UIU QUESTION BANK

MID-TERM QUESTION SOLUTIONS

INDUSTRIAL AND OPERATIONAL MANAGEMENT

IPE 3401

COMPOSED BY

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*UPDATED TILL **SPRING 2025***

Index

Spring 2025

1. a) Mr. Suman invested some money at 15.5% interest rate compounded weekly for 40 years, and Mr. Sunny invested some money at 26% interest rate compounded quarterly for 30 years to reach 8 million. Whose investment was higher? And how many years it took for Sunny to reach 5 million? Show with necessary calculations.

Solution:

We know,

$$PV = \frac{FV}{(1+i)^N}$$

For Mr. Suman,

Effective annual rate,

$$i = \left(1 + \frac{i_{NOM}}{M}\right)^M - 1$$

$$\text{or, } i = \left(1 + \frac{0.155}{52}\right)^{52} - 1$$

$$\therefore i = 0.167$$

Here,

$i_{NOM} = 15.5\% = 0.155$
$M = 52$
$N = 40$ years
$FV = \$8000000$
$i = ?$
$PV = ?$

Present investment value,

$$PV = \frac{FV}{(1+i)^N}$$

$$\text{or, } PV = \frac{8000000}{(1+0.167)^{40}}$$

$$\therefore PV = \$16605.64$$

For Mr. Sunny,

Effective annual rate,

$$i = \left(1 + \frac{i_{NOM}}{M}\right)^M - 1$$

$$\text{or, } i = \left(1 + \frac{0.26}{4}\right)^{4} - 1$$

$$\therefore i = 0.286$$

Here,

$i_{NOM} = 26\% = 0.26$
$M = 4$
$N = 30$ years
$FV = \$8000000$
$i = ?$
$PV = ?$

Present investment value,

$$PV = \frac{FV}{(1+i)^N}$$

$$\text{or, } PV = \frac{8000000}{(1+0.286)^{30}}$$

$$\therefore PV = \$4225.33$$

Let,

N years will need for Sunny to reach 5 million.

Now,

$$FV = PV(1+i)^N$$

or, $\ln((1+i)^N) = \ln\left(\frac{FV}{PV}\right)$

or, $N \times \ln(1+i) = \ln\left(\frac{FV}{PV}\right)$

or, $N = \frac{\ln\left(\frac{FV}{PV}\right)}{\ln(1+i)}$

or, $N = \frac{\ln\left(\frac{5000000}{4225.33}\right)}{\ln(1+0.286)}$

$\therefore N = 28.13 \approx 28$ years

Here,

$i = 0.286$
$PV = \$4225.33$
$FV = \$5000000$
$N = ?$

∴ Investment of Mr. Suman was higher. It will took approximately 28 years for Sunny to reach 5 million.

1. b) A steel factory is open for 250 days a year. The demand for refractory material in the factory is 80 bags per day. Whenever an order is placed, it costs \$60, and the holding cost per unit per year is 30%. The quantity schedule chart is given below. Determine **Optimal order quantity** and **Total cost** associated with it.

Discount Number	Discount quantity	Discount %	Discount price $
1	0 to 400	No discount	17
2	401 to 650	10%	?
3	651 and over	14%	?

Solution:

Here,

$D = 80 \times 250$ units $= 20000$ units
$S = \$60$

For Discount 1,

Optimal Order Quantity,

$$Q_1^* = \sqrt{\frac{2DS}{H}}$$

or, $Q_1^* = \sqrt{\frac{2 \times 20000 \times 60}{5.1}}$

or, $Q_1^* = 685.99 \approx 686$

Here,

Price $= \$17$
$H = \$17 \times 30\%$
$= \$5.1$

Since 686 is not between 0 to 400,

$\therefore Q_1^* = 400$

Total Cost,

$TC_1 =$ Setup Cost + Holding Cost + Product Cost

$$\text{or, } TC_1 = \frac{D}{Q_1^*}S + \frac{Q_1^* H}{2} + \text{Price} * D$$

$$\text{or, } TC_1 = \frac{20000}{400} \times 60 + \frac{400 \times 5.1}{2} + 17 \times 20000$$

$$\therefore TC_1 = \$344020$$

For Discount 2,

Optimal Order Quantity,

$$Q_2^* = \sqrt{\frac{2DS}{H}}$$

$$\text{or, } Q_2^* = \sqrt{\frac{2 \times 20000 \times 60}{4.59}}$$

$$\text{or, } Q_2^* = 723.10 \approx 724$$

Here,

$$\begin{aligned} \text{Price} &= \$17 - \$17 \times 10\% \\ &= \$17 - \$1.7 \\ &= \$15.3 \end{aligned}$$

$$\begin{aligned} H &= \$15.3 \times 30\% \\ &= \$4.59 \end{aligned}$$

Since 724 is not between 401 to 650,

$$\therefore Q_2^* = 650$$

Total Cost,

$$TC_2 = \text{Setup Cost} + \text{Holding Cost} + \text{Product Cost}$$

$$\text{or, } TC_2 = \frac{D}{Q_2^*}S + \frac{Q_2^* H}{2} + \text{Price} * D$$

$$\text{or, } TC_2 = \frac{20000}{650} \times 60 + \frac{650 \times 4.59}{2} + 15.3 \times 20000$$

$$\therefore TC_2 = \$309337.90$$

For Discount 3,

Optimal Order Quantity,

$$Q_3^* = \sqrt{\frac{2DS}{H}}$$

$$\text{or, } Q_3^* = \sqrt{\frac{2 \times 20000 \times 60}{4.386}}$$

$$\therefore Q_3^* = 739.72 \approx 740$$

Here,

$$\begin{aligned} \text{Price} &= \$17 - \$17 \times 14\% \\ &= \$17 - \$2.38 \\ &= \$14.62 \end{aligned}$$

