Econ Homework #03

7-2

Original cost: $50,000 (10 yrs of life)

Interest rate of 6%

With salvage value, we will need $45,000 saved to replace.

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

$$A = (45{,}000)\left(\frac{0.06}{1.06^{10} - 1}\right) = \$3414.06/yr \text{ needs to be saved}$$

7-5

A.) Costs $20,000 with 6 years of life. No salvage at the end
B.) Costs $34,000 with 10 years of life. $4000 salvage value at the end.

Interest rate of 6%.

To figure out which is worth more, we need to annualize the loan and annualize the salvage value.

Option A.)

$$A_c = P\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right) = 20{,}000\left(\frac{0.06(1.06)^6}{(1.06)^6 - 1}\right) = \$4067.25$$

Option B.)

$$A_c = P\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right) = 34{,}000\left(\frac{0.06(1.06)^{10}}{(1.06)^{10} - 1}\right) = \$4619$$

$$A_s = F\left(\frac{i}{(1+i)^n - 1}\right) = 4000\left(\frac{0.06}{(1.06)^{10} - 1}\right) = \$303.47$$

$$A_{tot} = \$4315.51$$

Option A is the preferred option

7-9

FCI = $20 million.
Property taxes are 1% of FCI
State taxes are 5% of gross earnings
The net income is $2 million and federal income taxes are 35% of the gross earnings.

What if we had the same plant but the following conditions:
Property taxes of 4% FCI
State income of 2% of gross earnings
What is the net income per year?

$$Net\ Income\ =\ gross\ earnings\ -\ taxes$$

$$gross\ earnings\ =\ Net\ Income\ +\ taxes$$

$$taxes\ =\ 0.01FCI\ +\ 0.02GE$$

Thus,

$$GE = \frac{NetI + 0.01FCI}{0.6} = \frac{2M + 0.01(20M)}{0.6} = 3.66\ million$$

Plant #2:

$$NetI\ =\ GE\ - (0.04FCI\ +\ 0.02GE\ +\ 0.35GE)\ =\ 3.66\ -\ (0.04(20)\ +\ 0.37(3.66)$$
$$=\ \$1.51\ million$$

7-17

There are three methods to calculate depreciation:

1. Straight line (linear)
2. MACRS
3. Sum of the digits

Equipment costs amount to $35,000 with 5 years of use. There is a $5000 salvage value at the end.

Straight Line –

The total change in value is $30,000 over 5 years.

That's $\frac{\$30,000}{5\ yrs}\ =\ \$6000$ each year.

Straight Line

Year	*Depreciation Allowance*	*Year-End value*
1	6000	29000
2	12000	23000
3	18000	17000
4	24000	11000
5	30000	5000

MACRS –

MACRS is a special formula/depreciation schedule used by the IRS to calculate the value of depreciation of various investments and equipment purchases.

Each new depreciation allowance is equal to the original price minus the most recent depreciation allowance, divided by the service life.

$$DA_{i+1} = \frac{P_o - DA_i}{5}$$

MACRS

Year	*Depreication Allowance*	*Year-End value*
1	7000	28000
2	5600	22400
3	5880	16520
4	5824	10696
5	5835.2	4860.8

Sum of the digits –

We can calculate each depreciation allowance with the following formula:

% depreciation = $\frac{year}{SYD}$ where SYD = n(n+1)/2

Sum of the Digits

Year	*Depreication Allowance*	*Year-End value*
1	10000	25000
2	8000	17000
3	6000	11000
4	4000	7000
5	2000	5000

8-4

	Pump A	Pump B
Installed cost	\$20,000	\$25,000
Salvage value	2,000	4,000

We need to annualize the cost and the salvage value:

Pump A –

$$A_c = P\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right) = 20{,}000\left(\frac{0.15(1.15)^4}{(1.15)^4 - 1}\right) = \$7005.31$$

$$A_s = F\left(\frac{i}{(1+i)^n - 1}\right) = 2000\left(\frac{0.15}{(1.15)^4 - 1}\right) = \$400.53$$

Pump B –

$$A_c = P\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right) = 25{,}000\left(\frac{0.15(1.15)^n}{(1.15)^n - 1}\right) = ???$$

$$A_s = F\left(\frac{i}{(1+i)^n - 1}\right) = 2000\left(\frac{0.15}{(1.15)^n - 1}\right) = ???$$

The sum of the annualized cost and salvage value for pump B must be equal to the sum of the annualized cost and salvage value for pump A. Use excel solver to get the value of n.

