CharSada	37	4E-05	1	0.0013704	0.45
Mardan	24	1E-05	1	0.0002634	0.087122
Nowshera	28	2E-05	1	0.0005528	0.182855
Swabi	24	5E-06	1	0.0001111	0.036755
Abbotabad	14	7E-08	1	0.0000010	0.000335 ~~0.076232~~
Kohat	21	1E-05	1	0.0000705	0.076232 ~~3.89E-05~~
Dikhan	13	9E-09	1	0.0000001	3.89E-05
Total =				0.0030	1

for i = 2 P_3 = 63300

	a_j	F_{3j}	K_{3j}	$a_j F_{3j} K_{3j}$	P_{3j}
Peshawar	45	3.7037E-05	1	0.0016666	0.279076
charSada	37	3.7037E-05	1	0.0013703	0.229462
Mardan	24	0.000064	1	0.001536	0.257196
Nowshera	28	3.7037E-05	1	0.0010370	0.173647
Swabi	24	1.09739E-05	1	0.0002633	0.044101

	Swabi	24	3.70−05	1	0.000888888		
6	Abbotabad	14	1.34864-07	1	1.8881−06	0.000146	8.645724
7	Kohat	21	1.628−06	1	3.4195-05	0.002636	1565812
8	Di Khan	13	6.5308-09	1	8.489−08	6.546−06	0.38874
	Total		=		0.012972069		

for $i = 4$ $P_4 = 56200$

j		aj	F_{3j}	K_{3j}	$a_j F_{3j} K_{3j}$	P_{3j}	Q_{3j}
1	Peshawar	45	1.974-05	1	0.0008883	0.07359	4136.05
2	charsada	37	3.703-05	1	0.00137037	0.11352	6379.9
3	Mardan	24	0.000296	1	0.007111	0.58908	33106.7
4	Nowshera	28	0.000064	1	0.001792	0.14845	8342.9
5	Swabi	24	3.703-05	1	0.000 88889	0.0736	4138.34
6	Abbotabad	14	1.71−07	1	2.4005−06	0.0000199	11.17

for i = 5 $P_5 = 53100$

j		aj	F_{3j}	K_{3j}	$aj F_{3j} K_{3j}$	P_{3j}	Q_{3j}
1	Peshawar	45	4.62963E-06	1	0.00020833	0.067119	3564.25
2	charSada	37	1.09739-05	1	0.00040636	0.130813	6946.18
3	Mardan	24	3.7037-05	1	0.00048888	0.286375	15206.5
4	Nowshera	28	3.703E-05	1	0.001037037	0.334104	17740.92
5	Swabi	24	2.33236-05	1	0.00055976	0.180341	9576.109
6	Abbatabad	14	2.03542-07	1	2.84958-06	0.000918	48.748
7	Kohat	21	4.55539-08	1	9.56633-07	0.00038	16.36
8	Di Khan	13	5.12526-09	1	6.66284-08	2.15-05	1.139
	Total	=			0.003103935		

for i = 6 $P_6 = 50300$

j	~~Peshawar~~	aj	F_{3j}	K_{3j}	$aj F_{3j} K_{3j}$	P_{3j}	Q_{3j}
1	charSada	37	0.000000007	1	0.0000003	0.0044	223
2	Mardan	24	0.000000009	1	0.0000003	0.0047	239
3	Nowshera	28	0.00000001	1	0.0000003	0.0044	222
4	Swabi	24	0.00000001	1	0.0000004	0.0065	330

j		aj	F3j	K3j	aj F3j K3j	P3j	Q3j
1	Peshawar	45	0.000001	1	0.00049	0.324	15502
2	Charsada	37	0.0000004	1	0.00017	0.1124	5377
3	Mardan	24	0.0000001	1	0.000003	0.02566	1227
4	Nowshera	28	0.00000008	1	0.000002	0.01588	759
5	Swabi	24	0.00000006	1	0.000001	0.01036	495
6	Abbatabad	14	0.000000004	1	0.00000006	0.0004	20
7	Kohat	21	0.000003	1	0.00077	0.5107	24415
8	Di Khan	13	0.00000001	1	0.00000001	0.0001	5
			Total =		0.001522739	0.	