$$\begin{aligned} H &= \$14.62 \times 30\% \\ &= \$4.386 \end{aligned}$$

Total Cost,

$$TC_3 = \text{Setup Cost} + \text{Holding Cost} + \text{Product Cost}$$

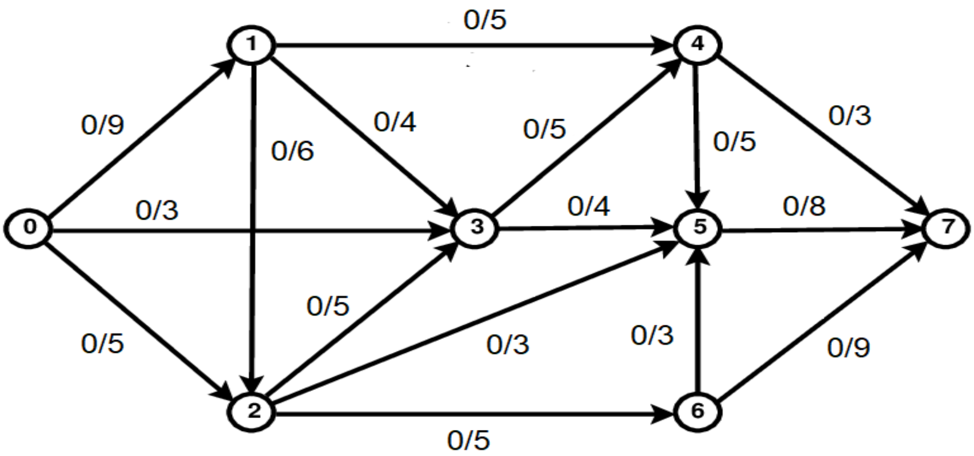
$$\text{or, } TC_3 = \frac{D}{Q_3^*}S + \frac{Q_3^* H}{2} + \text{Price} * D$$

$$\text{or, } TC_3 = \frac{20000}{740} \times 60 + \frac{740 \times 4.386}{2} + 14.62 \times 20000$$

$$\therefore TC_3 = \$295644.44$$

Since TC_3 is lower than TC_1 and TC_2, therefore Optimal Order Quantity is 740 and total cost is \$295644.44.

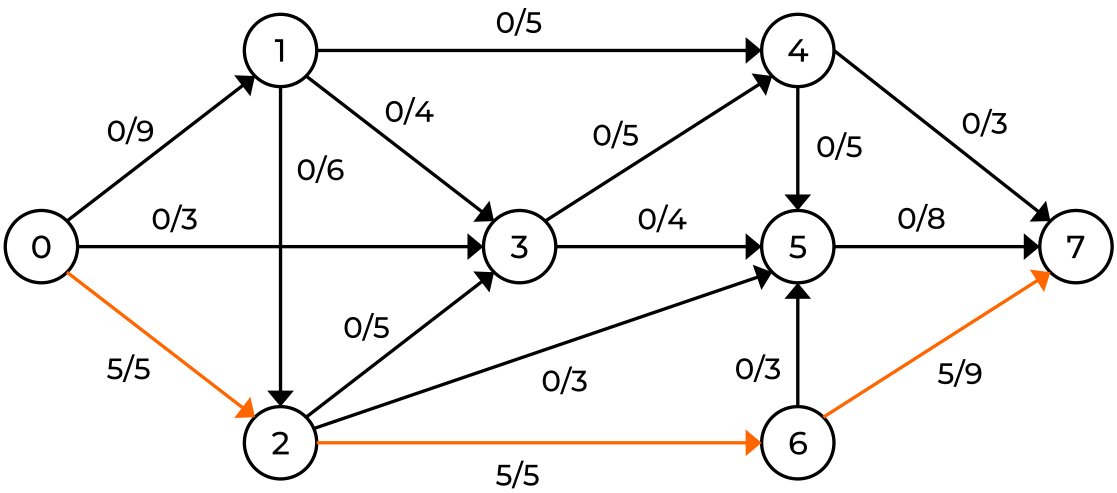
2. a)



Find the maximum flow.

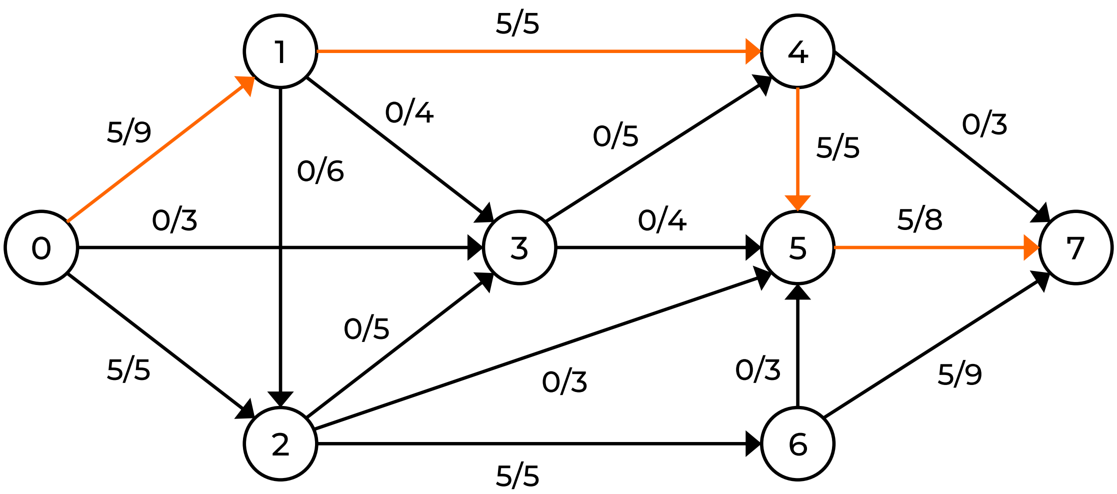
Solution:

1st Trial:



