Iqra National University

Final Term Exam Paper

Subject: Transportation Planning and Management

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Q1:

Calculation of the Trips distribution of each zone:

Peshawar:

For Peshawar Pi=67000						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.00049	1	0.022	0.2	13400
2	37	0.0011	1	0.04	0.36	24120
3	24	0.00049	1	0.012	0.11	7370
4	28	0.00073	1	0.02	0.18	12060
5	24	0.00027	1	0.0065	0.06	4020
6	14	0.000017	1	0.00036	0.0032	2144
7	21	0.00049	1	0.01	0.09	6030
8	13	0.0000043	1	0.000056	0.0005	33.5
Total				0.111	1	67000

Charsadda:

For Charsadda Pi = 63300						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.001	1	0.045	0.3	18990
2	37	0.001	1	0.037	0.23	14559
3	24	0.0016	1	0.038	0.24	15192
4	28	0.001	1	0.028	0.17	10761
5	24	0.00049	1	0.012	0.074	4684
6	14	0.00002	1	0.00028	0.0017	107.61
7	21	0.00027	1	0.000567	0.00035	22.155
8	13	0.000004	1	0.000052	0.00032	20
Total				0.161	1	63300

Mardan:

For Mardan Pi=59400						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.00049	1	0.022	0.169	10038
2	37	0.0016	1	0.059	0.45	11880
3	24	0.0011	1	0.026	0.2	11880
4	28	0.0044	1	0.123	0.94	55836
5	24	0.000031	1	0.00744	0.057	3385
6	14	0.000026	1	0.0004	0.003	178
7	21	0.00014	1	0.0029	0.018	1069
8	13	0.0000035	1	0.000045	0.00035	21
Total				0.13	1	59400

Nowshera:

For Nowshera Pi=56200						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.00073	1	0.033	0.132	7418
2	37	0.0011	1	0.041	0.164	9216
3	24	0.0044	1	0.105	0.42	23604
4	28	0.0016	1	0.044	0.176	9891
5	24	0.0011	1	0.026	0.104	5844
6	14	0.000031	1	0.000031	0.00012	6.7
7	21	0.00009	1	0.00189	0.0075	421
8	13	0.0000033	1	0.000043	0.00017	9
Total				0.25	1	56200

Swabi:

For Swabi Pi=53100						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.00027	1	0.012	0.098	5203
2	37	0.00049	1	0.018	0.15	7965
3	24	0.0011	1	0.026	0.86	45666
4	28	0.0011	1	0.03	0.24	12744
5	24	0.0008	1	0.0192	0.098	5203
6	14	0.000035	1	0.0005	0.0041	217.71
7	21	0.000076	1	0.0016	0.13	6903
8	13	0.0000029	1	0.000037	0.0003	16
Total				0.122	1	53100

Abbottabad:

For Abbottabad Pi=50300						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.000017	1	0.000765	0.03	1509
2	37	0.00002	1	0.000074	0.003	150.9
3	24	0.000026	1	0.00062	0.0248	1247
4	28	0.00003	1	0.00084	0.0336	1690
5	24	0.000035	1	0.00084	0.00336	169
6	14	0.0014	1	0.0196	0.11	5533
7	21	0.000013	1	0.0027	0.1	5030
8	13	0.0000019	1	0.000028	0.00112	56
Total				0.025	1	50300

Kotat:

For Kohat Pi=47800						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.00049	1	0.022	0.25	11950
2	37	0.00027	1	0.0099	0.1125	5377
3	24	0.00014	1	0.0034	0.039	1864
4	28	0.00009	1	0.0025	0.028	1338
5	24	0.000075	1	0.0018	0.02	956
6	14	0.000013	1	0.0018	0.02	956
7	21	0.0011	1	0.0242	0.277	13240
8	13	0.00052	1	0.0067	0.076	3639
Total				0.088	1	47800

DI Khan:

For DI Khan=51500						
J	a_j	F_{aj}	K_{aj}	$a_j F_{aj} K_{aj}$	P_{aj}	Q_{aj}
1	45	0.000043	1	0.002	0.083	4275
2	37	0.000004	1	0.00015	0.00625	322
3	24	0.0000035	1	0.000084	0.000336	17
4	28	0.0000033	1	0.000092	0.0038	195
5	24	0.000003	1	0.00072	0.03	1545
6	14	0.0000019	1	0.000026	0.0011	51
7	21	0.0000052	1	0.00011	0.0046	206
8	13	0.0016	1	0.021	0.875	45062
Total				0.024	1	51500

1= A1+A2…….A8=72783

2=322+1338……+2412=47843

3=17+956+…. +7370=96380

Like above we can find for every zone.

