Final term exam paper

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What is net present value and Equivalent Annual cost? What is the benefit of Benefit-cost ratio? (5)

i) The construction cost of a service reservoir for supplying water to a housing estate is estimated to be PKR 9,000,000,000. The annual operation and maintenance cost are estimated to be PKR 375,000,000 per year. The annual income from the collection of water supply fee from the users will be PKR 1,050,000,000. Assuming a time horizon of 30 years and taking i as 5% p.a., find out if the project is financially feasible. Use both methods equivalent annual costs and present value method also use benefit-cost ratio. (10)

Ans#1:

Net Present Value (NPV) is the value of all future cash flows (positive and negative) over the entire life of an investment discounted to the present. NPV analysis is a form of intrinsic valuation and is used extensively across finance and accounting for determining the value of a business, investment security, capital project, new venture, cost reduction program, and anything that involves cash flow.

or simply we can say that (present value of total benefit-present value of total cost)

It also indicate that the project is variable or not and show us the feasibility of project.

NPV analysis is used to help determine how much an investment, project, or any series of cash flows is worth. It is an all-encompassing metric, as it takes into account all revenues, expenses, and capital costs associated with an investment in its Free Cash Flow (FCF).

In addition to factoring all revenues and costs, it also takes into account the timing of each cash flow that can result in a large impact on the present value of an investment. For example, it's better to see cash inflows sooner and cash outflows later, compared to the opposite

EAC: In finance, the equivalent annual cost (EAC) is the cost per year of owning and operating an asset over its entire lifespan. It is calculated by dividing the NPV of a project by the "present value of annuity factor.

It will be used in following scenarios:

- ✓ Assessing alternative projects of unequal lives (where only the costs are relevant) in order to address any built-in bias favoring the longer-term investment.
- ✓ Determining the optimum economic life of an asset, through charting the change in EAC that may occur due to the fluctuation of operating costs and salvage values over time.
- ✓ Assessing whether leasing an asset would be more economical than purchasing it.
- ✓ Assessing whether increased maintenance costs will economically change the useful life of an asset.
- ✓ Calculating how much should be invested in an asset in order to achieve a desired result (i.e., purchasing a storage tank with a 20-year life, as opposed to one with a 5-year life, in order to achieve a similar EAC).
- ✓ Comparing to estimate annual cost savings, in order to determine whether it makes economic sense to invest.
- ✓ Estimating the cost savings required to justify the purchase of new equipment.
- ✓ Determining the cost of continuing with existing equipment.
- ✓ Where an asset undergoes a major overhaul and the cost is not fully reflected in salvage values, to calculate the optimum life (i.e., lowest EAC) of holding on to the asset.

Benefit of BCR:

A **benefit–cost ratio** (BCR) is an indicator, used in cost–benefit analysis, that attempts to summarize the overall value for money of a project or proposal. A BCR is the ratio of the benefits of a project or proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms. All benefits and costs should be expressed in discounted present values. A BCR can be a profitability index in for-profit contexts. A BCR takes into account the amount of monetary gain realized by performing a project versus the amount it costs to execute the project. The higher the BCR the better the investment. The general rule of thumb is that if the benefit is higher than the cost the project is a good investment.
The practice of cost–benefit analysis in some[*which?*] countries refers to the BCR as the cost–benefit ratio, but this is still calculated as the ratio of benefits to costs.
the ratio of BCR is defined as below:

$$\frac{B}{C} Ratio = \frac{Present\ worth\ of\ total\ benefits}{Present\ worth\ of\ total\ cost}\ OR$$

$$\frac{B}{C} Ratio = \frac{Equivalent\ annual\ total\ benefit}{Equivalent\ annual\ total\ cost}\ OR$$

if above ration grater then 1 then we can say project is worthwhile, if the ration is equal to 1 it mean the project break even and if it's less than 1 it mean the project is in loss.

i): given data
Construction cost =PKR 9,000,000,000
Operation and maintenance cost per year=PKR375,000,000
Annual income cost=1,050,000,000
Time horizon=30 years
i=5%pa

1st present value method:

a:present value of benefit in 30years=$1050000000\times \left[\frac{(1+0.05)^{30}-1}{(1+0.05)^{30}\times 0.05}\right] = 1050000000 \times 57.4 = PKR\ 6.02 \times 10^{10}$

b: Preset Construction cost =PKR 9000,000,000

c:Present value of operation cost =$375000000\times \left[\frac{(1+0.05)^{30}-1}{(1+0.05)^{30}\times 0.05}\right] = 375000000 * 57.4 = 2.15 \times 10^{10}$

Now will calculate the NPV=(present value of total benefit-present value of total cost)=2.97×10^{10}
Positive NPV mean the project is feasible.