Augmented path: 0 → 2 → 6 *(Bottleneck = 5)*

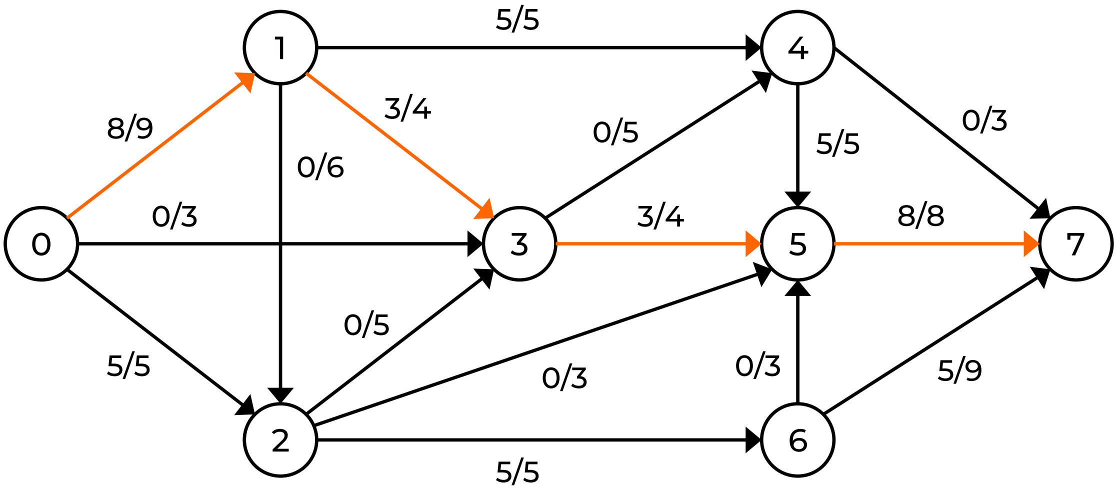
2nd Trial:



Augmented path: 0 → 1 → 4 → 5 → 7 *(Bottleneck = 5)*

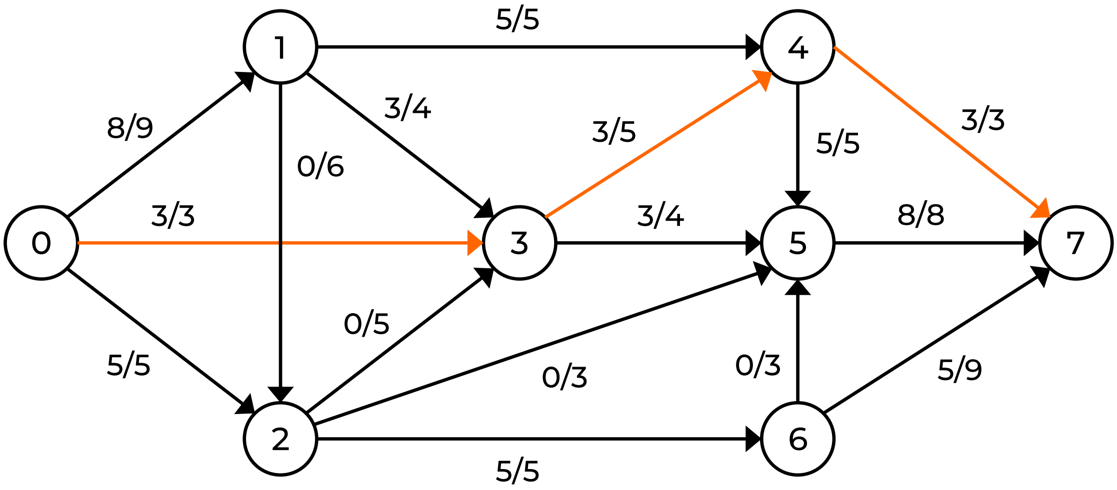
[P.T.O]

3rd Trial:



Augmented path: 0 → 1 → 3 → 5 → 7 *(Bottleneck = 3)*

4th Trial:



Augmented path: 0 → 3 → 4 → 7 *(Bottleneck = 3)*

No more flow is possible.

$\therefore$ Maximum flow $= 8 + 3 + 5 = 16$

2. b) Two projects are given

Project "A"

Year	0	1	2	3	4	5
Cash Flow	-30200	5520	8500	12300	16300	20000

Project "B"

Year	0	1	2	3	4	5
Cash Flow	-25,200	8,900	10,000	6,200	6,600	17,500

Now select the project using **the Discounted payback period method** and consider the rate = **23%** compounded **weekly**. Which project should you select?

Solution:

We know,

$$i = \left(1 + \frac{i_{NOM}}{M}\right)^M - 1$$

or, $i = \left(1 + \dfrac{0.23}{52}\right)^{52} - 1$

$\therefore i = 0.258$

Here,

$i_{NOM} = 23\% = 0.23$
$M = 52$
$i = ?$

Project A:

Years	Cash Flow	Discounted Cash Flow	Cumulative Discounted CF
0	-30200	−30200	−30200
1	5520	4387.92	−25812.08
2	8500	5371.03	−20441.05
3	12300	6178.21	−14262.84
4	16300	6508.26	−7754.58
5	20000	6347.85	−1406.73

Since cumulative discounted cash flow does not reach positive value,

∴ Discounted Payback Period is not achieved by Project A.

Project B:

Years	Cash Flow	Discounted Cash Flow	Cumulative Discounted CF
0	-25200	−25200	−25200
1	8900	7074.72	−18125.28
2	10000	6318.86	−11806.42
3	6200	3114.22	−8692.20
4	6600	2635.28	−6056.92
5	17500	5554.37	−502.55

Since cumulative discounted cash flow does not reach positive value,

∴ Discounted Payback Period is not achieved by Project B.

Therefore, no project should be selected from given two projects.

3. a) What do you mean by Economic order quantity? Explain with the necessary diagrams.

