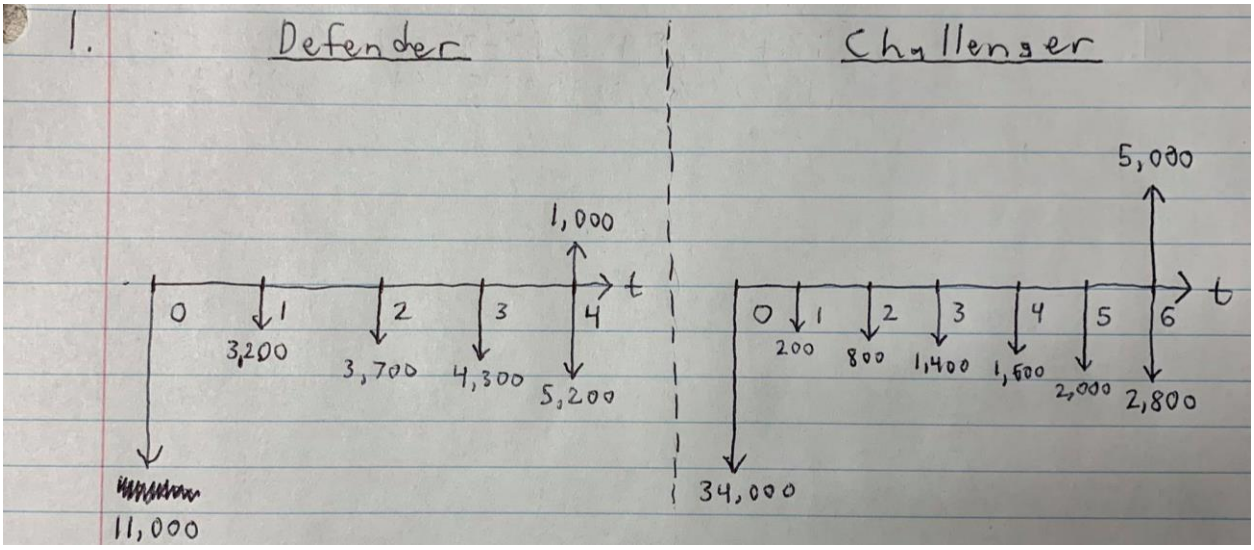
1 Question 1

1.1 a.

Cash flow diagrams for this question are shown below. They depict their last year of operation:



The EAC of capital cost and EAC of operating cost for both defender and challenger over the years is summarized in the table below:

	Defender			Challenger		
Year	EAC (capital)	EAC (op. cost)	EAC (total)	EAC (capital)	EAC (op. cost)	EAC (total)
0	0.00	0.00	0.00	0.00	0.00	0.00
1	6150.00	3200.00	9350.00	8100.00	200.00	8300.00
2	4905.81	3432.56	8338.37	8820.93	479.07	9300.00
3	4241.79	3682.36	7924.15	8555.72	744.28	9300.00
4	3652.65	3986.29	7638.95	7903.71	915.65	8819.36
5				7769.68	1076.47	8846.15
6				8412.87	1273.36	9686.23

The values were determined with Excel. The following is a sample calculation for Year 2 defender:

$$EAC_{capital,2} = (11000 - 4000)\left(\frac{0.15(1+0.15)^2}{(1+0.15)^2 - 1}\right) + (4000)(0.15) = 4905.81$$

$$EAC_{op.cost,2} = 3200\frac{1}{(1+0.15)^1}\frac{0.15(1+0.15)^2}{(1+0.15)^2-1} + 3700\frac{1}{(1+0.15)^2}\frac{0.15(1+0.15)^2}{(1+0.15)^2-1} = 3432.56$$

Curves of the EAC of capital costs and EAC of operating costs, including EAC of total costs, are shown below:

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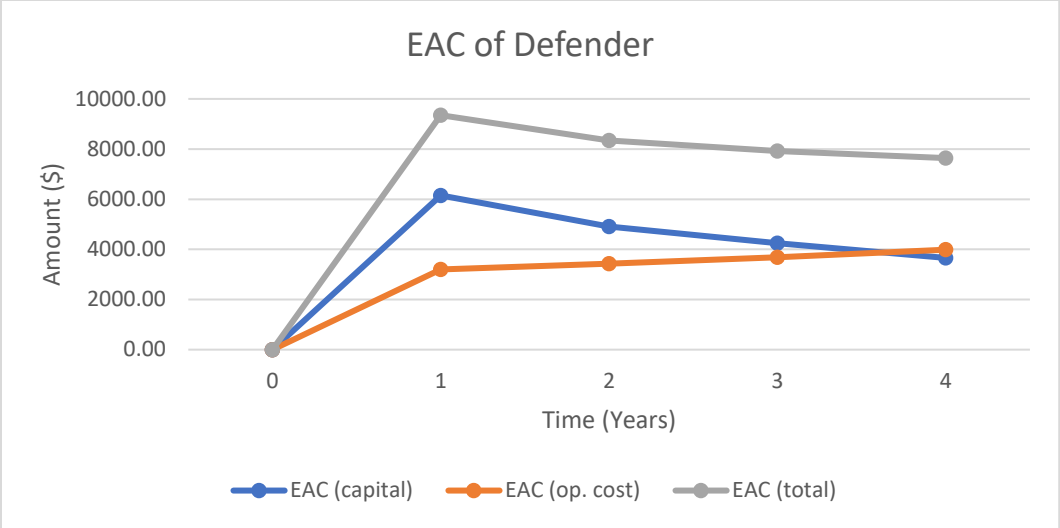

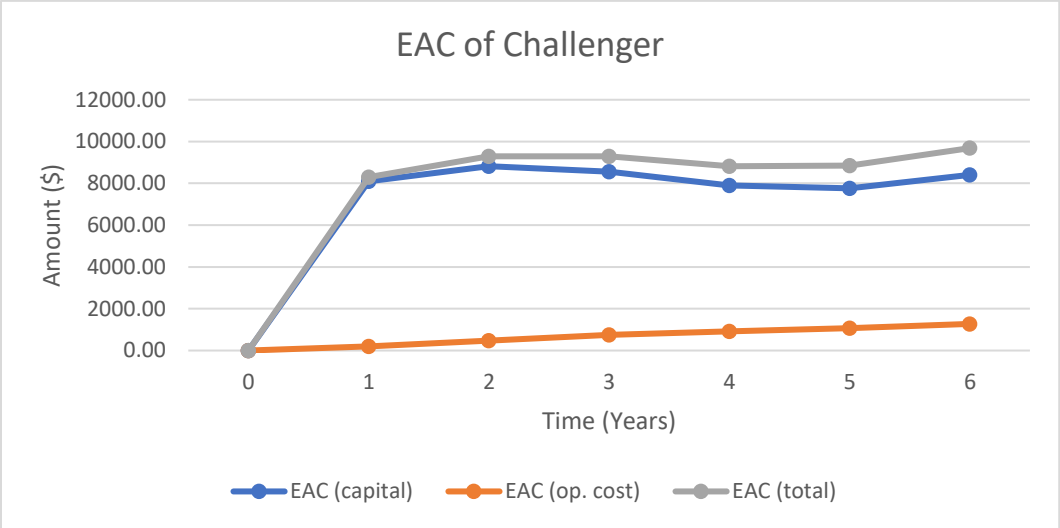

1.2 b.

The economic lives associated with the minimum EAC of total costs for both defender and challenger are shown below:

	Economic Life (years)
Defender	4
Challenger	1

1.3 c.

To determine whether or not it is worth it to replace the machine, the EAC of total costs must be compared at their economic lives. Since $EAC_{defender,4} = \$7{,}638.95 < EAC_{challenger,1} = \$8{,}300.00$, it is not worth it to replace the machine.

