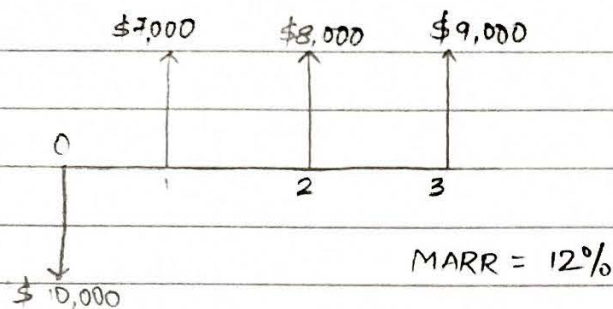


Q1.

a.

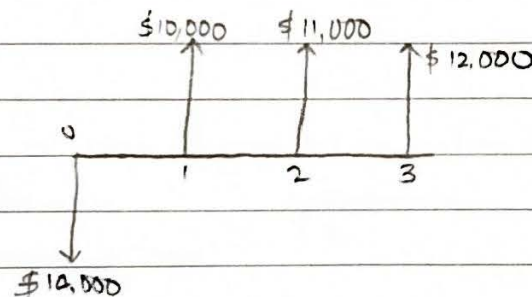
(i)



$$\begin{aligned} NPV &= -P + F_1(P/F, i, N) + F_2(P/F, i, N) + F_3(P/F, i, N) \\ &= -10,000 + 7,000(P/F, 12, 1) + 8,000(P/F, 12, 2) + 9,000(P/F, 12, 3) \\ &= -10,000 + 7,000(0.8929) + 8,000(0.7972) + 9,000(0.7118) \end{aligned}$$

$$NPV_x = \$9,034.1$$

(ii)



$$\begin{aligned} NPV_y &= -P + F_1(P/F, i, N) + F_2(P/F, i, N) + F_3(P/F, i, N) \\ &= -14,000 + 10,000(P/F, 12, 1) + 11,000(P/F, 12, 2) + 12,000(P/F, 12, 3) \\ &= -14,000 + 10,000(0.8929) + 11,000(0.7972) + 12,000(0.7118) \end{aligned}$$

$$NPV_y = \$12,239.8$$

b.

IRR

(i) - (ii)

Guess 1 = 55%

$$\begin{aligned} PW_x &= -P + F_1(P/F, i, N) + F_2(P/F, i, N) + F_3(P/F, i, N) \\ PW_x &= -10,000 + 7,000(P/F, 55, 1) + 8,000(P/F, 55, 2) + 9,000(P/F, 55, 3) \\ &= -10,000 + 7,000(0.6452) + 8,000(0.4162) + 9,000(0.2685) \end{aligned}$$

$$PW_x = 262.5$$

(i) - (i) Guess 2 - 60%

$$PW_x = -10,000 + 7000(P/F, 60, 1) + 8000(P/F, 60, 2) + 9000(P/F, 60, 3) \\ = -10,000 + 7000(0.6250) + 8000(0.3906) + 9000(0.2441)$$

$$PW_x = (-303.3)$$

$$y = y_1 + \frac{(x - x_1)(y_2 - y_1)}{(x_2 - x_1)} \\ = 55 + \frac{(-262.5)(5)}{-565.8}$$

$$y = 57.3197\%$$

(i) - (ii) Guess 1 - 55%

$$PW_y = -14,000 + 10,000(P/F, 55, 1) + 11,000(P/F, 55, 2) + 12,000(P/F, 55, 3) \\ = -14,000 + 10,000(0.6452) + 11,000(0.4162) + 12,000(0.2685)$$

$$PW_y = 252.2$$

Guess 2 - 60%

$$PW_y = -14,000 + 10,000(P/F, 60, 1) + 11,000(P/F, 60, 2) + 12,000(P/F, 60, 3) \\ = -14,000 + 10,000(0.6250) + 11,000(0.3906) + 12,000(0.2441) \\ = -524.2$$

$$y = 55 + \frac{(-252.2)(5)}{-776.4}$$

$$y = 56.6241\%$$

Q 1.

b (ii) → On Excel.