2nd EAC Method:

i) annual benefit =PKR1,050,000,000,
j) Annual operation cost=PKR375,000,000
k) Now annual construction cost=$9,000,000,000\times \frac{[(1+0.05)^{30}\times 0.05]}{[(1+0.05)^{30}-1]} = 9,000,000,000 \times \frac{0.22}{3.32} = 9,000,000,000 \times 0.066 = PKR\ 585462916$

No NAB=1,050,000,000-(375,000,000+585462916)=PKR 89537084
The positive NAB show us that the project is feasible.

3rd the BCR:

$$\frac{B}{C}Ratio = \frac{Present\ worht\ of\ total\ binifit}{present\ worth\ of\ total\ cost} = \frac{PKR\ 6.02 \times 10^{10}}{30500000000} = 1.97$$

$$\frac{B}{C}Ratio = \frac{Equivalent\ annual\ total\ benefit}{Equivalent\ annual\ total\ cost} = \frac{1{,}050{,}000{,}000}{960462916} = 1.1$$

As ratio more than 1 so project is worthwhile

Q2. What is internal rate of Return? What is the difference between IRR and NPV? Also please explain Inflation. (07)

i) An Asset was purchased four years ago at PKR 9,000,000 and had a life of four years. This investment resulted in actual annual cash receipt of PKR 2,100,000, 2,700,000, 3,450,000, 4,200,000 respectively in the past four years. These figures are found from the accounting record of each year in the past four years. The average inflation rate in these four years was 4% p.a. find the real Internal Rate of Return (IRR) (08)

Ans#2
a):

What Is Internal Rate of Return (IRR)?

Internal rate of return (IRR) is the discount rate that makes the net present value of all cash flows (both positive and negative) equal to zero for a specific project or investment.

- **IRR: What Is It Used For?**

The internal rate of return is used to evaluate projects or investments. The IRR estimates a project's breakeven discount rate or rate of return, which indicates the project's potential for profitability.

Based on IRR, a company will decide to either accept or reject a project. If the IRR of a new project exceeds a company's required rate of return, that project will most likely be accepted. If IRR falls below the required rate of return, the project should be rejected.

What Is the IRR Formula?

You can use the following formula to calculate IRR:

0 (NPV) = P0 + P1/(1+IRR) + P2/(1+IRR)2 + P3/(1+IRR)3 + . . . +Pn /(1+IRR)n

Where:

- P0 equals the initial investment (cash outflow)
- P1, P2, P3..., equals the cash flows in periods 1, 2, 3, etc.
- IRR equals the project's internal rate of return
- NPV equals the Net Present Value
- N equals the holding periods

❖ **Differences Between NPV vs IRR**

Under the NPV approach, the present value can be calculated by discounting a project's future cash flow at predefined rates known as cut off rates. However, under the IRR approach, cash flow is discounted at suitable rates using a trial and error method that equates to a present value. The present value is calculated to an amount equal to the investment made. If IRR is the preferred method, the discount rate is often not predetermined as would be the case with NPV.

NPV takes cognizance of the value of capital cost or the market rate of interest. It obtains the amount that should be invested in a project in order to recover projected earnings at current market rates from the amount invested.

On the other hand, the IRR approach doesn't look at the prevailing rate of interest on the market, and its purpose is to find the maximum rates of interest that will encourage earnings to be made from the invested amount.

NPV's presumption is that intermediate cash flow is reinvested at cutoff rate while under the IRR approach, an intermediate cash flow is invested at the prevailing internal rate of return. The results from NPV show some similarities to the figures obtained from IRR under a similar set of conditions, while both methods offer contradicting results in cases where the circumstances are different.

NPV's predefined cutoff rates are quite reliable compared to IRR when it comes to ranking more than two project proposals.

What Is Inflation?

To put it simply, inflation is the long term rise in the prices of goods and services caused by the devaluation of currency. While there are advantages to inflation which I will discuss later in this article, I want to first focus on some of the negative aspects of inflation.

