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Transportation Planning &
Management

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SUBMITTED
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MS Transportation

Question No 01

J	A_j	$F_{1j} = 1/w_{1j}$	K_{1j}	$A_j F_{1j} K_{1j}$	P_{1j}
1	45	0.000010	1	0.0045	0.130
2	30	0.000037	1	0.0011	0.319
3	45	0.000010	1	0.0045	0.130
4	37	0.000019	1	0.0007	0.208
5	60	0.000046	1	0.00276	0.080
6	240	0.00000079	1	0.00017	0.005
7	45	0.000010	1	0.0045	0.130
8	480	0.00000090	1	0.00004	0.0012
				$\Sigma 0.0034$	$\Sigma 0.9987$ ≈ 1

Pesh	Chand	Mardan	Nowshera	Sauwadi	Abbod	Kohat	Dikhan
$Q_{1j} = 67000 \cdot P_{1j}$	63300X P_{1j}	59400X P_{1j}	56200X P_{1j}	53100X P_{1j}	53100X P_{1j}	47800X P_{1j}	51500X P_{1j}
8710	8229	7722	7306	6903	6539	6214	6695
21373	20192	18948	17927	16939	16045	15248	16428
8710	8229	7722	7306	6903	6539	6218	6695
13601	12849	12058	11408	10779	10210	9703	10454
5360	5064	4752	4496	4248	4024	3824	4120
335	316	297	281	265	251	239	257
8710	8229	7722	7306	6903	6539	6214	6695
80.4	76	71	68	63	60	57	62

$$A_1 = 8710 + 8229 + 7722 + 7306 + 6903 + 6539 + 6214 + 6695 = 58318$$

$$A_2 = 21373 + 20192 + 18948 + 17927 + 16939 + 16045 + 15248 + 16428 = 143100$$

$$A_3 = 8710 + 8229 + 7722 + 7306 + 6903 + 6539 + 6214 + 6695 = 58318$$

$$A_4 = 13601 + 12849 + 12058 + 11408 + 10779 + 10210 + 9703 + 10454 = 91062$$

$$A_5 = 5360 + 5064 + 4752 + 4496 + 4248 + 4024 + 3824 + 4120 = 40888$$

$$A_6 = 335 + 316 + 297 + 281 + 265 + 251 + 239 + 257 = 2241$$

$$A_7 = 8710 + 8229 + 7722 + 7306 + 6903 + 6539 + 6214 + 6695 = 58318$$

$$A_8 = 81 + 76 + 71 + 68 + 63 + 60 + 57 + 62 = 538$$

Question No 2

Finding Utilities for Roads.

$$\begin{aligned}\Rightarrow \text{AUTOS} &= 3.2 - 0.85C - 0.015A - 0.5W - 0.035R \\ &= 3.2 - 0.85(300) - 0.015(6) - 0.5W - 0.035(25) \\ &= 3.2 - 0.85(300) - 0.015(6) - 0.5(4) - 0.035(25) \\ &= 3.2 - 255 - 0.09 - 2 - 0.895 \\ U_{\text{AUTOS}} &= -254.765\end{aligned}$$

\Rightarrow Light Circular Rail:

$$\begin{aligned}&= 1.0 - 0.35C - 0.025A - 0.7W - 0.055R \\ &= 1.0 - 0.35(70) - 0.025(7) - 0.7(10) - 0.05(30) \\ &= 1.0 - 24.5 - 0.175 - 1.65 \\ U_{\text{LCR}} &= -32.32\end{aligned}$$

$$\begin{aligned}\Rightarrow \text{Local Bus} &= 1.7 - 0.15C - 0.75A - 0.9W - 0.075R \\ &= 1.7 - 0.15(50) - 0.75(15) - 0.9(15) - 0.075(40) \\ &= 1.7 - 7.5 - 0.75 - 13.5 - 3 \\ U_{\text{LB}} &= -23.05\end{aligned}$$

\Rightarrow Riding Bikes:

$$\begin{aligned}&= 1.3 - 0.17C - 0.012A - 0.075(0) - 0.0(W) \\ &= 1.3 - 0.17(45) - 0.012(1) - 0.07(20) \\ &= 1.3 - 7.65 - 0.012 - 1.9 \\ U_{\text{RB}} &= -8.262\end{aligned}$$

