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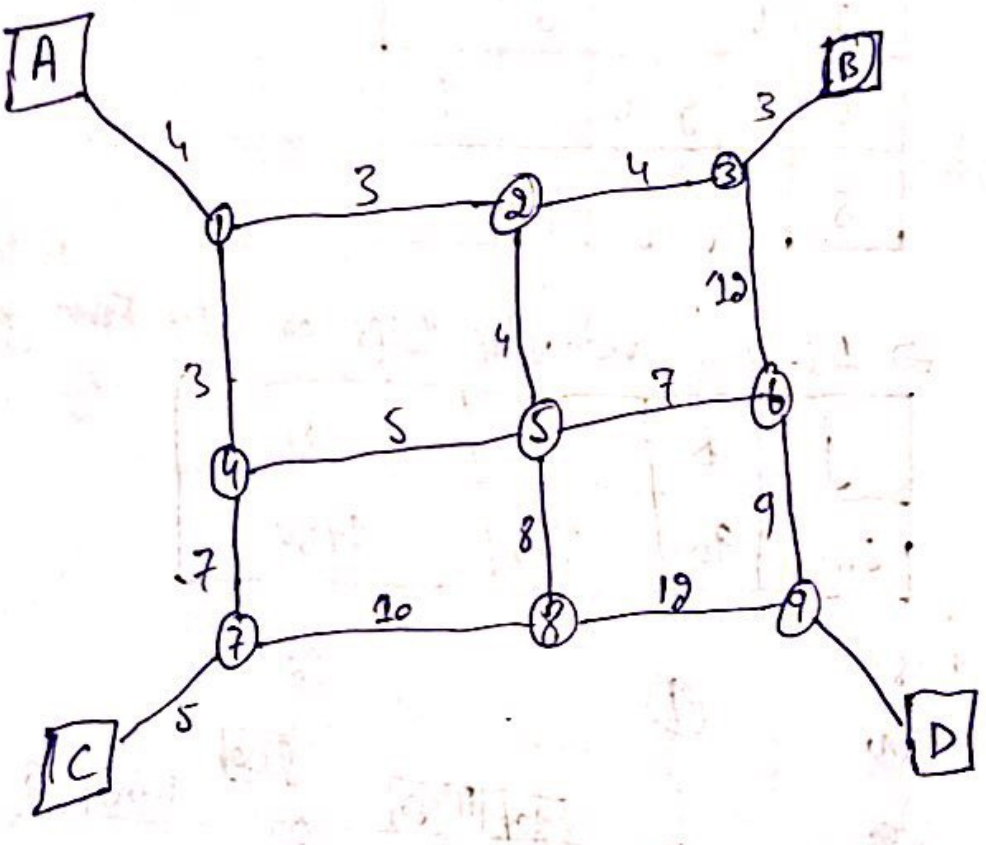
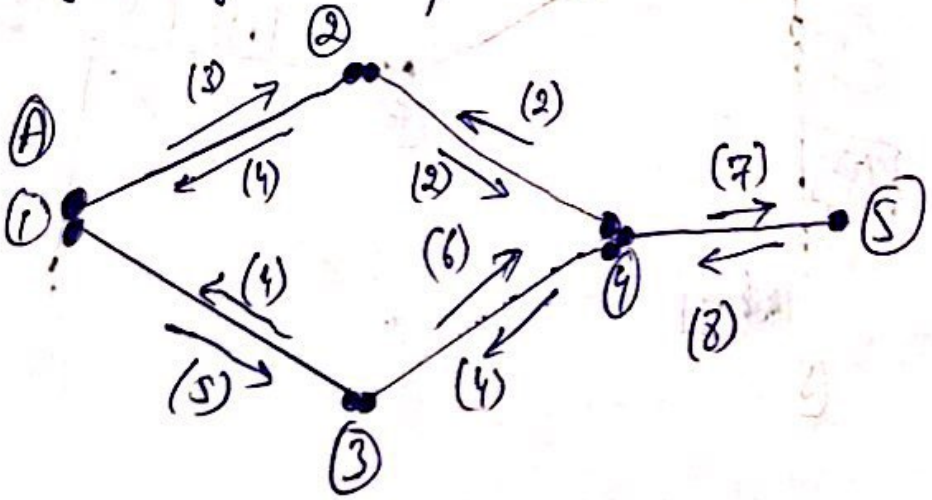
Final Semester Paper.