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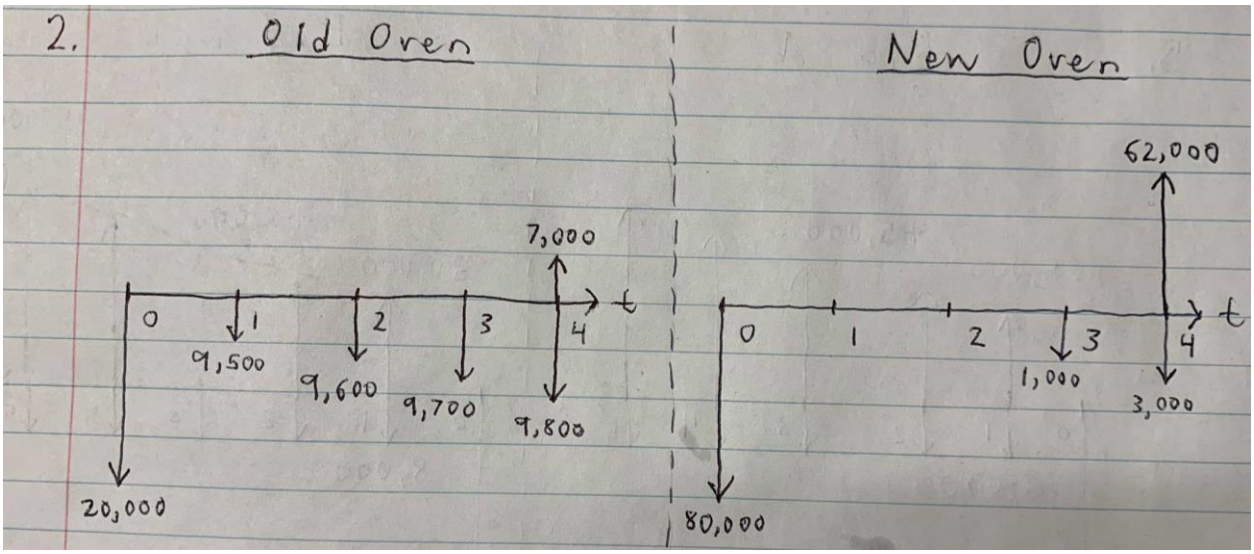
2 Question 2

Cash flow diagrams for this question are shown below. They depict their last year of operation:



The EAC of capital cost and EAC of operating cost for both the old oven and the new oven over the years is summarized in the table below:

Year	Old Oven			New Oven		
	EAC (capital)	EAC (op. cost)	EAC (total)	EAC (capital)	EAC (op. cost)	EAC (total)
0	0.00	0.00	0.00	0.00	0.00	0.00
1	5000.00	9500.00	14500.00	13000.00	0.00	13000.00
2	4857.14	9547.62	14404.76	12761.90	0.00	12761.90
3	4719.03	9593.66	14312.69	12229.61	302.11	12531.72
4	4801.12	9638.12	14439.24	11878.47	883.43	12761.90

The values were determined with Excel. The following is a sample calculation for Year 2 old oven:

$$EAC_{capital,2} = (20000 - 14000)\left(\frac{0.1(1+0.1)^2}{(1+0.1)^2 - 1}\right) + (14000)(0.15) = 4857.14$$

$$EAC_{op.cost,2} = 9500\frac{1}{(1+0.1)^1}\frac{0.1(1+0.1)^2}{(1+0.1)^2 - 1} + 9600\frac{1}{(1+0.1)^2}\frac{0.1(1+0.1)^2}{(1+0.1)^2 - 1} = 9547.62$$

The economic lives associated with the minimum EAC of total costs for both the old oven and new oven are shown below:

	Economic Life (years)
Old Oven	3
New Oven	3

To determine whether or not it is worth it to replace the machine, the EAC of total costs must be compared at their economic lives. Since $EAC_{old\ oven,3} = \$14{,}312.69 > EAC_{new\ oven,3} = \$12{,}531.72$, it is worth it to replace the machine.