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⇒ Ripid fail:-

$$\begin{aligned} &= 1.5 - 0.25C - 0.095A - 0.6W - 0.025R \\ &= 1.5 - 0.25(90) - 0.095(5) - 0.6(20) - 0.025(75) \\ &= 1.5 - 22.5 - 0.475 - 12 - 0.375 \end{aligned}$$

$$URL = -33.85$$

Now,

$$P(\text{Autos}) = \frac{e^{UA}}{\sum e^{UN}}$$

$$= \frac{e^{-254.7}}{e^{-254.7} + e^{-32.32} + e^{-23.65} + e^{-8.26} + e^{-33.85}}$$

$$= \frac{e^{-254.7}}{e^{-352.18}}$$

$$= 0$$

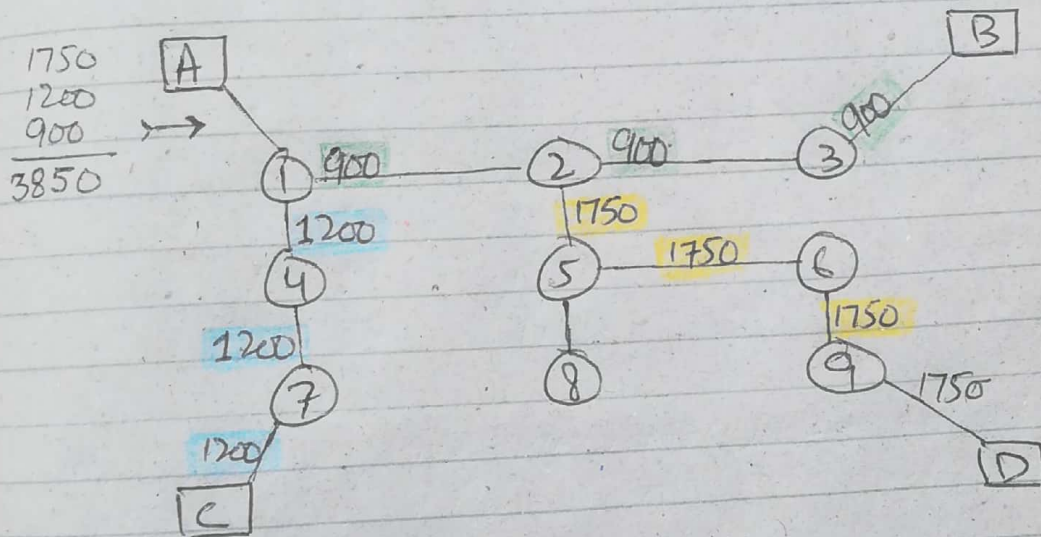
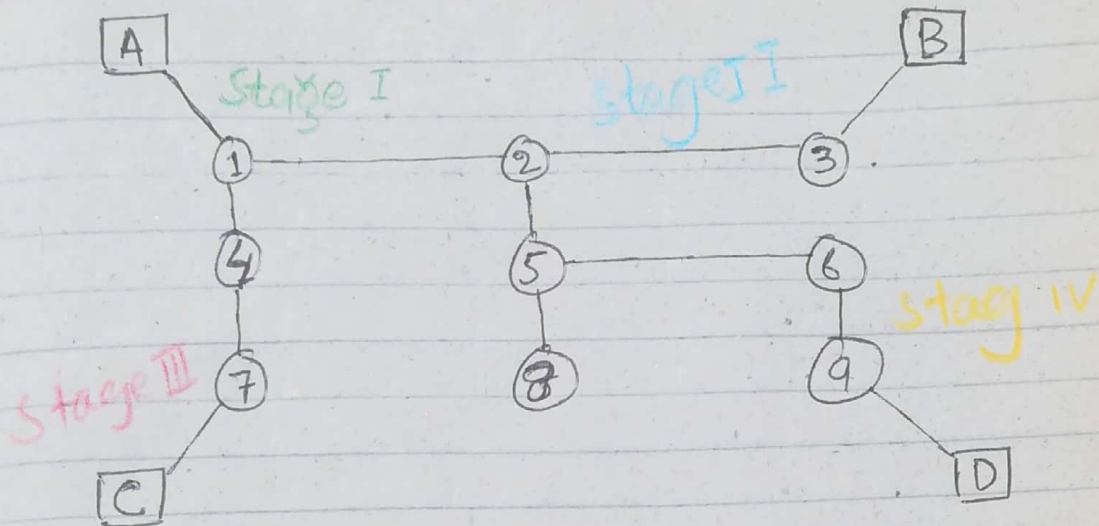
Question # 03