QUESTION 3 :- Find link array and minimum impedance tree originating from zone-A for the network described below.

Solution :-



Link Array originated from zone-A.

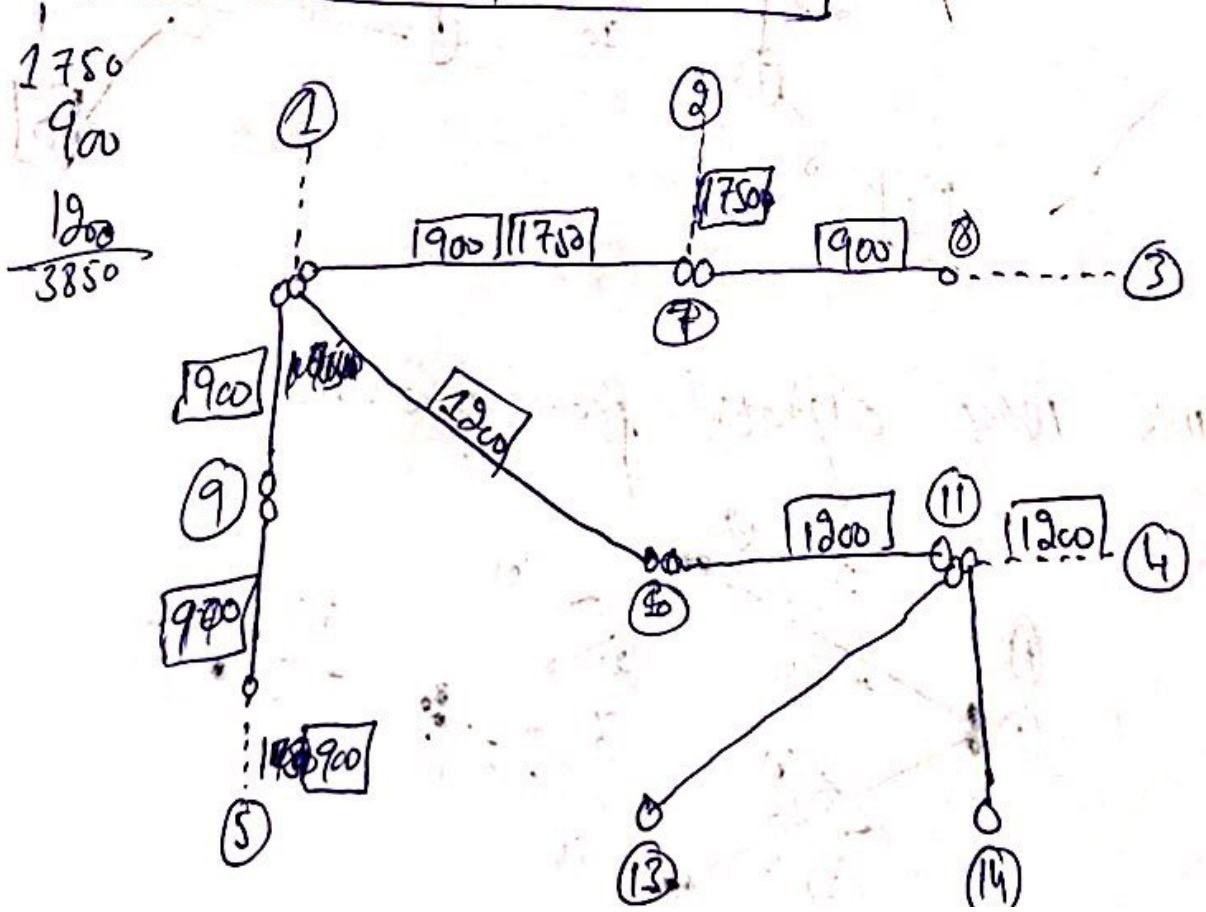


Link Array:-

i \ j	1	2	3	4	5
1		3	5		
2	4			2	
3	4			6	
4		2	4		7
5				8	

⇒ Intezonal, vehicular-trips originating from zone A.

j	B	C	D
Q_{Aj}	900	1200	1750



Node (1 to j)	Total impedance from Node-1 to Node j	Node preceding (j).
1	0	-
2	15	7
3	21	8
4	18	11
5	19	12
6	5	1
7	13	16
8	17	7

Question #04 :- The city government wants to start a transit service b/w three cities A, B & C. The alternatives are having the following attributes.

Ans :- Evaluation of Transportation proposals For Economic Efficiency :-

⇒ By using Net present value (NPV) :-

⇒ The NPV of an investment is the difference b/w the present worth of benefits and the present worth of costs.

$$NPV = PW(\text{Benefits}) - PW(\text{costs})$$

⇒ NPV reflects the value of the project at the time of the base year of the analysis which may be considered the year of decision making.

⇒ NPV provides a magnitude of net benefits in monetary terms.

We will select three alternatives A, B, & C.