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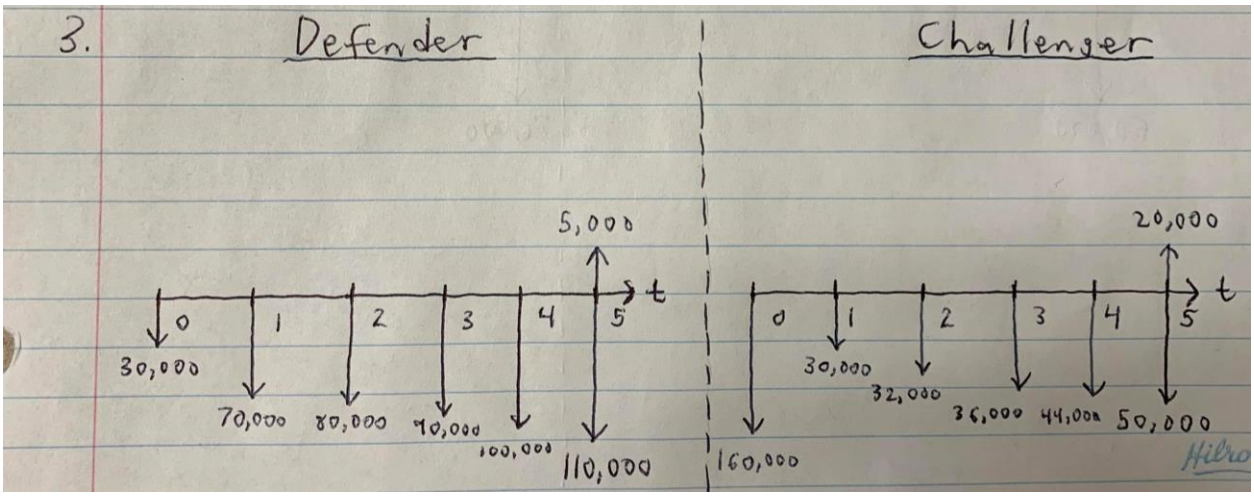
3 Question 3

3.1 a.

Cash flow diagrams for this question are shown below:



The depreciation rates for the defender and challenger are calculated as follows:

$$d_{defender} = 1 - \sqrt[n_{defender}]{\frac{S_{defender}}{P_{defender}}} = 1 - \sqrt[5]{\frac{5000}{30000}} = 0.3012$$

$$d_{challenger} = 1 - \sqrt[n_{challenger}]{\frac{S_{challenger}}{P_{challenger}}} = 1 - \sqrt[5]{\frac{20000}{160000}} = 0.3402$$

These rates are used to determine the salvage values at each year, shown below:

Period (years)	Defender			Challenger		
	Initial Cost ($)	M&O ($)	Salvage Value ($)	Initial Cost ($)	M&O ($)	Salvage Value ($)
0	30000.00		30000.00	160000.00		160000.00
1		70000.00	20964.81		30000.00	105560.63
2		80000.00	14650.78		32000.00	69644.05
3		90000.00	10238.36		36000.00	45947.93
4		100000.00	7154.85		44000.00	30314.33
5		110000.00	5000.00		50000.00	20000.00

The following is a sample calculation for the salvage value of the defender at Year 1:

$$S_{defender,1} = P\left(1 - d_{defender}\right)^{n} = 30000(1 - 0.3012)^{1} = 20964.81$$

The EAC of capital cost and EAC of operating cost for both defender and challenger over the years is summarized in the table below:

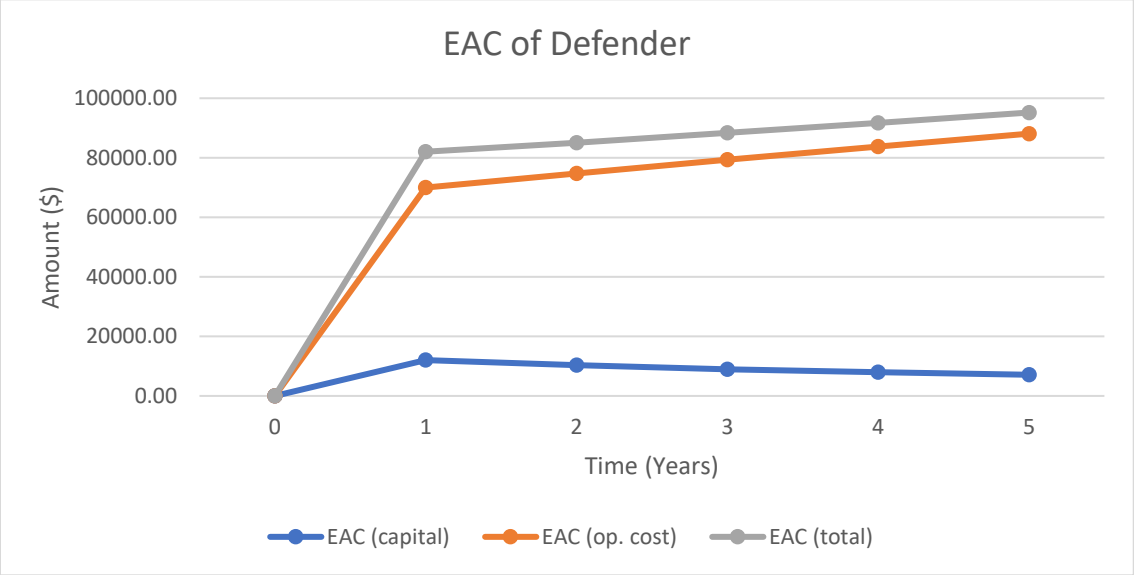
Period (years)	Defender			Challenger		
	EAC (capital)	EAC (op. cost)	EAC (total)	EAC (capital)	EAC (op. cost)	EAC (total)
0	0.00	0.00	0.00	0.00	0.00	0.00
1	12035.19	70000.00	82035.19	70439.37	30000.00	100439.37
2	10309.15	74761.90	85071.06	59026.65	30952.38	89979.03
3	8970.28	79365.56	88335.84	50456.82	32477.34	82934.16
4	7922.46	83811.68	91734.14	43943.48	34960.14	78903.61
5	7094.94	88101.26	95196.20	38931.65	37423.63	76355.28

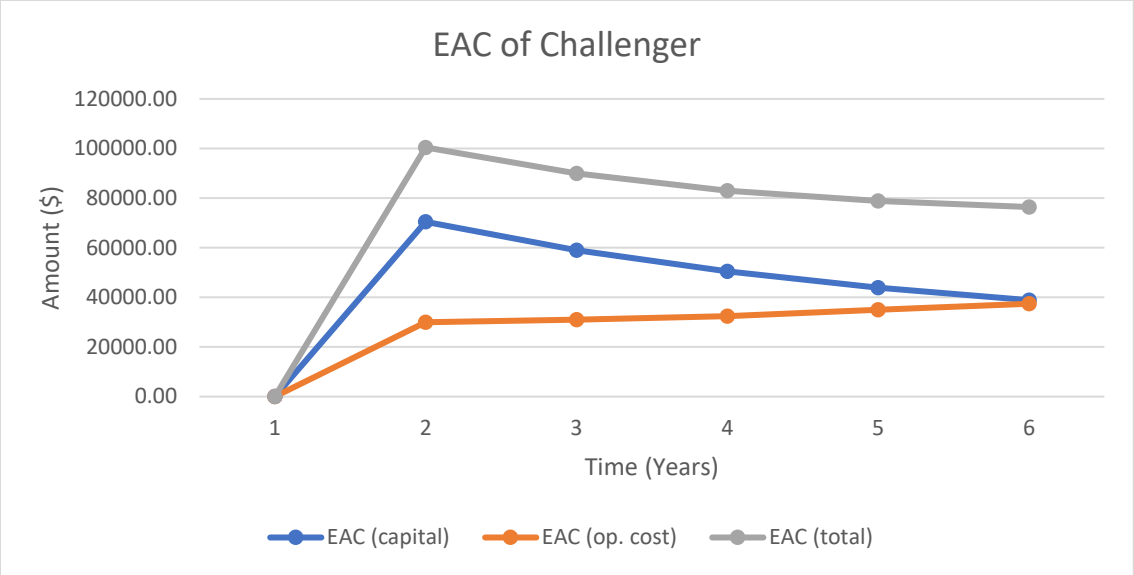
The values were determined with Excel. The following is a sample calculation for Year 2 defender:

$$EAC_{capital,2} = (30000 - 14650.78)\left(\frac{0.1(1+0.1)^2}{(1+0.1)^2-1}\right) + (14650.78)(0.1) = 10309.15$$

$$EAC_{op.cost,2} = 70000\frac{1}{(1+0.1)^1}\frac{0.1(1+0.1)^2}{(1+0.1)^2-1} + 80000\frac{1}{(1+0.1)^2}\frac{0.1(1+0.1)^2}{(1+0.1)^2-1} = 74761.90$$

Curves of the EAC of capital costs and EAC of operating costs, including EAC of total costs, are shown below:





3.2 b.