Inflationary problems arise when we experience *unexpected* inflation which is not adequately matched by a rise in people's incomes. If incomes do not increase along with the prices of goods, everyone's purchasing power has been effectively reduced, which can in turn lead to a slowing

or stagnant economy. Moreover, excessive inflation can also wreak havoc on retirement savings as it reduces the purchasing power of the money that savers and investors have squirreled away.

Causes of Inflation

So what exactly causes inflation in an economy? There is not a single, agreed-upon answer, but there are a variety of theories, all of which play some role in inflation:

1. The Money Supply

Inflation is primarily caused by an increase in the money supply that outpaces economic growth.

Ever since industrialized nations moved away from the gold standard during the past century, the value of money is determined by the amount of currency that is in circulation and the public's perception of the value of that money. When the Federal Reserve decides to put more money into circulation at a rate higher than the economy's growth rate, the value of money can fall because of the changing public perception of the value of the underlying currency. As a result, this devaluation will force prices to rise due to the fact that each unit of currency is now worth less.

One way of looking at the money supply effect on inflation is the same way collectors value items. The rarer a specific item is, the more valuable it must be. The same logic works for currency; the less currency there is in the money supply, the more valuable that currency will be. When a government decides to print new currency, they essentially water down the value of the money already in circulation. A more macroeconomic way of looking at the negative effects of an increased money supply is that there will be more dollars chasing the same amount of goods in an economy, which will inevitably lead to increased demand and therefore higher prices.

2. The National Debt

We all know that high national debt in the U.S. is a bad thing, but did you know that it can actually drive inflation to higher levels over time? The reason for this is that as a country's debt increases, the government has two options: they can either raise taxes or print more money to pay off the debt.

A rise in taxes will cause businesses to react by raising their prices to offset the increased corporate tax rate. Alternatively, should the government choose the latter option, printing more money will lead directly to an increase in the money supply, which will in turn lead to the devaluation of the currency and increased prices (as discussed above).

3. Demand-Pull Effect

The demand-pull effect states that as wages increase within an economic system (often the case in a growing economy with low unemployment), people will have more money to spend on consumer goods. This increase in liquidity and demand for consumer goods results in an increase in demand for products. As a result of the increased demand, companies will raise prices to the level the consumer will bear in order to balance supply and demand.

An example would be a huge increase in consumer demand for a product or service that the public determines to be cheap. For instance, when hourly wages increase, many people may determine to undertake home improvement projects. This increased demand for home improvement goods and services will result in price increases by house-painters, electricians, and other general contractors in order to offset the increased demand. This will in turn drive up prices across the board.

4. Cost-Push Effect

Another factor in driving up prices of consumer goods and services is explained by an economic theory known as the cost-push effect. Essentially, this theory states that when companies are faced with increased input costs like raw goods and materials or wages, they will preserve their profitability by passing this increased cost of production onto the consumer in the form of higher prices.

A simple example would be an increase in milk prices, which would undoubtedly drive up the price of a cappuccino at your local Starbucks since each cup of coffee is now more expensive for Starbucks to make.

5. Exchange Rates

Inflation can be made worse by our increasing exposure to foreign marketplaces. In America, we function on a basis of the value of the dollar. On a day-to-day basis, we as consumers may not care what the exchange rates between our foreign trade partners are, but in an increasingly global economy, exchange rates are one of the most important factors in determining our rate of inflation.

When the exchange rate suffers such that the U.S. currency has become less valuable relative to foreign currency, this makes foreign commodities and goods more expensive to American consumers while simultaneously making U.S. goods, services, and exports cheaper to consumers overseas.

This exchange rate differential between our economy and that of our trade partners can stimulate the sales and profitability of American corporations by increasing their profitability and competitiveness in overseas markets. But it also has the simultaneous effect of making imported goods (which make up the majority of consumer products in America), more expensive to consumers in the United States.

The Good Aspects of Inflation

In a fact that is surprising to most people, economists generally argue that some inflation is a good thing. A healthy rate of inflation is considered to be approximately 2-3% per year. The goal is for inflation (which is measured by the Consumer Price Index, or CPI) to outpace the growth of the underlying economy (measured by Gross Domestic Product, or GDP) by a small amount per year.

A healthy rate of inflation is considered a positive because it results in increasing wages and corporate profitability and keeps capital flowing in a presumably growing economy. As long as things are moving in relative unison, inflation will not be detrimental.