Q2:

The choice transport modes of a city includes: Auto (A), light Circular Rail (LCR), Local Buses (LB), Riding Bikes (RB) and 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 - 0.035R	300	6	4	25
2	Light Circular Rail	1.0 - 0.35C - 0.025A - 0.7W - 0.055R	70	7	10	30
3	Local Buses	1.7 - 0.15C - 0.075A - 0.9W - 0.075R	50	10	15	40
4	Riding Bikes	1.3 - 0.17C - 0.012A - 0.0W - 0.095R	45	1	0	20
5	Rapid Rail	1.5 - 0.25C - 0.095A - 0.6W - 0.025R	90	5	20	15

Auto (A)

UAuto:

3.2 - 0.85C - 0.015A - 0.5W - 0.035R

C-300 W, A=6, W=4 R=25

Utility functions:

U(Auto)=3.2-085*300-0.5*4-0.015*6-0.035*25=-254.765

Light circular rail:

1.0 - 0.35C - 0.025A - 0.7W - 0.055R

U(LCR)=1-0.35*70-0.025*7-0.7*10-0.05*30=-32.32

Local Bus:

1.7 - 0.15C - 0.075A - 0.9W - 0.075R

U(LB)=1.7-0.075*50-0.07*10-0.9*15-0.075*40=23.5

Riding Bikes:

1.3 - 0.17C - 0.012A - 0.0W - 0.095R

U(RB)=1.3-0.17*45-0.012*1-0.0*0-0.095*20=-7.3

Rapid rail:

1.5 - 0.25C - 0.095A - 0.6W - 0.025R

U(RR)=1.5—0.25*90-0.6*20-0.095*5-0.025*15=-33.85

As known

P (K)=$\frac{e^{uk}}{\sum_x e^{uk}}$

P(A)=$\frac{e^{-245.76}}{e^{-254.76}+e^{-26.9}+e^{-23.5}+e^{-7.3}+e^{33.85}} = 0$

P(LCR)=$\frac{e^{-32.9}}{6.75*10^{-4}} = 3.077$

P(LB)=$\frac{e^{-23.5}}{6.75*10^{-4}} = 0$

P(RB)=$\frac{e^{-7.3}}{6.75*10^{-4}} = 0$

P(RR)=$\frac{e^{-33.85}}{6.75*10^{-4}} = 0$

B:

When give subsidizes:

Subsidize with:

Light circular rail by 30%= 0.3*70=21+70=91

Local bus by 20%= 0.2*50=10+50=60

Rapid rail 10%=0.1*90=9+90=99

U(LCR)=1.0 - 0.35C - 0.025A - 0.7W - 0.055R=1-0.35*91-0.025*7-0.7*10-0.055*30=-39.67

U(LB)= 1.7 - 0.15C - 0.075A - 0.9W - 0.075R=1.7-0.15*60-0.075*10-0.9*15-0.075*40=-24.55

U(RL)= 1.5 - 0.25C - 0.095A - 0.6W - 0.025R=1.5-0.25*99-0.095*5-0.6*20-0.025*15=-36.1

P(K)=$\frac{e^{uk}}{\sum_e e^{ux}}$

P(Lcr)=$\frac{e^{-39.67}}{e^{-254.76}+e^{-39.76}+e^{-24.55}+e^{-36.1}+e^{33.85}} = \frac{5.9}{10.24} = 0.57$

P(LB)=$\frac{2.18}{10.240} = 0.21$

P(LB)=$\frac{1.16}{10.240} = 0.11$

Total per day trips:

Q(IJ) Lcr=0.57*30000=17100

QIJ LB=0.21*30000=5300

QI RL=0.11*30000=3300

QI Auto=0

QLB=0

QBR=0

QRR=0

Revenue for LCR=17100*91=1547000

Revenue for Local bus=5300*60=318000

Revenue for RL=99*3300=326700

C

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

U=1.2-0.22*80-.015*4-0.65*5-0.02*10=-19.91

Auto cost=1.15*300*1.15=396.75

Bike cost=1.05*45=47.25

Uaut0=-254.765

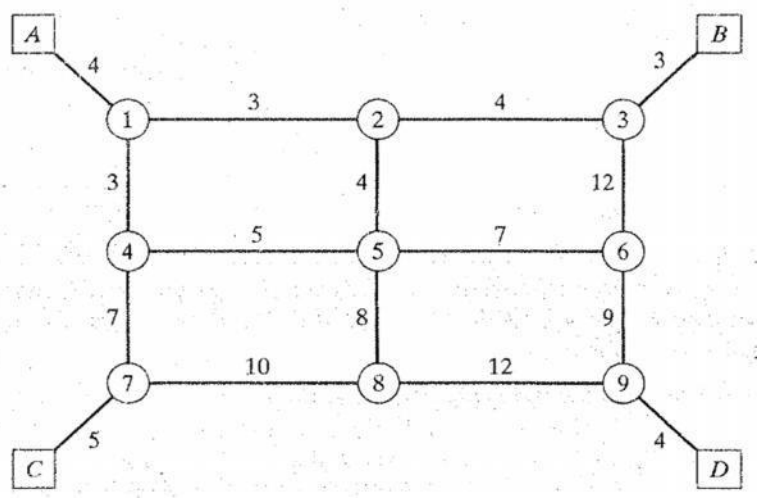
ULCR=-39.67

URB=-7.3

ULB=-24.55

URR=-36.1

Q3: Find link array and minimum impedance tree originating from Zone-A for the network describe below:



Assign the following interzonal vehicular-trips originating from Zone-A per hour to the above network.

If the travel time at practical capacity of link (5-6) 36.24-miles long is as shown in the network diagram above with assigned traffic of 75000 veh/day. What is the link operating? speed with $\alpha = 0.25$ and $\beta = 6$.

Interzonal vehicular-trips originating from Zone-A			
J	*B*	*C*	*D*
Q_{Aj}	*900*	*120* *0*	*1750*

i/j	A	1	2	3	B	4	5	6	7	C	8	9	D
A		4											
1	4		3			3							
2		3		4			4						
3			4					12					
B				3									
4		3							7				
5			4			5		7					
6				12			7					9	
7						7				5	10		
C									5				
8							8					12	
9								9			12		4
D													

Impedance FROM Zone A TO OTHER Zones & nodes

Stage N	Link		Compute new path impedance			Compare to tree table Stage N-1	Decision
	i	j					
I	A	1	0	4	4	4< Infinity	Accepted
II	1	2	4	3	7	7< Infinity	Accepted
	1	4	4	3	7	7 < Infinity	Accepted
	2	1	7	3	10	10> 4	Rejected
III	2	3	7	4	11	11 < Infinity	Accepted
	2	5	7	4	11	11 < Infinity	Accepted
	3	B	11	3	14	14 < Infinity	Accepted
	3	6	11	12	23	23> 18	Rejected
	3	2	11	4	15	15> 7	Rejected
	4	1	7	3	10	10> 4	Rejected
	4	5	7	5	12	12> 11	Rejected
	4	7	7	7	14	14 < Infinity	Accepted
	5	2	11	4	15	15> 7	Rejected
	5	4	11	5	16	16> 7	Rejected
	5	6	11	7	18	18 < Infinity	Accepted
	5	8	11	8	19	19 < Infinity	Accepted
	6	3	23	12	35	35 > 11	Rejected
	6	5	23	7	30	30 > 11	Rejected
	6	9	23	9	32	32> 31	Rejected
	7	4	14	7	21	21 > 7	Accepted
	7	8	14	10	24	24 > 19	Rejected
	7	C	14	5	19	19< Infinity	Accepted
iv	8	5	19	8	27	27> 11	Rejected
	8	9	19	12	31	31< Infinity	Accepted
	8	7	19	10	29	29> 14	Rejected
	9	D	32	4	36	36< Infinity	Accepted
	9	8	32	12	44	44> 19	Rejected
	9	6	32	9	41	41> 18	Rejected