	Pump A	Pump B	
Cost	20000	25000	
Salvage	2000	4000	
i	0.15	0.15	
n	4	5.320202	
Ac	7005.307	7148.543	
As	400.5307	543.7669	**Error Sq**
Atot	6604.776	6604.776	0

This equates to about 5-6 years.

8-5

	0.025 m	0.051 m	0.076 m	0.102 m
kJ/s energy saved	88	102	108	111
Cost for installed insulation	$8,000	$10,100	$11,100	$11,500
Annual fixed charges, % of installed cost	10	10	10	10

Heat is $1.50/GJ = $0.0000015/kJ

Income taxed at 35% Exchanger operatres at 300 days/yr

We can use the information to calculate the money saved, annual fixed cost,net savings, and net savings after tax:

	Insulation			
	0.025 m	**0.051 m**	**0.076 m**	**0.102 m**
kJ/s saved	88	102	108	111
Installlation Cost	8000	10,100	11,100	11,500
Annual fixed cost, as % of install cost	10.00%	10.00%	10.00%	10.00%
Fixed Cost Annual	800	1010	1110	1150
Money saved	3421.44	3965.76	4199.04	4315.68
Net Savings	2621.44	2955.76	3089.04	3165.68
Net savings after tax	1703.936	1921.244	2007.876	2057.692
Investment return	21.30%	19.02%	18.09%	17.89%

We cab see that the greatest investment return is the first option. This is ncluding the fact that each investment is compared also to the previous.

8-7

	1	2	3	4
FCI	10,000	12,000	14,000	16,000
Post-tax total costs	3,000	2,800	2,350	2,100
Return on Investment		0.1	0.1625	0.125

We can see that design 3 is the most favorable option.

8-10

We can calculate the depreciation for each year based on the calculations and formulas from 7-17:

year	annual revenue	Annual Operating Expenses (excluding depreciation)	Plant Value	MACRS	Depreciation	Cash Flow	Cash Flow Tax
1	7	4	50	0	10	-7	0
2	10	5.6	40	0.2	16	-11.6	0
3	15	6.8	24	0.32	9.6	-1.4	0
4	20	7.8	14.4	0.192	5.76	6.44	2.254
5	22.5	8.8	8.64	0.1152	5.76	7.94	2.779
6	24	9.6	2.88	0.1152	2.88	11.52	4.032
7	25	10	0	0.0576	0	15	5.25

8-18

Our FCI is equal to $100 million spent over 3 years. The product has a 10-year life span.

We can calculate the net profit as such:

$$net\ profit = (sale - oper.exp. - dep)(1 - tax\ value)$$

$$CF = net\ profit + dep$$

We can tabulate the data per year as such:

Year	FCI	Sales	Payoff annually	Depreciation	Capacity	Operating Expenses		Net Profit	Cash Flow
1	33.333	75	3.3333	3.3333	50.00%	100		-18.416645	-15.083345
2	33.333	112.5	3.703666667	7.036966667	75.00%	100		3.550971667	10.5879383
3	33.333	150	4.166625	11.20359167	100.00%	100		25.21766542	36.4212571
4	0	150	0	11.20359167	100.00%	100		25.21766542	36.4212571
5	0	150	0	11.20359167	100.00%	100		25.21766542	36.4212571
6	0	150	0	11.20359167	100.00%	100		25.21766542	36.4212571
7	0	150	0	11.20359167	100.00%	100		25.21766542	36.4212571
8	0	150	0	11.20359167	100.00%	100		25.21766542	36.4212571
9	0	150	0	11.20359167	100.00%	100		25.21766542	36.4212571
10	0	150	0	11.20359167	100.00%	100		25.21766542	36.4212571
							Sum	186.87565	186.87565
							Average	18.687565	28.687465
							ROI	15.57%	
							PBP	3.485843033	