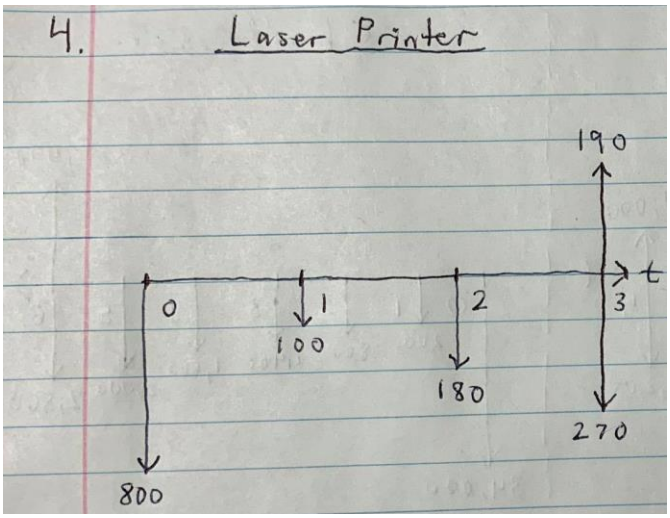
The economic lives associated with the minimum EAC of total costs for both defender and challenger are shown below:

	Economic Life (years)
Defender	1
Challenger	5

To determine whether or not it is worth it to replace the machine, the EAC of total costs must be compared at their economic lives. Since $EAC_{defender,1} = \$82{,}035.19 > EAC_{challenger,5} = \$76{,}355.28$, it is worth it to replace the machine.

4 Question 4

A cash flow diagram for this question is shown below:



The EAC of capital cost and EAC of operating cost for both defender and challenger over the years is summarized in the table below:

Period (Years)	EAC (capital)	EAC (op. cost)	EAC (total)
1	290.00	100.00	390.00
2	246.67	138.10	384.76
3	264.29	177.95	442.24

The values were determined with Excel. The following is a sample calculation for Year 2:

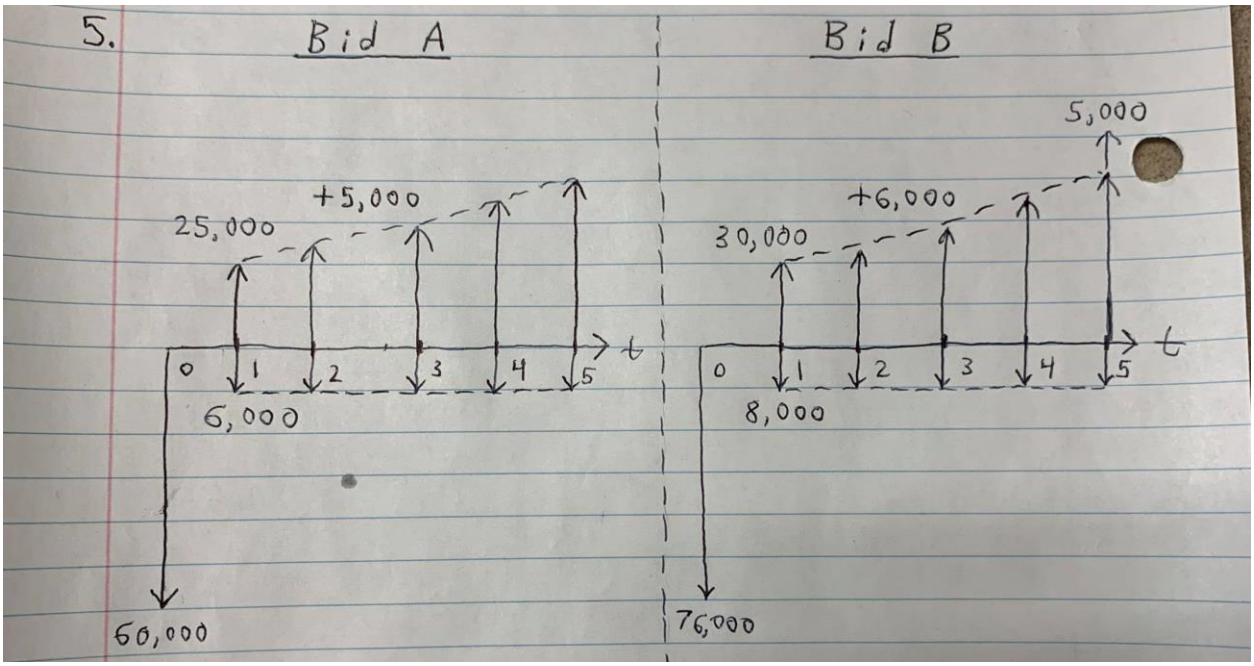
$$EAC_{capital,2} = (800 - 450)\left(\frac{0.1(1+0.1)^2}{(1+0.1)^2 - 1}\right) + (450)(0.1) = 246.67$$

