightarrow \{70,000 + 70,000[A/G, 8\%, 6][F/A, 8, 6]\} - 7,00,000[F/P, 8, 6]$$

(b) $i = 9\%$: $\Rightarrow$ Rs 11,427,681.52.

(b) $i = 9\%$: $P = 35,00,000$ $A_1 = 50,000$ $G_1 = 50,000$.

$i = 9\%$ $n = 6$

$$FW_1 = \{A_1 + G_1[A/G, 9, 6][F/A, 9, 6]\} - P[F/P, 9, 6]$$

$$= \{50,000 + 50,000[2.250][7.523] - 35,00,000(1.677)$$

$$= -49,73,162.5$$

$P = 7,00,000$ $A_1 = 70,000$ $G_1 = 70,000$. $i = 9\%$. $n = 6$.

$$FW_2 = \{70,000 + 70,000[2.250][7.523]\} - 7,00,000(1.677)$$

$$= 80,972.5$$

$i = 20\%$: $FW_1 = \{50,000 + 50,000[1.979][9.930]\} - 35,00,000(2.986)$

$$= \text{Rs } -1,83,76,426.5.$$

$$FW_2 = \{70,000 + 70,000[1.979][9.930]\} - 7,00,000(2.986)$$

$$= -64,597.1$$

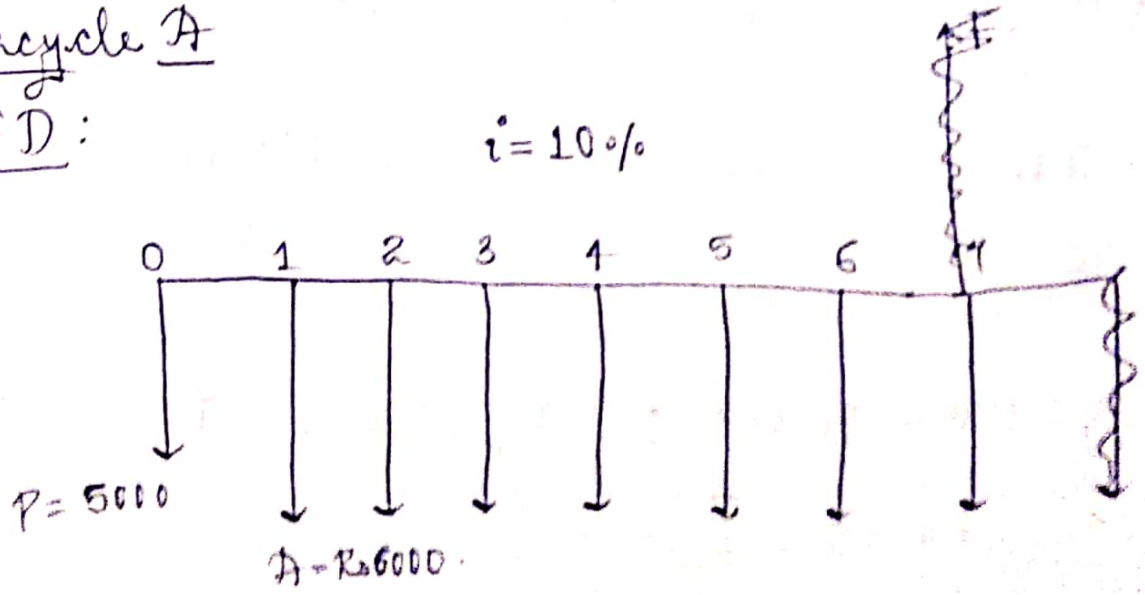
11.03.20.

Q5. The details of Motorcycle of brand A and B are given. Motorcycle-A - Down payment of Rs 5000 and Rs 6000 at the end of each years for 7 years. Motorcycle B- Down payment of Rs 15000, no payment for the next three years, from the end of 4th year annual payment of Rs 12,000 for the next 4 years. Suggest Motorcycle based on future worth comparison (Default i = 10%)

Sol: Since interest i is not given, consider i = 10%

Motorcycle A

CFD:

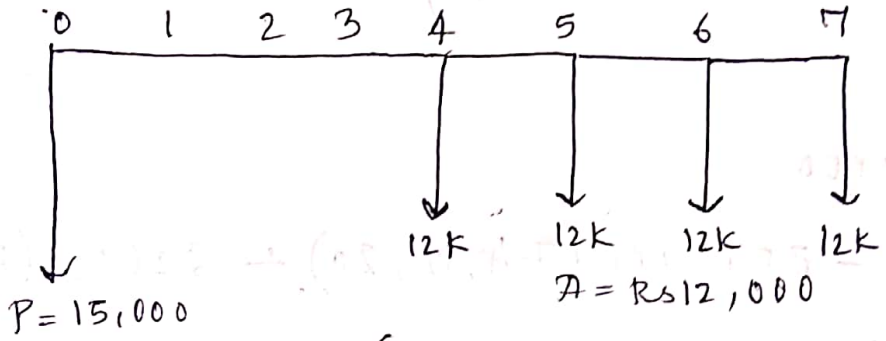


Net FW$_A$ = $-(5000(F/P,10,7) + 6000(F/A,10,7)$

$\Rightarrow -(5000(1.949) + 6000(9.487))$

$\Rightarrow -66667/-$

Motorcycle B : CFD



Net FW$_B$ = $-((15,000(F/P,10,7)) + (12,000(F/A,10,7))$

$\Rightarrow -15,000(1.949) + 12,000(9.4.641)]$

$\Rightarrow$ Rs. $-84,927/-$

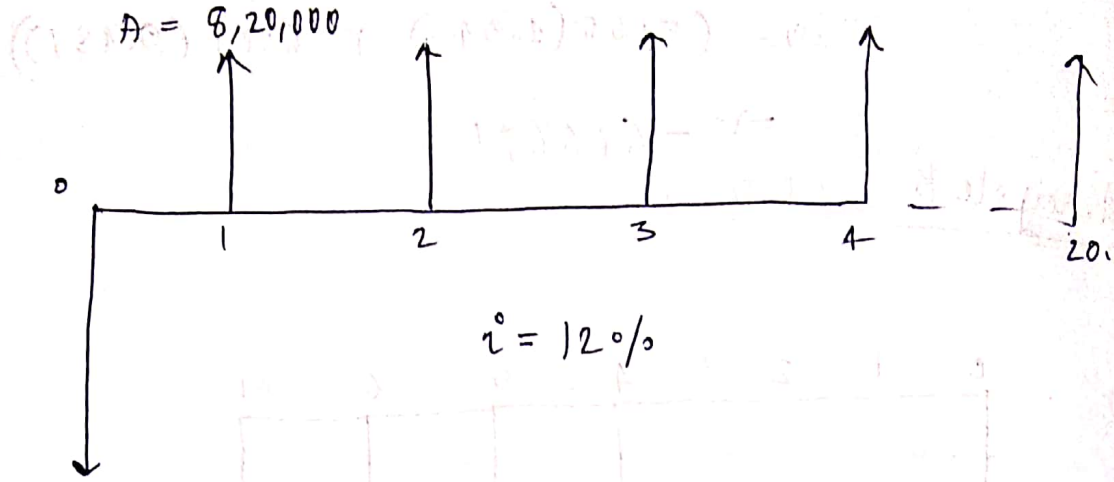
Since Future worth of A is greater than B we select motorcycle A as best choice.

Qc. i=12%	Particulars/ Items	Building gas station	Building family restaurant
1	FC	25,00,000.	36,00,000.
2	Tax	80,000.	1,50,000.
3*	A; I/C	9,00,000.	10,80,000.
4*	B.L	20 years	20 years
5*	S.V	0	0.

3* - Annual Income 4* Building life

5* - Salvage value.

Building gas station:

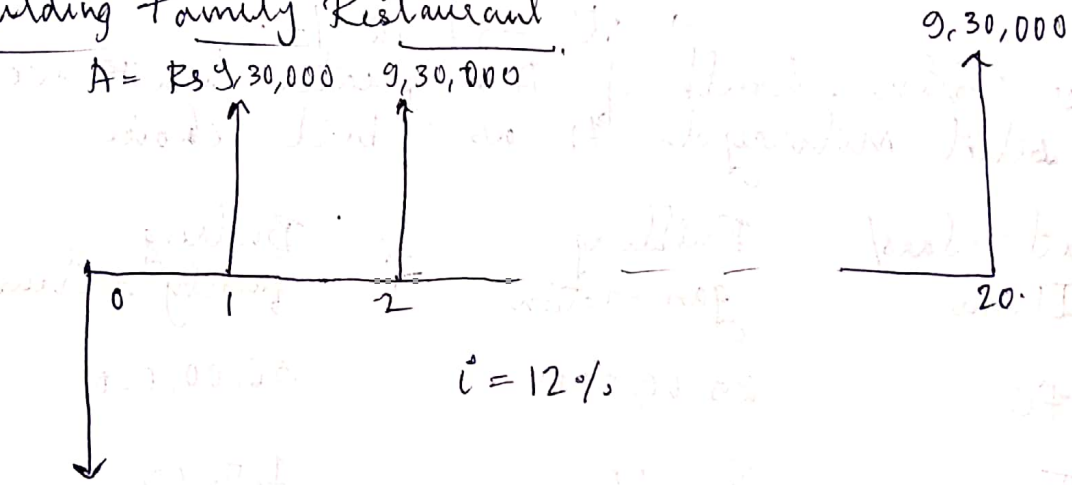


$$\text{Net FW} = -25,00,000\,(F/P, 12, 20) + 8,20,000\,(F/A, 12, 20)$$

$$\Rightarrow -25,00,000\,(9.646) + 8,20,000\,(72.052)$$

$$\Rightarrow \text{Rs } 3,49,67,640$$

Building Family Restaurant



$$\text{Net FW} = -36,00,000\,(9.646) + 9,30,000\,(72.052)$$

$$\Rightarrow \text{Rs } 3,22,82,760.$$

Since Future worth of Building a gas station is greater than Building a Family restaurant, Building a gast station is better.

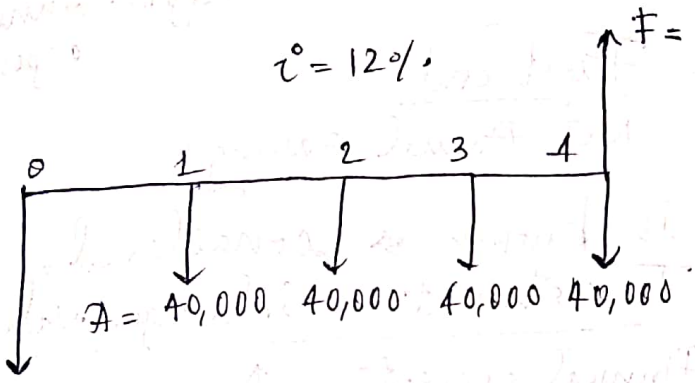
Q1. The details of Machine A & B are given as follows Consider the life of both the machines is 4 years.

Machine A - IC: 4 lakhs, S.V - Rs 2,00,000 at the end of life, Annual maintainance cost - Rs 40,000

Machine B - IC - 8,00,000, S.V - Rs 5,50,000 at the end of life, Annual maintainance - 0. i = 12%.

Sol: Machine A : IC = Rs 4,00,000 S.V = 2,00,000.

A. = Rs 40,000



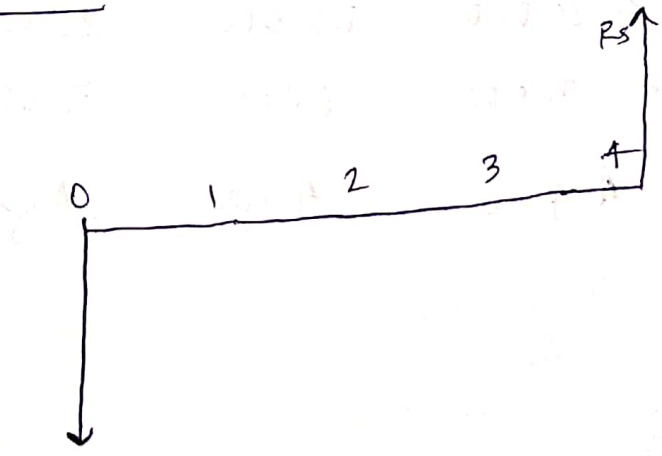
P = Rs 4,00,000.

Net FW$_A$ = − 4,00,000 (F/P, 12, 4) − 40,000 (F/A, 12, 4) + 2,00,000.

= −4,00,000 (1.574) − 40,000 (4.779) + 2,00,000.

= − 6,20,760/-

Machine B : IC - 8,00,000 SV = 5,50,000.



Net $FW_B = -8,00,000\ (1.574) + 5,50,000$

$= -709,200/-$

Machine A is better.

PAY BACK COMPARISON

A simple formula to find an approximate pay back period, Pay back period = Required Investment / Annual reciept − Annual expenditure

$$= \frac{P}{R-C} = \frac{\text{First cost}}{\text{Net Annual savings.}}$$

If salvage value is known or considered,

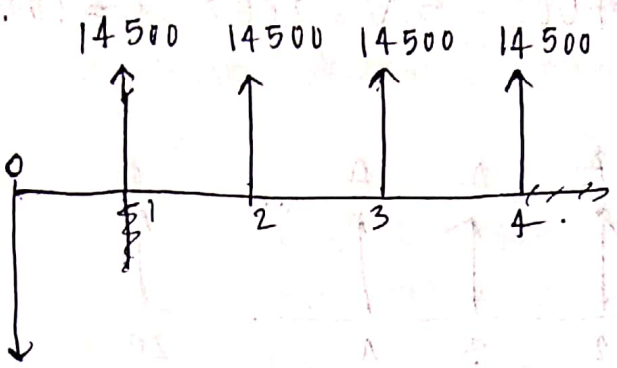
Payback period = Investment − Salvage value / Annual reciepts − Annual expenditure

$= P-S/R-C$

Q1. Find out which machine has fastest payback period.