Solution:

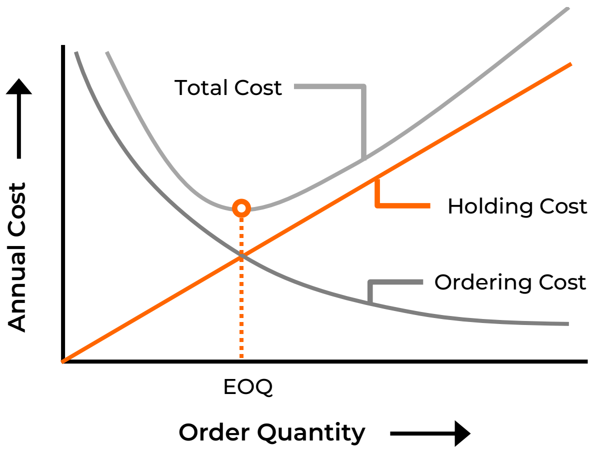


Fig: Economic Order Quantity

Economic Order Quantity (EOQ) is the ideal order quantity a company should purchase to minimize the total costs of inventory management, which include:

- Ordering cost
- Holding cost

The EOQ model helps to determine how much stock to order each time so that the combined cost of ordering and holding inventory is the possible lowest cost.

3. b)

Year	0	1	2	3	4	5
Project A	-10,0000	30,000	40000	50000	20000	15000
Project B	-200,000	65,000	58,000	55,000	37,000	40,000

Calculate the **IRR**, starting from 10%, using the trial-and-error method. If the required rate of return is 12%, should the company accept the projects? (You must show the necessary calculations).

Solution:

We know,

$$PV = \frac{FV}{(1+i)^N}$$

For Project A,

$$NPV = -100000 + \frac{30000}{(1+i)^1} + \frac{40000}{(1+i)^2} + \frac{50000}{(1+i)^3} + \frac{20000}{(1+i)^4} + \frac{15000}{(1+i)^5}$$

Now,

For $i = 10\%$, $NPV = 20870.41$
For $i = 11\%$, $NPV = 18539.93$
For $i = 12\%$, $NPV = 15484.25$
For $i = 13\%$, $NPV = 12934.82$
For $i = 14\%$, $NPV = 10475.20$
For $i = 15\%$, $NPV = 8101.23$
For $i = 16\%$, $NPV = 5808.99$
For $i = 17\%$, $NPV = 3594.76$
For $i = 18\%$, $NPV = 1455.07$
For $i = 19\%$, $NPV = -613.41$

∴ IRR is between 18% to 19%.

For Project B,

$$NPV = -200000 + \frac{65000}{(1+i)^1} + \frac{58000}{(1+i)^2} + \frac{55000}{(1+i)^3} + \frac{37000}{(1+i)^4} + \frac{40000}{(1+i)^5}$$

Now,

For $i = 10\%$, $\quad NPV = -1544.54$
For $i = 9\%$, $\quad NPV = 3129.55$

∴ IRR is between 9% to 10%.

Since the Project A has higher IRR than required rate 12% and IRR if Project B is less than required rate 12%, therefore company should accept only Project A.

4. a) A cheese factory produces specialty cheese wheels and operates 300 days a year. The weekly demand for the cheese wheels is 1,200 units, and the factory produces them at a rate of 600 units per day. Every time a production run is set up, it incurs a cost of $400. The annual holding cost per unit is 15% of product cost, each wheel costs $17. Calculate the optimal **production batch size, the total annual setup cost, the total annual holding cost** and **total cost**.

Solution:

We know,

Optimal Production Order Quantity,

$$Q^* = \sqrt{\frac{2DS}{H\left(1 - \frac{d}{p}\right)}}$$

$$\text{or, } Q^* = \sqrt{\frac{2 \times 62400 \times 400}{2.55 \times \left(1 - \frac{172}{600}\right)}}$$

$$\therefore Q^* = 5238.67 \approx 5239 \text{ units}$$

Here,

$$D = 1200 \times 52 \text{ units}$$
$$= 62400 \text{ units}$$
$$p = 600 \text{ units per day}$$
$$d = \frac{1200}{7} \text{ units per day}$$
$$= 171.43 \text{ units per day}$$
$$\approx 172 \text{ units per day}$$
$$S = \$400$$
$$\text{Price} = \$17$$
$$H = \$17 \times 15\%$$
$$= \$2.55$$
$$L = 7 \text{ days}$$

Now,

$$\text{Annual Setup Cost} = \frac{D}{Q^*}S$$
$$= \frac{62400}{5239} \times 400$$
$$= \$4764.27$$

$$\text{Annual Holding Cost} = \frac{1}{2}HQ^*\left(1 - \frac{d}{p}\right)$$
$$= \frac{1}{2} \times 2.55 \times 5239 \times \left(1 - \frac{172}{600}\right)$$
$$= \$4764.87$$

$$\text{Product Cost} = \text{Price} \times D$$
$$= 17 \times 62400$$
$$= \$1060800$$

$$\therefore \text{Total Cost} = 4764.27 + 4764.87 + 1060800$$
$$= \$1070329.14$$

∴ Optimal production batch size is 5239 units, the total annual setup cost is \$4764.27, the total annual holding cost is \$4764.87 and total cost is \$1070329.14.