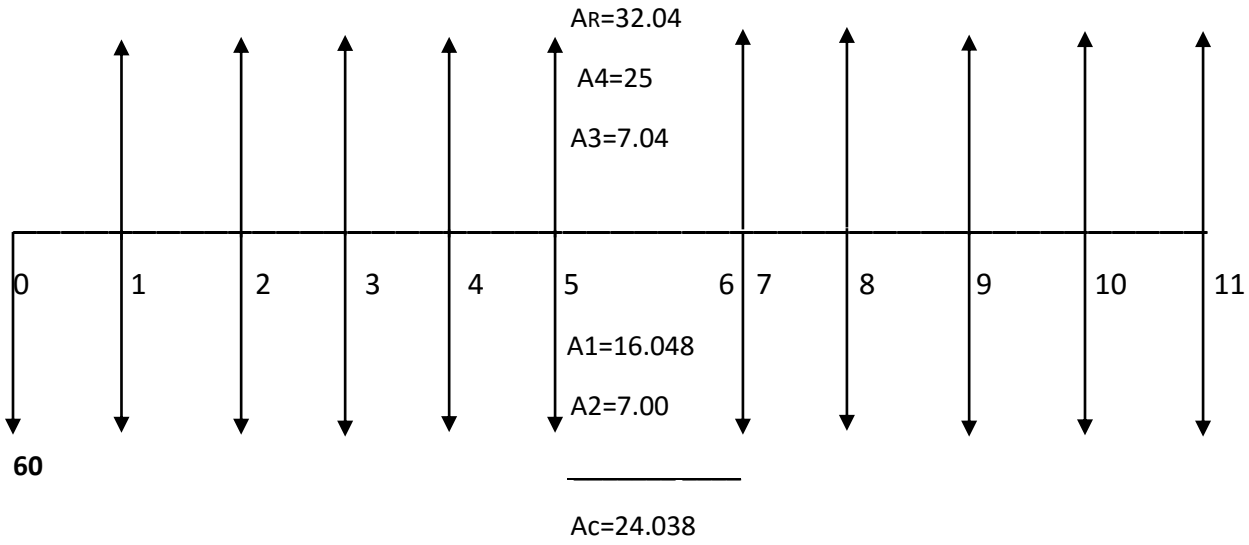
Minimum Impedance from Zone-A to all other zones and nodes after removal of rejected links

	Link		Compute new path impedance			Compare to tree table Stage N-1	Decision
	i	j					
I	A	1	0	4	4	4< Infinity	Accepted
II	1	2	4	3	7	7< Infinity	Accepted
	1	4	4	3	7	7 < Infinity	Accepted
III	2	3	7	4	11	11 < Infinity	Accepted
	2	5	7	4	11	11 < Infinity	Accepted
	3	B	11	3	14	14 < Infinity	Accepted
	4	7	7	7	14	14 < Infinity	Accepted
	5	6	11	7	18	18 < Infinity	Accepted
	5	8	11	8	19	19 < Infinity	Accepted
	7	4	14	7	21	21 > 7	Accepted
	7	C	14	5	19	19< Infinity	Accepted
Iv	8	9	19	12	31	31< Infinity	Accepted
	9	D	32	4	36	36< Infinity	Accepted

Q 4:

The City government want to start a transit service between A, B and C. the alternatives have the fowling attributes:

For CNG:



Formula:

NPV= initial cost + A2 (P|Ac 7÷11| – AR (P|AR 7÷11|)

Putting values

NPV = 60 + 180.260 – 240.267

NPV = 240.26 – 240.26

NPV = 0 = 0.007

For BRT:

NPV = 50 +31.705(7.943) -38 (7.943)

NPV = 50 + 251.8 – 301.8

NPV = 0 = 0.001185

For light Rail:

NPV = 66 + 35.554 (8.863) - 43 (8.863)

NPO = 0 = O.006102

For fast Train:

NPV = 95 + 50.477(8.244) – 57 (8.244)

NPV = 41.22

For Metro:

NPV = 70 + 44.535 (10.828) – 51 (10.828)

NPV = 0 = 0.00302

Conclusion:

According to my observation the fast train is more expensive than the rest of the alternatives.

And the other NPA are zero but I Recommend the BRT.