IQRA National University, Peshawar

Subject : Transportation Planning & Management (Final Term Paper)

Name : Amir Fareed

I.D # 14926

DEGREE : MS (CE)

Q1: Calculate the trips distribution of each zone. Note: (Impedance exponent is 3) (15)

Zone i		Productions	Attractiveness	Interzonal Impedance, j							
S.No	Name			1	2	3	4	5	6	7	8
1	Peshawar	67000	45	45	30	45	37	60	240	45	480
2	Charsadda	63300	37	30	30	25	30	45	220	60	500
3	Mardan	59400	24	45	25	30	15	30	195	85	535
4	Nowshera	56200	28	37	30	15	25	30	180	105	547
5	Swabi	53100	24	60	45	30	30	35	170	115	580
6	Abbottabad	50300	14	240	220	195	180	170	27	280	725
7	Kohat	47800	21	45	60	85	105	115	280	30	440
8	D.I Khan	51500	13	480	500	535	547	580	725	440	25

Ans:

Q . N O . (01) ANSWER (BELOW)

Zone,+D8:M22 i	Name	Trip Productions, P_i	Attractiveness, A_i
1	peshawar	67000	45
2	Charsada	63300	37
3	Mardan	59400	24
4	Nowshera	56200	28
5	swabi	53100	24
6	Abbot abad	50300	14
7	Kohat	47800	21
8	DI khan	51500	13

		for I=1 P1=67000							
Zone i		Interzonal impedance W_{ij}							
		Zone j							
		1	2	3	4	5	6	7	8
1	peshawar	45	30	45	37	60	240	45	480
2	Charsada	30	30	25	30	45	220	60	500
3	Mardan	45	25	30	15	30	195	85	535
4	Nowshera	37	30	15	25	30	180	105	547
5	swabi	60	45	30	30	35	170	115	580
6	Abbot abad	240	220	195	180	170	27	280	725
7	Kohat	45	60	85	105	280	230	30	440
8	DI khan	480	500	535	547	580	725	440	25

For i =1, P_1 = 67000							
j		a_j	F_{1j}	K_{1j}	$a_j F_{1j}K_{1j}$	P_{1j}	Q_{1j}
1	peshawar	45	1.1E-05	1	0.0004938	0.1634	10945
2	Charsada	37	4E-05	1	0.0013704	0.4533	28694
3	Mardan	24	1E-05	1	0.0002634	0.0871	5175
4	Nowshera	28	2E-05	1	0.0005528	0.1829	10276
5	swabi	24	5E-06	1	0.0001111	0.0368	1952
6	Abbot abad	14	7E-08	1	0.0000010	0.0003	17
7	Kohat	21	1E-05	1	0.0002305	0.0762	3644
8	DI khan	13	9E-09	1	0.0000001	4E-05	2
Total					0.0030	1	67000

For i =2, P_3 = 63300							
j		a_j	F_{3j}	K_{3j}	$a_j F_{3j}K_{3j}$	P_{3j}	Q_{3j}
1	peshawar	45	3.7E-05	1	0.00166667	0.2791	17666
2	Charsada	37	3.7E-05	1	0.00137037	0.2295	13630
3	Mardan	24	0.000064	1	0.001536	0.2572	14454
4	Nowshera	28	3.7E-05	1	0.00103704	0.1736	9221
5	swabi	24	1.1E-05	1	0.00026337	0.0441	2218
6	Abbot abad	14	9.39E-08	1	1.3148E-06	0.0002	11
7	Kohat	21	4.63E-06	1	9.7222E-05	0.0163	838
8	DI khan	13	8E-09	1	1.04E-07	2E-05	1
					0.00597209	1	

For i =, P_3 = 59400							
j		a_j	F_{3j}	K_{3j}	$a_j F_{3j}K_{3j}$	P_{3j}	Q_{3j}
1	peshawar	45	1.1E-05	1	0.00049383	0.0381	2261.3
2	Charsada	37	0.000064	1	0.002368	0.1825	10843
3	Mardan	24	3.7E-05	1	0.00088889	0.0685	4070.3
4	Nowshera	28	0.000296	1	0.0082963	0.6396	37989
5	swabi	24	3.7E-05	1	0.00088889	0.0685	4070.3
6	Abbot abad	14	1.35E-07	1	1.8881E-06	0.0001	8.6457
7	Kohat	21	1.63E-06	1	3.4195E-05	0.0026	156.58
8	DI khan	13	6.53E-09	1	8.4895E-08	7E-06	0.3887
					0.01297207	1	