Stage	Link	Compute new path Impedance			Compare to tree	Decision
N	i j				Table N-1	
I	A 1	0	4	4	$4 < \text{Infinity}$	Accepted
II	1 2	4	3	7	$7 < //$	"
	1 4	4	3	7	$7 < //$	"
	2 3	7	4	11	$11 < //$	"
	2 5	7	4	11	$11 < //$	"
	3 B	11	3	14	$14 < //$	"
	3 6	11	12	23	$23 > 18$	Rejected
	4 5	7	5	12	$12 > 11$	Rejected
IV	4 7	7	7	14	$14 < \text{Infinity}$	Accepted
	5 6	11	7	18	$18 < //$	"
	5 8	11	8	19	$19 < //$	"
III	6 9	18	9	27	$27 < //$	"
	7 C	14	5	19	$19 < //$	"
IV	7 8	14	10	24	$24 > 19$	Rejected
	8 9	19	12	31	$31 > 27$	Rejected
	9 D	27	4	31	$31 < \text{Infinity}$	Accepted

Now, Minimum Impedance from Zone-A to all other Zones & Nodes after Removal of Rejected Links.

Stage N	i j	Compute new path Impedance			Comparison	Decision
I	A 1	0	4	4	$4 < \text{Infinity}$	Accepted
II	1 2	4	3	7	$4 < //$	"
	1 4	4	3	7	$4 < //$	"
	2 3	7	4	11	$11 < //$	"
	2 5	7	4	11	$11 < //$	"
	3 B	11	3	14	$14 < //$	"
	4 7	7	7	14	$14 < //$	"
IV	5 6	11	7	18	$18 < //$	"
	5 8	11	8	19	$19 < //$	"
	6 9	18	9	27	$27 < //$	"
III	7 C	14	5	19	$19 < //$	"
IV	9 D	27	4	31	$31 < //$	"

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Travel time = $t_0 = 1.5 \times 0.87 = 1.31$ mint
 Traffic flow (Veh/hr) = $Q = \frac{10000}{24} = 4166.67$
 $= 4583.33$

Practical capacity (Veh/hr) = $Q_{max} = 75,000/24$ veh/hr

$T_R = 1.31 \left[1 + 0.15 \left(\frac{4583.3}{3125} \right)^4 \right]$
 $1.31 [1.694] = 2.219$ mints

Link Operating Speed = $\left(\frac{36 \cdot 24}{2.2} \right) / 60 = 0.27$ mph

Question No 04.

Using net present value calculation.

⇒ CNG Bus:-

$$= 25 \text{ uspwf}(7\%, 11) - 60 - (16.048 + 7.99 \text{ uspwf}(7\%, 11) + 7.04 \text{ sppwf}(7\%, 11))$$

$$= -49.44$$

⇒ Bus Rapid transit:-

$$= 27 \text{ uspwf}(7\%, 12) - 50 - (19.589 + 19.116) \text{ uspwf}(7\%, 12) + 11 \text{ sppwf}(7\%, 12) + 11 \text{ sppwf}(7\%, 12)$$

$$= -82.49$$

⇒ Light Rail:-

$$= 29 \text{ uspwf}(5\%, 12) - 66 - (19.554 + 16) \text{ uspwf}(5\%, 12) + 14 \text{ (sppwf)}(5\%, 12) =$$

$$= -116.294$$

⇒ Fast Train:- $45 \text{ uspwf}(8\%, 14) - 95 - (31.132 + 19.35) \text{ uspwf}(8\%, 14) + 17 \text{ sppwf}(8\%, 14) = -134.36$

⇒ METRO:-

$$= 35 \text{ uspwf}(6\%, 18) - 70 - (25 + 19.535) \text{ uspwf}(6\%, 18) + 16 \text{ sppwf}(6\%, 8) = -167.64$$

Recommendation: CNG BUS.