

Economics Homework 02

Problem 1

We have the following two alternatives for a purification unit:

	Initial Investment	Salvage Value	Service Life	Annual Operating Expenses
A.)	\$180,000	\$15,000	6 years	\$25,000
B.)	\$210,000	\$20,000	8 years	\$20,000

We have an annual interest rate of 20%, and we are using annualized costs.

Alternative A –

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

We need to solve for A, the annualized cost:

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

$$A = \$180,000(0.2 + 1)^6 \left(\frac{(1 + 0.2)^6 - 1}{0.2} \right)^{-1} = \$54,127.03/\text{yr}$$

$$\text{Salvage per year} = \$15,000/6 \text{ years} = \$2,500/\text{yr}$$

Cost per year:

$$54,127 + 25,000 - 2,500 = \mathbf{\$76,627/\text{year spent.}}$$

Alternative B –

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

We need to solve for A, the annualized cost:

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

$$A = \$210,000(0.2 + 1)^8 \left(\frac{(1 + 0.2)^8 - 1}{0.2} \right)^{-1} = \$54,727/\text{yr}$$

$$\text{Salvage per year} = \$25,000/8 \text{ years} = \$2,500/\text{yr}$$

Cost per year:

$$54,727 + 20,000 - 2,500 = \mathbf{\$72,227/\text{year spent.}}$$

Thus, Option B is the better option.

Problem 2

Renting v Buying –

Our income gives us enough money to save \$10,000/yr and pay rent on a house at \$12,000/yr including utilities. We also have an accumulated \$20,000 in savings which earns interest at 4%. We can also buy a house for \$134,000 and then incur the following costs:

- Taxes + Insurance: \$2,000
- Maintenance: \$1,600
- Utilities: \$2,400
- Interest on Loan: 6% (on Principle)
- Income Tax Rate: %25

We can also assume that inflation increases the value of the house by 3% compounded annually.

Rent –

\$12,000/year of rent for 4 years = \$48,000.

How does our savings change?

$$F = 20,000(1 + 0.04) = 20,800 + 10,000$$

$$F = 30,800(1 + 0.04) = 32,032 + 10,000$$

$$F = 42,032(1 + 0.04) = 43,713.28 + 10,000$$

$$F = 53,713.28(1 + 0.04) = 55,861.88 \text{ in savings after four years.}$$

This leaves us with a net of \$7,861, which is taxed to achieve **\$6,346** after paying all of our rent and income tax.

House –

$$\text{House loan required} = \$134,000 - \$20,000 = \$114,000$$

$$\text{The house appreciates for 4 years: } F = \$134,000(1 + 0.03)^4 = \$150,818.2$$

Interest is added to the loan to make the total payment come out to be:

$$\$114,000(1 + 0.03)^4 = \$143,922.39$$

The total tax, insurance, and utilities cost:

$$(1600 + 2400 + 2000) * 4 = \$24,000$$

From our income, we receive \$22,000 per year for four years which equates to \$88,000

$$150,818.2 + 88,000 - 143,922.37 - 24,800 = \mathbf{\$70,895}$$

Purchasing the house is clearly the better option.

Problem 3

To determine what costs can be spent on maintenance each year, we must find when the cost of buying milk solids is equal to the cost of buying a plant to create them. It currently costs \$30,000/yr to buy the milk solids.

The following costs are associated with a milk solids plant:

- PI = \$100,000
- Pay over ten years
- 16% interest rate
- Land price = \$10,000

We can use the following equation to calculate the annualized cost of the plant:

$$A = P(i + 1)^n \left(\frac{(1 + i)^n - 1}{i} \right)^{-1}$$
$$A = 100,000(0.16 + 1)^{10} \left(\frac{(1 + 0.16)^{10} - 1}{0.16} \right)^{-1} = \$22,759/\text{yr}$$

(Cost of buying Milk Solids) = (Cost of plant per year) + (cost of annual maintenance)

This, the maintenance costs can be:

$$30,000 - 22,759 = \$7,341/\text{yr}$$

Problem 4

A company wants to purchase a plant for \$350,000. This plant has a service life of 10 years, which provides annual sales of \$500,000. The annual operating costs would be \$300,000. The value of the land, equipment, buildings, etc. at the end of the 10 years is estimated to be \$100,000. The company uses straight line depreciation. The tax rate is 47% and the required working capital is \$50,000. The company requires a 25% after tax rate return. Is this an acceptable investment.

First, we will calculate the depreciation rate, m :

$$m = \frac{350,000 - 100,000}{10 - 0} = \$25,000/\text{yr}$$

The total profit from the plant is the annual sales minus the annual expenses:

$$\text{Profit} = \$500,000 - \$300,000 = \$200,000$$

The plant depreciates in value, so we are also losing \$25,000/yr as well.

So the profit we get is actually \$175,000/yr.

The net cash flow after taxes becomes $175,000(1-0.47) = \$92,750/\text{yr}$

$$\text{TCI} = \text{FCI} + \text{WC}$$

$$400,000 = 350,000 + \text{WC}, \text{ so, } \text{WC} = \$50,000$$

$$\text{The net return} = \frac{\text{Cash Flow}}{\text{TCI}} = \frac{\$92,750}{\$400,000} = 23.2 \%$$

Thus, this is not an acceptable investment.