$$EAC_{op.cost,2} = 100\frac{1}{(1+0.1)^1}\frac{0.1(1+0.1)^2}{(1+0.1)^2 - 1} + 180\frac{1}{(1+0.1)^2}\frac{0.1(1+0.1)^2}{(1+0.1)^2 - 1} = 138.10$$

The economic life for the laser printer is the year at which its $EAC\ (total)$ increases to a greater value the following year. This occurs on Year 2, therefore the machine's economic life is 2 years.

5 Question 5

Cash flow diagrams for this question are shown below:



The CTF and CSF factors are calculated as follows:

$$CTF = 1 - \left(\frac{td}{i+d}\right)\left(\frac{1+\frac{i}{2}}{1+i}\right) = 1 - \left(\frac{(0.4)(0.2)}{0.12+0.2}\right)\left(\frac{1+\frac{0.12}{2}}{1+0.12}\right) = 0.763393$$

$$CSF = 1 - \left(\frac{td}{i+d}\right) = 1 - \left(\frac{(0.4)(0.2)}{0.12+0.2}\right) = 0.75$$

The following parameters are calculated and converted to present values: initial cost, annual savings in costs, increase amount in annual savings, additional annual operating cost, and salvage value. These parameters are summed for each bid and compared with each other to determine the most economical alternative. The following table summarizes the calculated values:

	A	B
Initial Cost	-45803.57	-58017.86
Annual Savings in Costs	54072.00	64886.40
Increase Amount in Annual Savings	19191.23	23029.48
Additional Annual Operating Cost	-12977.28	-17303.04
Salvage Value	0.00	2127.86
Total	14482.38	14722.85

The values were determined with Excel. The following is a sample calculation for Bid A:

$$PW_{initial\ cost,A} = -60000 \times CTF = -45803.57$$

$$PW_{annual\ savings,A} = 25000 \times \left(\frac{P}{A}, 12\%, , 5\right) \times (1-t) = 54072.00$$

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$$PW_{increase\ amount,A} = 5000 \times \left(\frac{A}{G}, 12\%, , 5\right)\left(\frac{P}{A}, 12\%, , 5\right) \times (1 - t) = 19191.23$$

$$PW_{operating\ cost,A} = -6000 \times \left(\frac{P}{A}, 12\%, , 5\right) \times (1 - t) = -12977.28$$

$$PW_{salvage\ value,A} = 0 \times \left(\frac{P}{F}, 12\%, , 5\right) \times CSF = 0.00$$

$$PW_{total,A} = 14482.38$$

The most economical alternative is the bid with the higher present worth. Since $PW_{total,A} = \$14{,}482.38 < PW_{total,B} = \$14{,}722.85$, the most economical alternative is Bid B.

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