Another way of looking at small amounts of inflation is that it encourages consumption. For example, if you wanted to buy a specific item, and knew that the price of it would rise by 2-3% in a year, you would be encouraged to buy it now. Thus, inflation can encourage consumption which can in turn further stimulate the economy and create more jobs.

b):

End of year	NCF	$\left[\frac{1}{(1+i)^n}\right]$ I=8%, n=4	DCF of 8%	$\left[\frac{1}{(1+i)^n}\right]$ I=3%, n=4	DCF of 13%
0	-9,000,000	1	-9,000,000	1	-9,000,000
1	2,100,000	0.926	1944600	0.885	1858500
2	2,700,000	0.857	2313900	0.783	2114100
3	3,450,000	0.794	2739300	0.693	2390850
4	4,200,000	0.735	3087000	0.613	2574600
			1084800		-61950

$$i' = 8\% + \left[\frac{1084800}{1084800 + 61950}\right] \times (13 - 8)\% = 12.72\%(i.e. aparent\ IRR)$$

As we know that $i' = (1+i)(i+f) - 1\ or\ 0.1272 = (1+i)(1+0.04) - 1$

1.04i=0.1272-1.04+1
i=0.084=8.4%
Ans: so the real is 8.4%

Q3. A subcontractor specialized in wastewater disposal makes and sells cast iron pipes, steel pipes and concrete pipes. The following variable costs and selling prices/sales volumes are obtained from the cost accounting department and sales department respectively.

Pipe	p	v	Volume (% Rs Sales)
Cast iron	Rs 450,000	Rs 300,000	25%

Steel	Rs 525,000	Rs 375,000	35%
Concrete	Rs 600,000	Rs 450,000	40%

The company capacity in terms of total (maximum) sales volume is $900 million in a year. The annual

Fixed cost is $200 million. a) Find the BEP of the subcontractor, b) Find the profit if the subcontractor is operating at 95% of its capacity (10):

Ans#:

Contribution per unit expressed in percentage=$\left[\left(\frac{p-v}{p}\right)\right] \times 100$

Contribution for per unit due to cast iron pipe=$\frac{450000-300000}{450000} \times 100 = 33.33\%$

Contribution for per unit due to steel pipe=$\frac{525000-375000}{525000} \times 100 = 28.57\%$

Contribution for per unit due to steel pipe=$\frac{600000-450000}{450000} \times 100 = 25\%$

	Contribution		% of sell
Cost iron pipes	33.33%	x	25%=8.33%
Steel pipes	28.57%	x	35%=10%
Concrete pipe	25%	x	40%=10%
			total 28.33%

this 28.33% is the total contribution of pipes

a) BEP=$\frac{FC}{Contribution} = \frac{200}{0.2833} = \$\ 706\ m, BEP = \frac{706}{900} = 78.4\%$
b) at 95% of capacity:

Profit=TR-TC=(900X0.95%)-VC-FC=855-810(1-0.2833)-200=$75 m

Q#4: A sewage pumping station is being designed. Three possible pumping schemes are proposed and the itemized costs of each scheme are shown below:

What is the most economical range of pumping time in hours/year for each scheme? (Take i = 5% p.a. and maximum pumping hours in a year = 8,760 hours) (10)

Scheme number		Scheme A	Scheme B	Scheme C
Pump	Cost of pumps ($) Life (years) Maintenance ($/year)	120,000 14 18,000	190,000 16 16,500	285,000 20 16,000
Pipe	Cost of pipes ($) Life (years) Cost of pumping ($/hour)	200,000 30 2.00	160,000 30 1.60	100,000 30 1.20

Scheme A:

Equivalent annul cost of installation and maintenance

$=\$ 120{,}000\times \{0.05(1+0.05)^{14}/ (1+0.05)^{14} - 1\} + \$200{,}000 \times \{0.05(1+0.05)^{30} / (1+0.05)^{30} - 1\} + \$18{,}000$

$=\$120{,}000 \times 0.1010 + \$200{,}000 \times 0.0651 + \$18{,}000 = \$43{,}140$

Scheme B:

Equivalent annual cost of installation and maintenance

$= \$190{,}000 \times \{0.05(1+0.05)^{16}/ (1+0.05)^{16}-1\} +\$160{,}000\times\{0.05(1+0.05)^{30}/(1+0.05)^{30}-1\}+\$16{,}500$