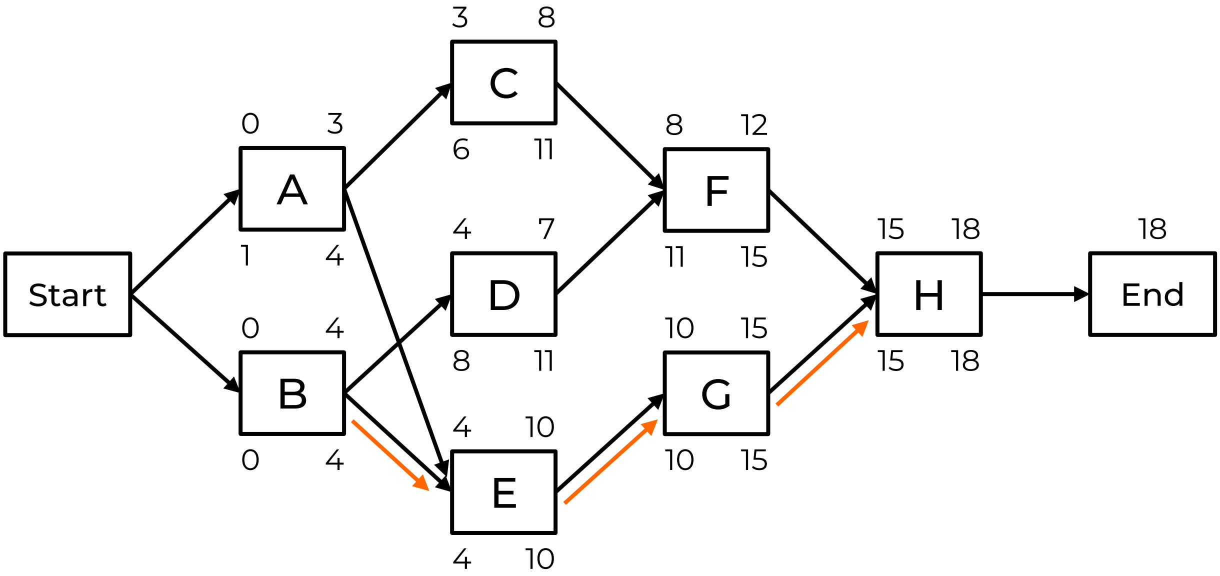
5. a)

Task	Predecessors	Duration
A	--	3
B	--	4
C	A	5
D	B	3
E	A, B	6
F	C, D	4
G	E	5
H	F, G	3

Find the Critical Path.

Solution:

Drawing the diagram based on given information:



∴ Critical Path: B → E → G → H

Fall 2024

1. a) Mr. Suman invested $17239 at a certain effective rate, and after 29 years, he earned 1.5 million. Now find the following: **i)** find out the effective rate, and **ii)** find out what the future value will be if the rate is compounded weekly.

Solution:

i) We know,

$$FV = PV(1+i)^N$$
$$\text{or, } 1500000 = 17239(1+i)^{29}$$
$$\text{or, } (1+i)^{29} = \frac{1500000}{17239}$$
$$\text{or, } i = \sqrt[29]{\frac{1500000}{17239}} - 1$$
$$\therefore i = 0.1665$$

Here,

$PV = \$17239$
$FV = \$1500000$
$N = 29$ years
$i = ?$

∴ Effective rate is 0.1665 or 16.65%.

ii) If the rate is compounded weekly,

Effective annual rate,

$$i = \left(1 + \frac{i_{NOM}}{M}\right)^M - 1$$
$$\text{or, } i = \left(1 + \frac{0.1665}{52}\right)^{52} - 1$$
$$\therefore i = 0.1808$$

Now,

$$FV = PV(1+i)^N$$
$$\text{or, } FV = 17239\,(1+0.1808)^{29}$$
$$\therefore FV = 2136122.03$$

Here,

$i_{NOM} = 0.1665$
$N = 29$ years
$PV = \$17239$
$M = 52$
$i = ?$
$FV = ?$

∴ Future value will be $2136122.033.

1. b) Given the cash flows below and an annual interest rate of **10%** compounded annually, find the **Future Value (FV)** of all cash flows at the end of **Year 5**.

Solution:

Year	Cash inflow	Cash outflow	Cash flow
0	0	10000	-10000
1	3000	2000	1000
2	4500	1500	3000
3	5000	3500	1500
4	6000	4000	2000
5	7500	0	7500

Here,

$i = 10\% = 0.1$

Now,

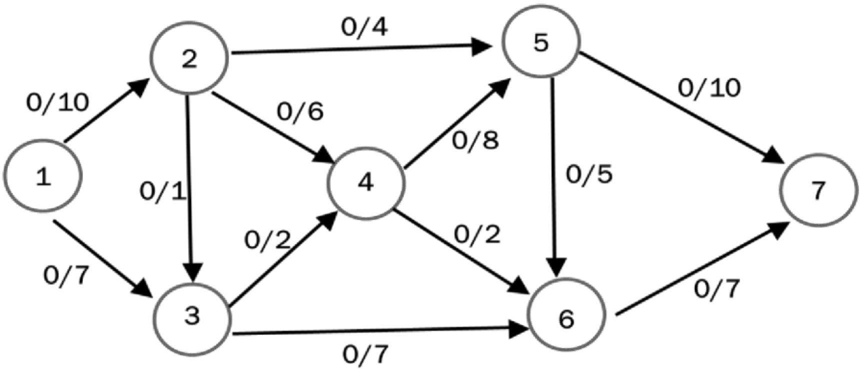
For Year 5, $FV_5 = 7500$
For Year 4, $FV_4 = 2000 \times (1 + 0.1)^1 = 2200$
For Year 3, $FV_3 = 1500 \times (1 + 0.1)^2 = 1815$
For Year 2, $FV_2 = 3000 \times (1 + 0.1)^3 = 3993$
For Year 1, $FV_1 = 1000 \times (1 + 0.1)^4 = 1461.1$
For Year 0, $FV_0 = -10000 \times (1 + 0.1)^5 = -16105.1$

∴ Future Value at the end of Year 5,

$$\begin{aligned} FV &= 7500 + 2200 + 1815 + 3993 + 1461.1 - 16105.1 \\ &= 864 \end{aligned}$$