Particulars	M/C A	M/C B	M/C C
1. Inibial investments	Rs 30,000	38,000	42,000
2. Annual reciept.	Rs 20,000	23,500	26,000
3. Annual expenditure	Rs 5,500	6500	7,000
4. Economic life	4 years	4 yrs	4 yrs.

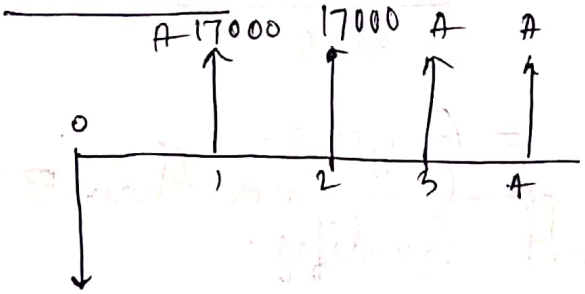
Sol: Machine A.



P = Rs 30,000.

$$PB\ period = \frac{30,000}{14,500} = 2.068 \text{ years.}$$

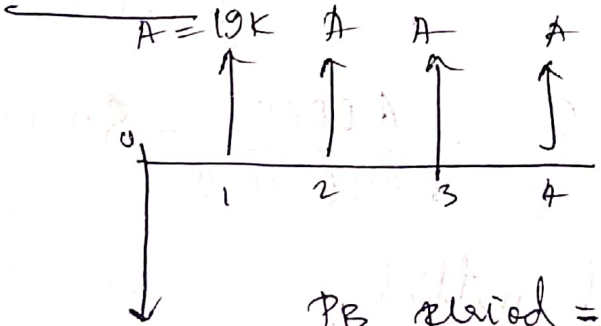
Machine B



P = 38,000

$$PB\ period = \frac{38,000}{17,000} = 2.23 \text{ years.}$$

Machine C



P = 42,000

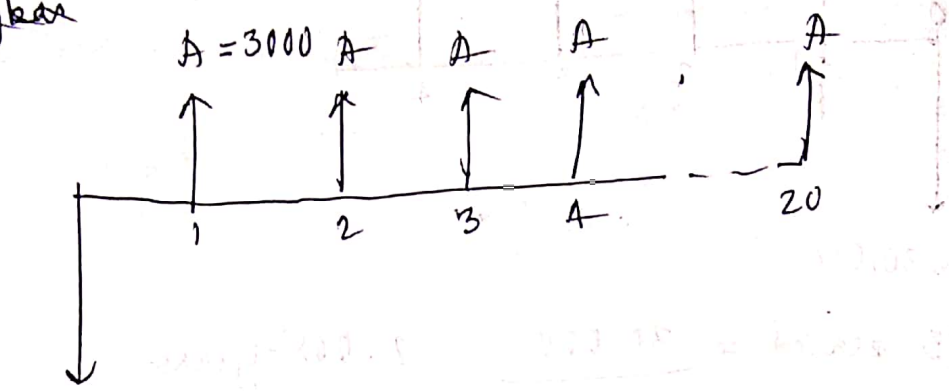
$$PB\ period = \frac{42,000}{19000} = 2.21 \text{ years.}$$

Machine A has fastest payback.

Q2. A bank is considering the purchase of a storage unit costing Rs 20,000, and will last for 20 years and will have a guaranteed salvage value of Rs 2000. It will generate savings of Rs 4000/per but Rs 1000 must be paid in taxes. If bank insists on a 5 year payback, does this investment Qualify?

Sol: $P = 20,000$ $R = 4000$ $S.V = 2000$ $C = 1000$.

Payback



P = Rs 20,000

$$\text{Payback period} = \frac{20,000 - 2000}{3000}$$

$$= 6 \text{ years}.$$

Since this PB is more than 5 years this investment does not Qualify.

Q3. $P = 40,000$ $S = 0$ Annual reciept = 8000
Annual disbursement = 3000 Calculate pay back period.

$$PB \text{ period} = \frac{P - S}{AR - C} = \frac{40000}{8000 - 3000} = 8 \text{ years}.$$

Advantages of Pay back method.

1. Simple and Quick to calculate
2. Easy to understand
3. A measure of time required to return on original investment.

Disadvantages.

1. It does not consider the economic life of investment

2. Does not consider the total return on investment
3. Single payback doesn't consider the time value of money.

MODULE-3