$=\$190{,}000 \times 0.0923+\$160{,}000\times 0.0651+\$16{,}500=\$44{,}453$

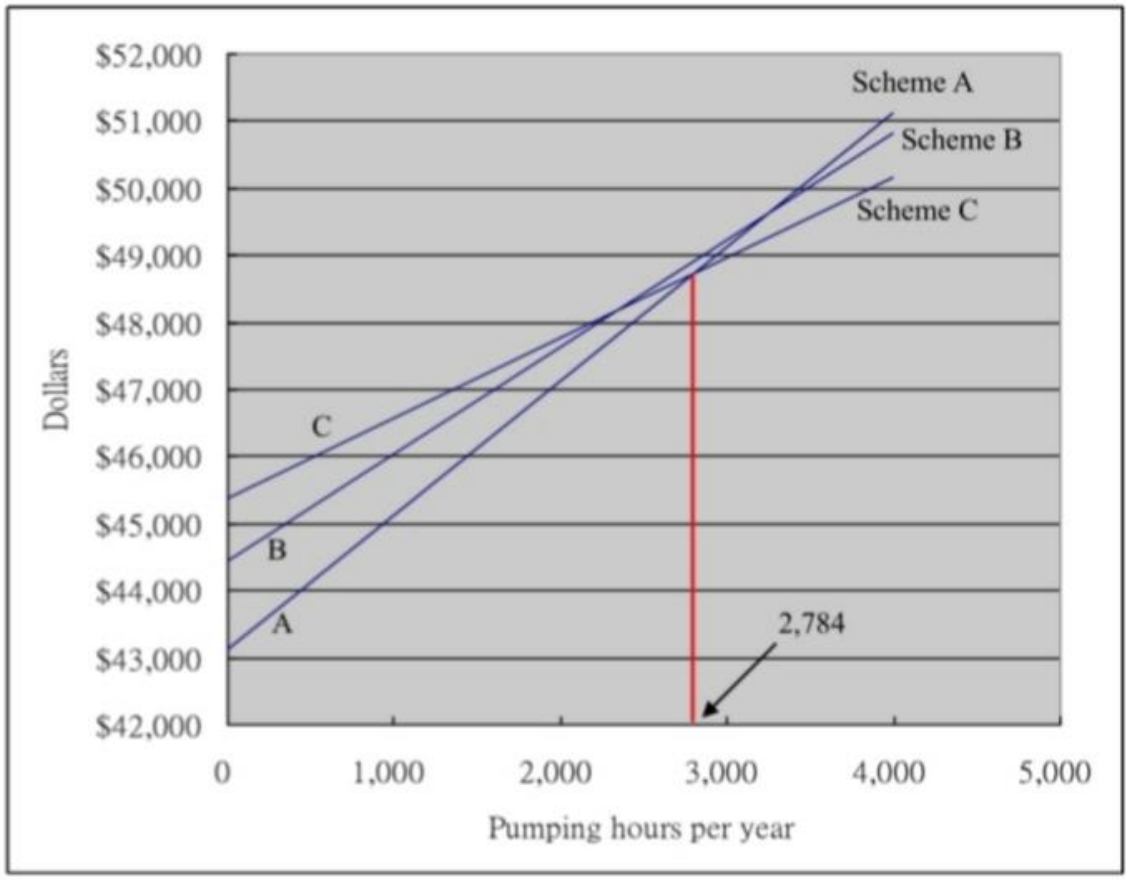
Scheme C:

Equivalent annual cost of installation and maintenance

$=\$285,000\times\{0.05(1+0.05)^{20}/(1+0.05)^{20}-1\}+\$100,000\times\{0.05(1+0.05)^{30}/(1+0.05)^{30}-1\}+\$16,000$

$=\$285,000\times0.0802+\$100,000\times0.0651+\$16,000=\$45,367$

The break-even chart is:



Break-even Chart for the scheme choice decision problem.

In Above Fig. the slope of the line for the scheme A is 2, and those for scheme B and C are 1.6 and 1.2 respectively. The fixed costs for Scheme A, B and C are \$43,140, \$44,453 and \$45,367 respectively. From this break-even chart, we see that for pumping time smaller than 2,784 hours per year, Scheme A is the best. For pumping time larger than 2,784 hour per year, Scheme C is the best. Scheme B is never to be used because it is in no situation better than Scheme A or Scheme C.