1. CNG Bus.
2. Bus Rapid Transit.
3. Light Rail.

By using NPV. we will recommend which alternative will be feaseable.

For CNG Bus :- (Alternative A).

$$NPV = PW(\text{Benefits}) - PW(\text{costs})$$

NPV_A (In millions).

$$= 256 \times USPWF(7\%, 11) - 60 - 7.04\, USPWF(7\%, 11) + 11 \times SPPWF(7\%, 11)$$

$NPV_A = \$\ 256\ M$

For Bus Rapid Transit:-

$$NPV_B \text{ (In millions)} = 12\,USPWF(7\%,27) - 50 - 11\,USPWF(7\%,27) + 14\,SPPWF(7\%,27).$$

$$\boxed{NPV_B = \$198\,M}$$

For Light rail:-

$$NPV_C \text{ (In millions)} = 12\,USPWF(5\%,29) - 66 - 14\,USPWF(5\%,29) + 17\,SPPWF(5\%,29).$$

$$\boxed{NPV_C = 218\,M}$$

In all of the above NPV:
Alternative "A" is economically desirable.

12) The choice transport modes of a city includes autos (A), Light Circular Rail (LCR), Local Buses (LB), Riding Bikes (RB) & Fast Rail (FR). The utility functions of each mode are

S.No	Mode	Utility Functions	C	A	W	R
1	Autos	3.2-0.85C-0.015A-0.5W	300	6	4	25
2	Light Circular Rail	0.1-0.35C-0.025A-0.7W	70	7	10	30
3	Local Buses	1.7-0.15C-0.075-0.9A-0.8W	50	10	15	40
4	Riding Bikes	1.3-0.17C-0.012A-0.0W-0.9	45	1	0	20
5	Rapid Rail	1.5-0.25C-0.095A-0.6W	90	5	20	15