For i =4, P_4= 56200							
j		a_j	F_{3j}	K_{3j}	$a_j F_{3j}K_{3j}$	P_{3j}	Q_{3j}
1	peshawar	45	1.97E-05	1	0.0008884	0.0736	4136.1
2	Charsada	37	3.7E-05	1	0.00137037	0.1135	6379.9
3	Mardan	24	0.000296	1	0.00711111	0.5891	33107
4	Nowshera	28	0.000064	1	0.001792	0.1485	8342.9
5	swabi	24	3.7E-05	1	0.00088889	0.0736	4138.3
6	Abbot abad	14	1.71E-07	1	2.4005E-06	0.0002	11.176
7	Kohat	21	8.64E-07	1	1.8141E-05	0.0015	84.456
8	DI khan	13	6.11E-09	1	7.9429E-08	7E-06	0.3698
					0.01207139	1	

For i= P5=53100							
j		a_j	F_{3j}	K_{3j}	$a_j F_{3j}K_{3j}$	P_{3j}	Q_{3j}
1	peshawar	45	4.63E-06	1	0.00020833	0.0671	3564
2	Charsada	37	1.1E-05	1	0.00040604	0.1308	6946.2
3	Mardan	24	3.7E-05	1	0.00088889	0.2864	15207
4	Nowshera	28	3.7E-05	1	0.00103704	0.3341	17741
5	swabi	24	2.33E-05	1	0.00055977	0.1803	9576.1
6	Abbot abad	14	2.04E-07	1	2.8496E-06	0.0009	48.749
7	Kohat	21	4.56E-08	1	9.5663E-07	0.0003	16.365
8	DI khan	13	5.13E-09	1	6.6628E-08	2E-05	1.1398
					0.00310393	1	

For i= P6=50300							
j		a_j	F_{3j}	K_{3j}	$a_j F_{3j}K_{3j}$	P_{3j}	Q_{3j}
1	peshawar	45	7.23E-08	1	3.2552E-06	0.0044	223
2	Charsada	37	9.39E-08	1	3.4748E-06	0.0047	239
3	Mardan	24	1.35E-07	1	3.2367E-06	0.0044	222
4	Nowshera	28	1.71E-07	1	4.8011E-06	0.0066	330
5	swabi	24	2.04E-07	1	4.885E-06	0.0067	335
6	Abbot abad	14	5.08E-05	1	0.00071127	0.9708	48830
7	Kohat	21	8.22E-08	1	1.726E-06	0.0024	118
8	DI khan	13	2.62E-09	1	3.4114E-08	5E-05	2
					0.00073269	1	

For i= P7=478090							
j		a_j	F_{3j}	K_{3j}	$a_j F_{3j}K_{3j}$	P_{3j}	Q_{3j}
1	peshawar	45	1.1E-05	1	0.00049383	0.3243	15502
2	Charsada	37	4.63E-06	1	0.0001713	0.1125	5377
3	Mardan	24	1.63E-06	1	3.908E-05	0.0257	1227
4	Nowshera	28	8.64E-07	1	2.4187E-05	0.0159	759
5	swabi	24	6.58E-07	1	1.578E-05	0.0104	495
6	Abbot abad	14	4.56E-08	1	6.3776E-07	0.0004	20
7	Kohat	21	3.7E-05	1	0.00077778	0.5108	24415
8	DI khan	13	1.17E-08	1	1.5261E-07	0.0001	5
					0.00152274	1	

For i= P8=51500							
j		a_j	F_{3j}	K_{3j}	$a_j F_{3j}K_{3j}$	P_{3j}	Q_{3j}
1	peshawar	45	9.04E-09	1	4.069E-07	0.0005	25
2	Charsada	37	8E-09	1	2.96E-07	0.0004	18
3	Mardan	24	6.53E-09	1	1.5673E-07	0.0002	10
4	Nowshera	28	6.11E-09	1	1.7108E-07	0.0002	11
5	swabi	24	5.13E-09	1	1.2301E-07	0.0001	8
6	Abbot abad	14	2.62E-09	1	3.6738E-08	4E-05	2
7	Kohat	21	1.17E-08	1	2.4653E-07	0.0003	15
8	DI khan	13	0.000064	1	0.000832	0.9983	51411
					0.00083344	1	

A1	**54322**
A2	**72128**
A3	**73472**
A4	**84670**
A5	**22793**
A6	**48948**
A7	**29288**
A8	**51423**

RERUIRED RESULTS

Q . N O . (02) ANSWER (BELOW)

SOLUTION OF QUESTION 02

Parts(I) Utility Functions

U(A)=3.2-.85(300)-.015(60)-.5(4)-.035(25)

=-254.765

U(LC) = 10-.35(70)-.025(7)-.7(10)-.05(30)

=-32.32

U(LB)= 1.7-.15(50)-.075(10)-.9(15)-.075(40)