for i = 8 P8 = 51500

j		aj	F3j	K3j	aj F3j K3j	P3j	Q3j
1	Peshawar	45	9.04225E-09	1	0.00000006	0.0004	25
2	Charsada	37	0.00000008	1	0.0000002	0.0003	18
3	Mardan	24	0.000000006	1	0.00000001	0.0001	10
4	Nowshera	28	0.000000006	1	0.00000001	0.0002	11
5	Swabi	24	0.0000000005	1	0.00000001	0.0001	8
6	Abbatabad	14	0.000000002	1	0.00000003	0.00004	2
7	Kohat	21	0.00000001	1	0.00000002	0.0002	15
8	Di Khan	13	0.00006	1	0.0008	0.9982	51411

$A_1 = 54322$

$A_2 = 72128$

$A_3 = 34472$

$A_4 = 84670$

$A_5 = 22793$

$A_6 = 48948$

$A_7 = 29288$

$A_8 = 51423$

QNo#02 Given data Take from Question

(a) utility function

$U(A)\ 3.2 - 0.85(300) - 0.015(60) - 05(4) + 0.035(25)$

$U(A) = \boxed{-254.765}$

$U(LcR) = 1.0 - 0.35(70) - 0.025(7) - 0.7(10) - 0.05(30)$

$U(LcR) = \boxed{-32.32}$

$U(LB) = 1.7 - 0.15(50) - 0.075(10) - 0.09(15) - 0.075(40)$

$U(LB) = \boxed{-23.5}$

$U(RB) = 1.3 - 0.17(45) - 0.012(1) - 0.0(0) - 0.025(20)$

$U(RB) = \boxed{-7.3}$

$U(RR) = 1.5 - 0.25 - 0.95(2) - 0.6(4) - 0.025(2)$

$U(RR) = -33.85$

As we know That

$P(K) = e^{UK} / E \times e^{UX}$

$P(A) = e^{-254.745}$

$$P(L+R) = \frac{e^{-32.9}}{6.75 \times 10^{-4}} = 3.077$$

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

$$P(RB) = \frac{e^{-73}}{6.75 \times 10^{-4}} = \boxed{0}$$

$$P(R\ Rail) = \frac{e^{-33.85}}{6.75 \times 10^{-4}} = \boxed{0}$$

Part (B) utility function for Autos **when 30 subsidy**

$$= 3.2 - 085c - 0.015A - 0.5W - 0.035R$$

$$= 0.$$

putting the values

$$3.2 - 0.85(2/0) - 0.015(49) - 0.05(4) - 0.035(25)$$

$$\boxed{= -177.16}$$

$U(L Rail) = 1.0 - 0.35C - 0.025A - 0.7W - 0.05R$

$= 1.0 - 0.35(49) - 0.025(10) - 0.7(10) - 0.05(30)$

$= \boxed{-25.05}$

$U(Local Bus) = 1.7 - 0.15C - 0.075A - 0.09W - 0.075R$

$= 1.7 - 0.15 \times 35 - 0.075(10) - 0.09(15) - 0.075(40)$

$= \boxed{-20.8}$

$U(Riding\ bikes) = 1.3 - 0.17(31.5) - 0.012 R - 0.0 \times 0$

$- 0.0095(20)$

$\boxed{= -5.967}$

$u(R Rail) = 1.5 + 25(83) - 0.05(30) - 0.6 \times 20 - 0.025 \times 15$

$= -27.1$

As per funal $PK = \frac{UK}{\Sigma e^{UK}}$

$P(Auto) = \frac{e^{-177.16}}{e^{-177.16} + e^{-25.05} + e^{-20.8} + e^{5.967} + e^{2.71}}$