c	N	Project X	Project Y	Y-X
	0	-10,000	-14,000	-4,000
	1	7,000	10,000	3,000
	2	8,000	11,000	3,000
	3	9,000	12,000	3,000

$$\begin{aligned}
 PW_{Y-X} &= -P + A(P/A, I, N) & I \rightarrow \text{Guess } 1 = 50\% \\
 &= -4,000 + 3,000(P/A, 50, 3) \\
 &= -4,000 + 3,000(1.4074)
 \end{aligned}$$

$$PW_{Y-X} = 222.2$$

$$\begin{aligned}
 PW_{Y-X} &= -4,000 + 3,000(P/A, 55, 3) \\
 &= -4,000 + 3,000(1.3299)
 \end{aligned}$$

$$PW_{Y-X} = (-10.3)$$

$$\begin{aligned}
 y &= y_1 + \frac{(x-x_1)(y_2-y_1)}{(x_2-x_1)} \\
 &= 50 + \frac{(-222.2)(5)}{-232.5}
 \end{aligned}$$

$$\underline{IRR = 54.7785}$$

$$IRR > MARR$$

∴ Select Project Y

Q2.

a. (i) Program 1.

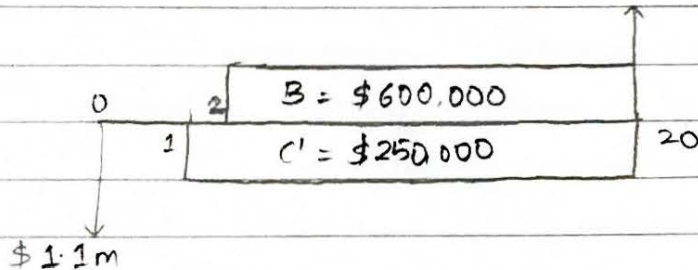
Initial cost (I) = \$ 1,100,000

O & M (C') = \$ 250,000

Savings & Benefits (B) = \$ 600,000

Period (N) = 20

Interest Rate (i) = 14%



$$\begin{aligned}PW_B &= [A(P/A, 14\%, 20)] - [A(P/A, 14\%, 1)] \\&= [600,000(6.6231)] - [600,000(0.8772)] \\&= \$ 3,447,520\end{aligned}$$

$$\begin{aligned}PW_{C'} &= A(P/A, 14\%, 20) \\&= 250,000(6.6231) \\&= \$ 1,655,775\end{aligned}$$

$$\begin{aligned}PW_{BCR(i)} &= B/C \\&= \frac{3,447,520}{1,655,775}\end{aligned}$$

$$BCR = 1.25$$

$$PW_I = \$ 1,100,000$$

$$\begin{aligned}PW_C &= PW_I + PW_{C'} \\&= 1,100,000 + 1,655,775 \\&= \$ 2,755,775\end{aligned}$$

Conclusion: Good Investment,
Accept

Q2

a. (ii) Program 2.

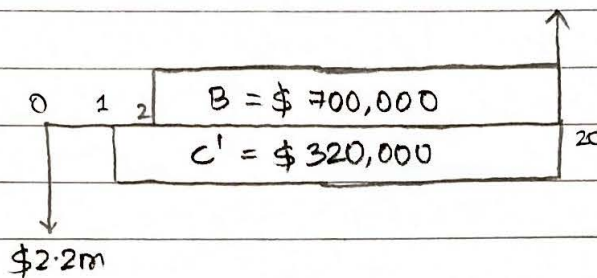
$$\text{Initial cost (I)} = \$2,200,000$$

$$\text{O \& M (C')} = \$320,000$$

$$\text{Savings \& Benefits (B)} = \$700,000$$

$$\text{Period (N)} = 20 \text{ years}$$

$$\text{Interest Period (i)} = 14\%$$



$$\begin{aligned} PW_B &= [700000 (6.6231)] - [700000 (0.8772)] \\ &= \$4,022,130 \end{aligned}$$

$$\begin{aligned} PW_{C'} &= 320000 (6.6231) \\ &= \$2,119,392 \end{aligned}$$

$$PW_I = \$2,200,000$$

$$\begin{aligned} PW_C &= PW_I + PW_{C'} \\ &= \$4,319,392 \end{aligned}$$

$$PW_{BCR(ii)} = B/C$$

$$BCR = 0.93$$

conclusion : Bad Investment, Reject.

Q.2

b.

	Project X	Project Y
B	\$ 3,447,520	\$ 4,022,130
I	\$ 1,100,000	\$ 2,200,000
C	\$ 2,755,775	\$ 4,319,392

$$\begin{aligned} BCR(14\%)_{Y-X} &= \frac{B_Y - B_X}{C_Y - C_X} \\ &= \frac{4,022,130 - 3,447,520}{4,319,392 - 2,755,775} \\ &= 0.37 \end{aligned}$$

$$BCR < 1$$

select project X.