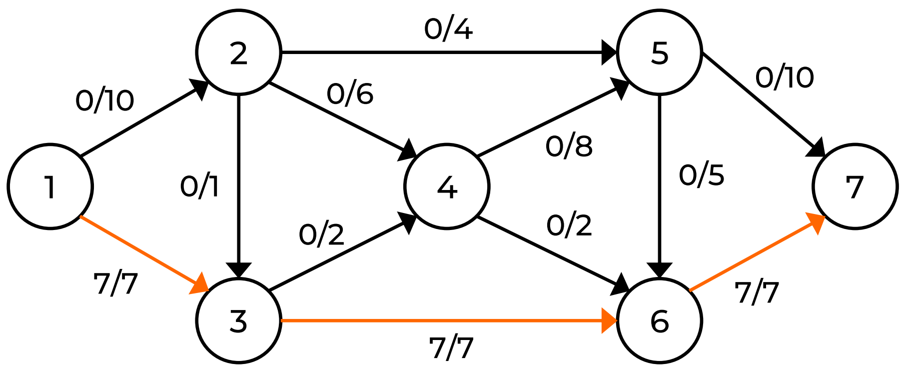
∴ Future Value of all cash flows at the end of Year 5 is $864.

2. a) Find Maximum Flow.



Solution:

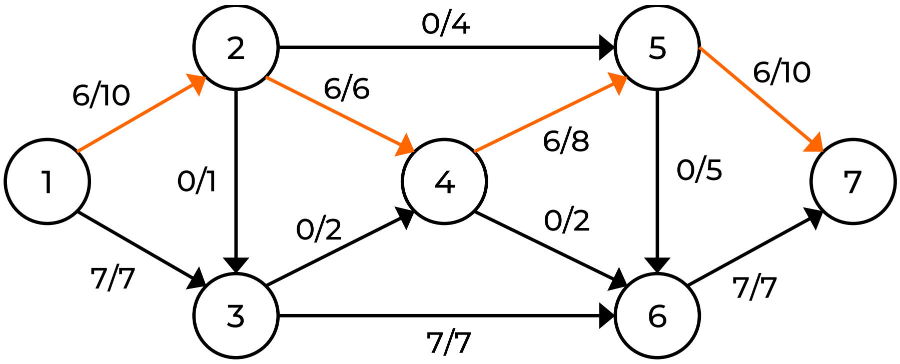
1st Trial:



Augmented path: 1 → 3 → 6 → 7 *(Bottleneck = 7)*

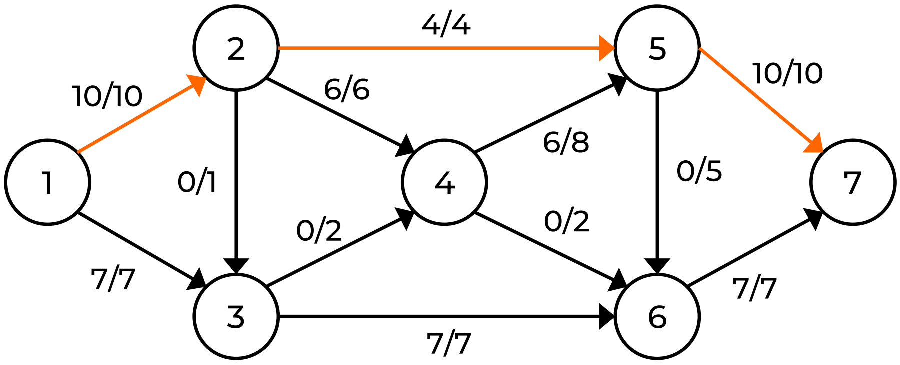
2nd Trial:

[P.T.O]



Augmented path: 1 → 2 → 4 → 5 → 7 *(Bottleneck = 6)*

3rd Trial:



Augmented path: 1 → 2 → 5 → 7 *(Bottleneck = 4)*

No more flow is possible.

∴ Maximum flow $= 10 + 7 = 17$

2. b) Two projects are given

Project "A"

Year	0	1	2	3	4	5
Cash Flow	-26200	6520	18500	9700	16300	20000

Project "B"

Year	0	1	2	3	4	5
Cash Flow	-25,200	8,900	10,000	6,200	6,600	17,500

Now select the project using **the Discounted payback period method** and consider the rate = **22%** compounded **quarterly**. Which project should you select?

Solution:

We know,

$$i = \left(1 + \frac{i_{NOM}}{M}\right)^M - 1$$

$$\text{or, } i = \left(1 + \frac{0.22}{4}\right)^4 - 1$$

$$\therefore i = 0.2388$$

Here,

$$i_{NOM} = 22\% = 0.22$$
$$M = 4$$
$$i = ?$$

Project A:

Years	Cash Flow	Discounted Cash Flow	Cumulative Discounted CF
0	−26200	−26200	−26200
1	6520	5263.16	−20936.84
2	18500	12055.06	−8881.78
3	9700	5102.33	−3779.45
4	16300	6921.22	3141.77
5	20000	6855.26	

$\therefore$ Discounted $PBP = 3 + \dfrac{3779.45}{6921.22} = 3.55$ years

Project B:

Years	Cash Flow	Discounted Cash Flow	Cumulative Discounted CF
0	−25200	−25200	−25200
1	8900	7184.37	−18015.63
2	10000	6516.25	−11499.38
3	6200	3261.28	−8238.10
4	6600	2802.46	−5435.64
5	17500	5998.35	562.71

$\therefore$ Discounted $PBP = 4 + \dfrac{5435.64}{5998.35} = 4.91$ years

Since Payback Period of Project A is lower, therefore Project A should be choose.

3. a) What do you mean by Economic order quantity? Explain with the necessary diagrams.