Sol: Part (a) (9) Utility Functions

$$U(A) = 3.2 - 0.85(300) - 0.015(60) - 0.5(4) - 0.035(25)$$
$$= -254.765.$$

$$U(LCR) = 1.0 - 0.35(70) - 0.025(7) - 0.7(10) - 0.05(30)$$
$$= -32.32.$$

$$U(LB) = 1.7 - 0.15(50) - 0.075(10) - 0.9(15) - 0.075(40)$$
$$= -23.5$$

$U(RB) = 1.3 - 0.17(45) - 0.012(1) - 0.0(0) - 0.095(20)$

$= -7.3$

$U(RR) = 1.5 - 0.25 - 0.95(4) - 0.6(\omega) - 0.025(R)$

$= 1.5 - 0.25(90) - 0.95(5) - 0.6(20) - 0.025(15)$

$= -33.85$

As we know

$$P(K) = \frac{e^{u}}{\Sigma x\, e^{u}}$$

$$P(A) = \frac{e^{-254.765}}{e^{-254.76} + e^{-269} + e^{-28.5} + e^{-7.3} + e^{-33.85}}$$

$= 0$

b) Total Revenue.

$P = 30\% - 0.05Q$

$R = Q(30 - 0.05Q)$

$R = 10Q - 0.05Q^2$

$dR/dQ = 10 - (0.05 \times 2)Q$

$R = 70 \times 0.7 = 56$

$LB = 50 \times 0.80$
$= 40$

$RR = 90 \times 0.9$
$= 81$

Total Revenue $= 56 + 40 + 81$
$= 181$

C) Subway Train Introduced

$U = 1.2 - 0.22C - 0.015A - 0.65W - 0.020R$

$U = 1.2 - 0.22(80) - 0.015(4) - 0.65(5) - 0.020(10)$
$= 3.1$

increased by 15%
$= 3.1 \times 1.15$
$= 3.2$

increased by 5%
$= 3.1 \times 1.05$
$= 3.13$

The revenue will be increased.

Zone i	Interzonal			
	Production	Attractiveness	1	2
Peshawar	67000	45	45	50
Charsadda	63000	37	30	45
Nowshehra	59400	24	50	75
Mardan	56200	28	65	70
DI Khan	53100	24	25	70
Swabi	50300	14	60	50
Abbottabad	47800	21	30	90
Kohat	51500	13	25	69

Using Table from Book Total numb
each category can be calculated, and
city.

Trip Generation

J	a_j	F_{1j}	K_{1j}	$a_j F_{1j} K_{1j}$	P_{1j}	Q_{1j}
1	70	4003345	1. 0	8.00	7.000	344
2	38	10066557	1. 0	3.00	6.584	875
3	27	44889768	1. 0	8.9	4.173	260
4	58	2577787	1. 0	2.5	8.243	365
5	77	7564565	3.0	2.2	4.67	776
6	66	565787	5.0	3.3	6.23	453
7	76	4646586	5.5	2.5	8.67	686
8	89	3558569	5.7	6.5	4.34	567
Total				0.0514	1.000	P_1=1500

Impedance.j							
Zone i	1	2	3	4	5	6	7
Peshawar	28	80	93	75	55	45	38
Charsadda	50	23	63	70	63	85	38
Nowshehra	35	90	15	73	60	48	40
Mardan	77	58	05	85	65	38	32
Katlang	53	83	83	73	55	53	35
DI Khan	73	25	35	25	13	18	15
Abbottabad	95	65	75	45	90	48	10
Kohat	52	23	10	55	54	35	43

The following table is formed by the product of **Gravity Model** with **Persons trips**
Trip generation, for corresponding category.

Now to find the number of Trip attractions, each trip will have a production and attraction so the **Productions** and **Attractions** should be equal in number.

Trip Attractions						
1	2	3	4	5	6	7
6,869,958	5,278,986	10,882,392	6,210,020	62,812,293	27,096,144	2,204,860

Land Use Category		Trips Generated						
		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7
Residential		990,720	2,689,200	1,586,952	3,015,300	1,612,435	25,938,720	2,030,910
Commercia	Retail	5,926,200	2,406,024	14,761,860	4,135,240	58,380,133	7,405,950	490,200
	Wholesales	2,016,900	966,960	2,412,240	563,195	5,403,900	366,480	77,400
	Services	2,659,320	652,224	882,740	2,376,220	59,172,705	3,440,840	564,160