$\boxed{= 0}$

Part(C) A Subway Bus

$U = 1.2 - 0.22c - 0.65w - 0.05R$

$c = 80$, $A = 4$, $w = 5$ and $R = 10$

$U(Auto) = 293.85$

$U(LoR) = -46.805$

$URT = -37.1$

$URB = -62.65$

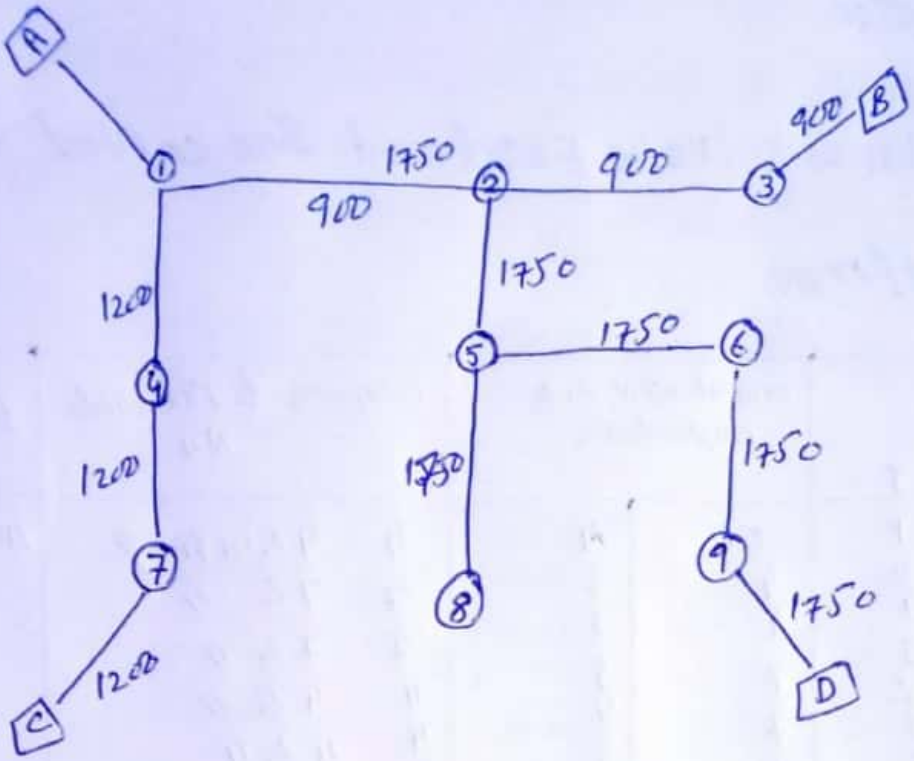
$U(subbus) = -69.78$

Solution:-

Question is solve in Excel and Then copied to written form

Link I	Link J	compute New path Impedence		compare to Tree Table N-1		Decision
A 1	1	0	4	4	4 < infinity	Accepted
1	2	4	3	7	7 < //	//
2	4	4	3	7	7 < //	//
2	3	7	4	11	11 < //	//
3	3	7	4	11	11 < //	//
3	5	11	12	14	14 < //	//
4	B	11	5	23	23 > 18	//
4	6	7	7	12	12 > //	Rejected
5	5	7	7	14	14 < //	Rejected
5	7	11	8	18	18 < //	//
6	6	11	9	19	19 < //	//
7	8	18	5	27	27 < //	//
7	9	14	10	19	19 < //	Rejected
7	C	14	12	24	24 > //	Rejected
8	8	19	4	31	31 < //	//
8	9	27		31	31 < //	
9	D					

Link I	Link J	compute New path Impedence	compare to Tree Table N-1	Decision



The Above diagram shows Link Array which is drawn

S.No	Alternative	Initial cost Million	Annual cost Million	Annual Maintance cost	Annual salvage value	Annual Revenue generation	useful life	Interest Rate
1	CNG Bus	60	16.048	7.99	7.04	25	11	7
2	BRT	50	19.589	12.116	11	27	12	7
3	Light Rail	66	19.554	16	14	29	12	5
4	Fast Train	95	31.132	19.345	17	45	14	8

For BRT

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

$NPV = 50 + 251.8 - 301.8$

$NPV = 0 = 0.001185$ Ans

For Light Rail:

$NPV = 66 + 35.554(8.863) - 4.3(8.863)$

$NPV = 0 = 0.006102$ Ans

For Fast Train:-

$NPV = 95 + 50.477(8.244) - 57(8.244)$

$NPV = 41.22$

For Metro:-

$NPV = 70 + 44.535(10.828) - 51(10.828)$

$NPV = 0.00302$

Conculsion:- According to the observation the fast Train is more expensive the rest of the Alternatives and the other NPV are zero but I Recommmed BRT.