Solution:

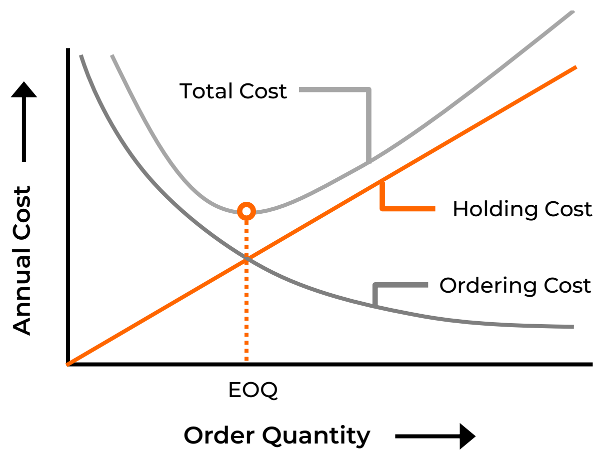


Fig: Economic Order Quantity

Economic Order Quantity (EOQ) is the ideal order quantity a company should purchase to minimize the total costs of inventory management, which include:

- Ordering cost
- Holding cost

The EOQ model helps to determine how much stock to order each time so that the combined cost of ordering and holding inventory is the possible lowest cost.

3. b)

Year	0	1	2	3	4	5
Cash Flow	-65000	19,000	13,300	17,000	26,500	11,200

Calculate the **IRR**, starting from 8%, and show necessary calculations.

Solution:

We know,

$$PV = \frac{FV}{(1+i)^N}$$

$$\therefore NPV = -65000 + \frac{19000}{(1+i)^1} + \frac{13300}{(1+i)^2} + \frac{17000}{(1+i)^3} + \frac{26500}{(1+i)^4} + \frac{11200}{(1+i)^5}$$

Now,

For $i = 8\%$, $NPV = 4591.17$
For $i = 9\%$, $NPV = 2802.46$
For $i = 10\%$, $NPV = 1090.99$
For $i = 11\%$, $NPV = -555.03$

∴ IRR is between 10% to 11%.

4. a) A certain chip factory has a monthly demand of 660 units. The production rate of Fried chips is 200 per day. The demand for these produced chips is 1050 per week, the set-up cost is $40, the holding cost is $3.5, the number of working days is 320 in a year, and the lead time is 7 days. Determine the **optimal production order quantity** and **reorder point**.

Solution:

We know,

Optimal Production Order Quantity,

$$Q^* = \sqrt{\frac{2DS}{H\left(1-\frac{d}{p}\right)}}$$

$$\text{or, } Q^* = \sqrt{\frac{2 \times 7920 \times 40}{3.5 \times \left(1-\frac{150}{200}\right)}}$$

$$\therefore Q^* = 850.95 \approx 851 \text{ units}$$

Here,

$D = 660 \times 12$ units
$= 7920$ units
$p = 200$ units per day
$d = \frac{1050}{7}$ units per day
$= 150$ units per day
$S = \$40$
$H = \$3.5$
$L = 7$ days

And,

Reorder Point,

$$ROP = d \times L$$

$$\text{or, } ROP = 150 \times 7$$

$$\therefore ROP = 1050 \text{ units}$$

∴ Optimal production order quantity is 851 units and reorder point is 1050 units.

4. **b)** A steel factory is open for 230 days a year. The demand for refractory material in the factory is 100 bags per day. Whenever an order is placed, it costs $48, and the holding cost per unit per year is 40%. The quantity schedule chart is given below. Determine **Optimal order quantity** and **Total cost** associated with it.

Discount Number	Discount quantity	Discount %	Discount price $
1	0 to 500	No discount	17
2	501 to 700	10%	?
3	701 and over	14%	?

Solution:

Here,

$$D = 100 \times 230 \text{ units} = 23000 \text{ units}$$
$$S = \$48$$

For Discount 1,

Optimal Order Quantity,

$$Q_1^* = \sqrt{\frac{2DS}{H}}$$

$$\text{or, } Q_1^* = \sqrt{\frac{2 \times 23000 \times 48}{6.8}}$$

$$\text{or, } Q_1^* = 569.83 \approx 570$$

Here,

$$\text{Price} = \$17$$
$$H = \$17 \times 40\%$$
$$= \$6.8$$

Since 570 is not between 0 to 500,

$$\therefore Q_1^* = 500$$

Total Cost,

$$TC_1 = \text{Setup Cost} + \text{Holding Cost} + \text{Product Cost}$$

$$\text{or, } TC_1 = \frac{D}{Q_1^*} S + \frac{Q_1^* H}{2} + \text{Price} * D$$

$$\text{or, } TC_1 = \frac{23000}{500} \times 48 + \frac{500 \times 6.8}{2} + 17 \times 23000$$

$$\therefore TC_1 = \$394908$$

For Discount 2,

Optimal Order Quantity,

$$Q_2^* = \sqrt{\frac{2DS}{H}}$$

$$\text{or, } Q_2^* = \sqrt{\frac{2 \times 23000 \times 48}{6.12}}$$

$$\therefore Q_2^* = 600.65 \approx 601$$

Here,

$$\text{Price} = \$17 - \$17 \times 10\%$$
$$= \$17 - \$1.7$$
$$= \$15.3$$
$$H = \$15.3 \times 40\%$$
$$= \$6.12$$

Total Cost,

$$TC_2 = \text{Setup Cost} + \text{Holding Cost} + \text{Product Cost}$$

$$\text{or, } TC_2 = \frac{D}{Q_2^*}S + \frac{Q_2^* H}{2} + \text{Price} * D$$

$$\text{or, } TC_2 = \frac{23000}{601} \times 48 + \frac{601 \times 6.12}{2} + 15.3 \times 23000$$

$$\therefore TC_2 = \$355575.99$$

For Discount 3,

Optimal Order Quantity,

$$Q_3^* = \sqrt{\frac{2DS}{H}}$$

$$\text{or, } Q_3^* = \sqrt{\frac{2 \times 23000 \times 48}{5.848}}$$

$$\text{or, } Q_3^* = 614.46 \approx 615$$

Here,

$$\text{Price} = \$17 - \$17 \times 14\%$$
$$= \$17 - \$2.38$$
$$= \$14.62$$
$$H = \$14.62 \times 40\%$$
$$= \$5.848$$

Since 615 is lower than 701 and over,

$$\therefore Q_3^* = 701$$

Total Cost,

$$TC_3 = \text{Setup Cost} + \text{Holding Cost} + \text{Product Cost}$$

$$\text{or, } TC_3 = \frac{D}{Q_3^*}S + \frac{Q_3^* H}{2} + \text{Price} * D$$

$$\text{or, } TC_3 = \frac{23000}{701} \times 48 + \frac{701 \times 5.848}{2} + 14.62 \times 23000$$

$$\therefore TC_3 = \$339884.62$$

Since TC_3 is lower than TC_1 and TC_2, therefore Optimal Order Quantity is 701 and total cost is $339884.62.