= -23.5

U(RB)=13-.17(45)-.012(1)-0.0(0)-.093(20)

=-7.3

U(RR)=1.5-.25-.95(A)-.6(W)-.025(R)

=1.5-.25(90)-.95(5)-.6(20)-.025(15)

=-33.85

As we know that

P(K)=e*uk/Exe*ux

P(A)=e*-254.765/e-254.76+e*-23.5+e*-7.3+e*-33 =0.00

P(LCR)=e*-32.9/6.75x10*-4 =3.077

P(LB)=e*-23.5/6.75x10*-4=00

P(RB)=e*-7.3/6.75x10*-4=0

P(R Rail)=e*-33.85/6.75x10*-4=0

Part B): When give 30 subsidy

Autos	C	A	W	R
Light Circular Rail	210	6	4	25
Local Buses	49	7	10	30
Riding Bikes	35	10	15	40
Rapid Rail	63	5	20	15

Utility function for Autos

=3.2-.85C-.015A-.5W-.035R

Putting the Values

=3.2-.85(210)-.015(49)-.5(4)-.035(25)

=-177.16

U(L Rail)= 10-.35C-.025A-.7W-.055R

=1-.35(49)-.025(10)-.7(10)-.055(30)

=-.25.05

U Local bus= 1.7-.15C-.075A-9W-.075R

=1.7-(.15x35)-.075(10)-.9(15)-.075(40)

=-20.8

U riding bikes = 1.3- .17(31.5)-.012(1)-(.0*0)-.095(20)

=-5.967

U R rail = 1.5-.25C-1.95A-.6W-.25(03)-.09(50)-.6x20-.025x15

=-27.1

So as per formula

P(Auto)= e*-177.16/e*-177.16+e*-25.05+e*-20.8+e*-5.967+e*-27.1

= [0] =1.149x10*-77/2.56x10*-5

P(Auto)=0

P(LCR)=0

P(P(LB)=0

P(BB)=0

P(RR)=0

and as other values are zero for all modes of transportation

Part c:A sub way is introduced and and the cost of auto and bike are increases respectively 15 and 5%

Part ©

	C	A	W	R
Autos	345	6	4	25
Light Circular Rail	70	7	10	30
Local Buses	50	10	15	40
Riding Bikes	47	1	0	20
Rapid Rail	90	5	20	15
Sub way bus	80,	4,	5	10

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

So by putting the values to calculate the utility function

U(a)=	-293.825
U(LCR)=	-46.805
U(RT)=	-37.1
U(RB)=	-39.5775
U(RR)=	-62.65
U(Sub bus)	-69.76

P(a) =	0.0
P(LCR) =	21.0
P(RT) =	0.0
P(RB) =	0.0
P(RR) =	0.0
P(Su Busb) =	0.0

Individuals	(Auto) =	0	individuals/day
	(LCR) =	-983	individuals/day
	(RT) =	0	individuals/day
	(RB) =	0	individuals/day
	(RR) =	0	individuals/day
	Sub way bus	0	individuals/day

Revenue		
	(Auto) =	-3.3644E-104
	(LCR) =	-29501142.83
	(RT) =	-8.5935E-11
	(RB) =	-5.77787E-21
	(RR) =	-8.72933E-31
	Sub way bus	-5.28828E-25

Note:The calculation has been also done in excel using standard procedure and formula and we have got the same result there are some attach screen shots

Attributes	C	A	W	R	ak
Automobile	300	60	4	25	3.2
LCR	70	7	10	30	1
LBUs	50	10	15	40	1.7
Rdidng Bikes	45	1	0	20	1.3
Rapid railk	90	5	20	15	1.5
U(a)= -255.575					
U(LCR)= -64.655					
U(RT)= -49.85					
U(RB)= -37.665					
U(RR)= -85.6					
P(a) = 0.0					
P(LCR) = 0.0					
P(RT) = 0.0					
P(RB) = 0.0					
P(RR) = 0.0					
Qij (Auto) =	0	ndividuals/day			
Qij (LCR) =	0	ndividuals/day			
Qij (RT) =	0	ndividuals/day			

Abbrevation are used for all modes of tranport

Next two question

After two pages

Q . N O . (03) ANSWER (BELOW)