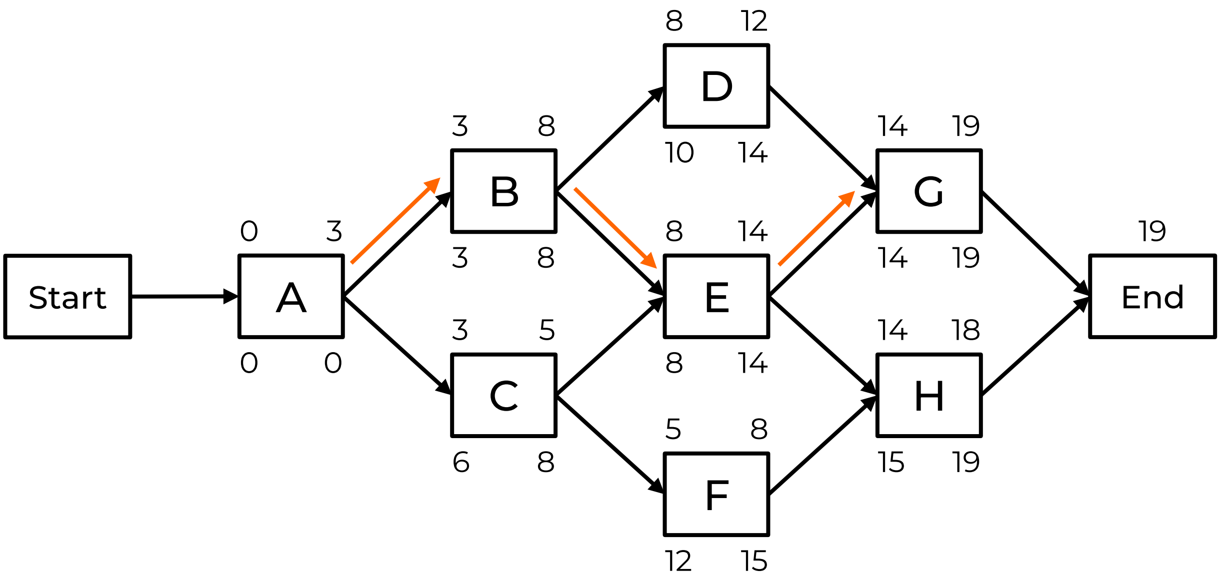
5. a)

Task	Predecessors	Duration
A	--	3
B	A	5
C	A	2
D	B	4
E	B, C	6
F	C	3
G	D, E	5
H	E, F	4

Find the Critical Path.

Solution:

Drawing the diagram based on given information:



∴ Critical Path: A → B → E → G

4. b) Find the benefit-cost ratio of the following project. Here the MARR is 14%

Year	0	1	2	3	4
Benifit	0	11500	11000	18500	8200
Cost	16000	6000	2500	7900	15000

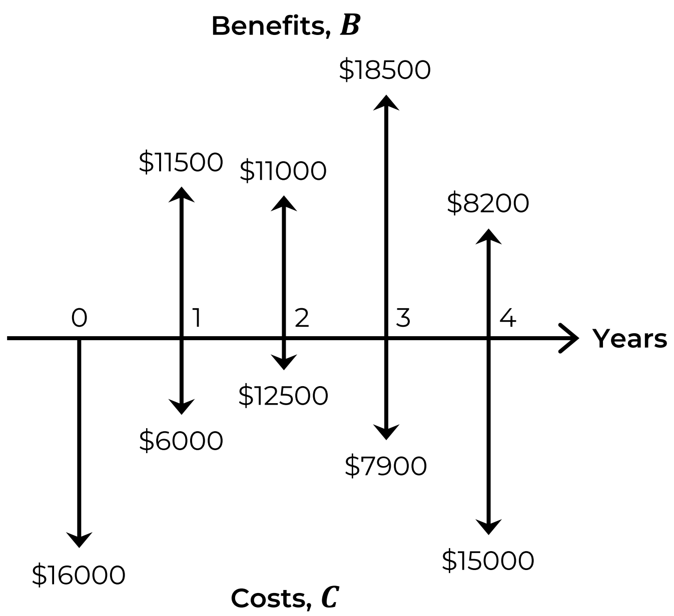
Solution:

We know,

Present Value, $PV = \dfrac{FV}{(1+i)^N}$

Here,

$i = 14\% = 0.14$



Calculating Net Present Value of Benefit,

$$B = \frac{11500}{(1+0.14)^1} + \frac{11000}{(1+0.14)^2} + \frac{18500}{(1+0.14)^3} + \frac{8200}{(1+0.14)^4}$$
$$= 35893.89$$

Calculating Net Present Value of Costs,

$$C = 16000 + \frac{6000}{(1+0.14)^1} + \frac{2500}{(1+0.14)^2} + \frac{7900}{(1+0.14)^3} + \frac{15000}{(1+0.14)^4}$$
$$= 37400.31$$

Now,

$$\text{Benefit Cost Ratio} = \frac{B}{C} = \frac{35893.89}{37400.31} = 0.96 < 1$$

Since the Benefit Cost Ratio is below 1, therefore this project should not be selected.