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

IMPEDEnCE FROM ZOnE A TO OTHER ZOnES & nODES

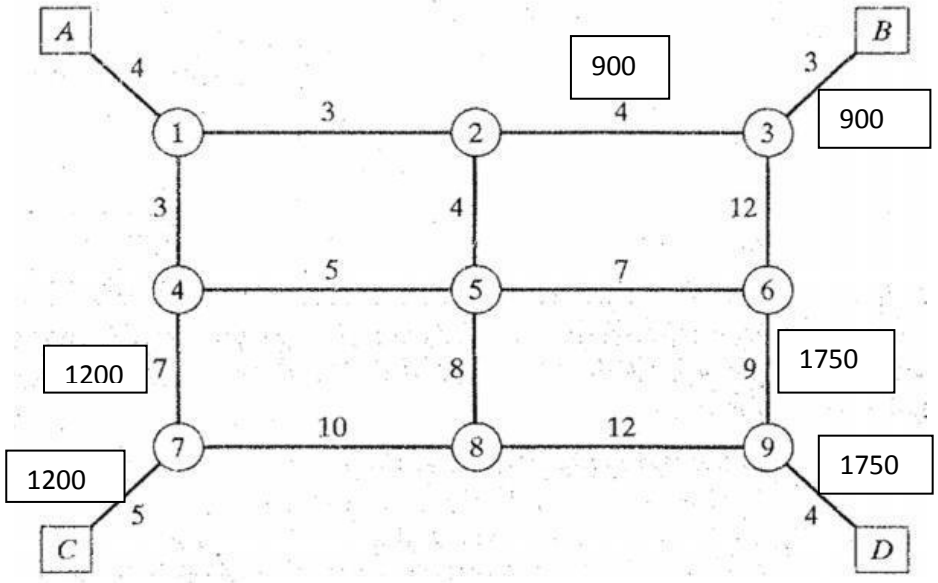
Stage N	Link		Compute new path impedance			Compare to tree table Stage N-1	Decision
	i	j					
I	A	1	0	4	4	4< Infinity	Accepted
II	1	2	4	3	7	7< Infinity	Accepted
	1	4	4	3	7	7 < Infinity	Accepted
	2	1	7	3	10	10> 4	Rejected
III	2	3	7	4	11	11 < Infinity	Accepted
	2	5	7	4	11	11 < Infinity	Accepted
	3	B	11	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	Rejected
	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	C	14	5	19	19< Infinity	Accepted
iv	8	9	19	12	31	31< Infinity	Accepted
	9	D	32	4	36	36< Infinity	Accepted

Final Tree Table		
Node (1 to j)	Total Impedance to node j	Node Preceding (j)
A	0	-
1	7	2
2	7	1
3	11	2
4	7	1
5	11	2
6	18	5
7	14	4
8	19	5
9	31	8

ASSIGn Vehicular.TRIPS TO nETWORK.



Link Operating Speed

Travel time at practical capacity = 7 mints

Travel time = T_0 = 7x 0.87 = 6.09 mints

Traffic flow (veh/hr) = Q = 75000/24 Vehicles/hour

practical capacity (veh/hr) = Q_{max} = 40000/24 Vehicles/hour

T_Q =6.09 [1 + 0.25($\frac{75000/24}{56250/24}$)^6] = 14.6 - minutes

Link Operating Speed = Length / time = 1mile/ 14.6 minutes

Link Operating Speed = Length / time = 1mile/ (14.6/60) hr = 4.1mph

Q . N O . (04) ANSWER (BELOW)

NPV = PW (BENEFITS) – PW (COSTS)
WE KnOW
USPWF = (1+i)^ n -1/i(1+i)^ n
SPPWF = 1/(1+i)^ n

SOLUTION:

(1) NPV(CNG BUS)

= 25 * USPWF (7%,11)- 60 - (24.038)*USPWF(7%,11)+7.04 (SPPWF) (7%,11)
By put values In above formulas (In rectangle) & then In equation we get
= - 49.27 MILL

(2) NPV(BUS RAPD TRASIT)

= 27 * USPWF (7%,12) - 50 - (31.704)*USPWF(7%,12) +11 (SPPWF) (7%,12)
By put values In above formulas (In rectangle) & then In equation we get

= - 82.61 MILL

(3) NPV(LIGHT RAIL)

= 29 * USPWF (5%,12) - 66 - (35.55)*USPWF(5%,12) +14 (SPPWF) (5%,12)
By put values In above formulas (In rectangle) & then In equation we get
= - 116.26 MILL

(4) NPV(FAST TRAIN)
By put values In above formulas (In rectangle) & then In equation we get
= 45 * USPWF (8%,14) - 95 - (50.47)*USPWF(8%,14) +17 (SPPWF) (8%,14)
= - 134.31 MILL

(5) NPV(METRO)

= 35 * USPWF (6%,18) - 70 - (44.53)*USPWF(6%,18) +16 (SPPWF) (6%,18)
By put values In above formulas (In rectangle) & then In equation we get
= - 167.3 MILL

RESULT : Alternative " METRO " is economically desirable With 18 year useful life.

AS we know alternative with the highest npv value considered to be most economically efficient.

THE END