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Internal Assessment Test 3– Dec 2020

Sub:	Urban Transportation Planning					Sub Code:	17CV751/ 15CV751	Branch:	CIVIL
Date:	18/12/2020	Duration	90 min	Max Marks:	50	Sem / Sec:	VII A, VII B		OBE

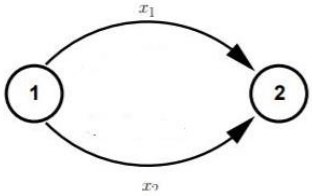
Answer Any Five Questions

		MARKS	CO	RBT
1	What do you understand by trip interchange modal split and what are the advantages of it?	[5]	CO3	L2
2.	What are the factors influencing mode choice?	[5]	CO3	L2
3.	What do you understand by capacity restraint technique and write a short note on BPR method.	[5]	CO4	L2
4.	Using California diversion curves, find the percentage of persons using motor way if the distance saved is 1 mile and time saved is 1 minute.	[5]	CO4	L3
5.	Explain minimum path tree using Moore's algorithm	[10]	CO4	L2
6.	Let the number of trips from i to j is 4000 and three modes are available which has the characteristics given in Table below. Compute the trips made by three modes and the fair required to travel by each mode.	[10]	CO3	L3

	t^v_{ij}	t^w_{ij}	t^t_{ij}	F_{ij}	ϕ_{ij}
coeff	0.02	0.03	0.05	0.1	0.1
car	25	-	-	15	5
bus	30	6	4	5	-
Train	15	12	3	4	-

7.	Let 1 and 2 are two nodes that are connected by 2 links (see the figure below) . The total traffic flow $x_1+x_2= 12$; Find traffic flow on each link x_1 and x_2 using UE assignment.	[10]	CO4	L3

$t_1=12+2x_1$



$t_2=18+2x_2$

Signature of CI **Signature of CCI** **Signature of HoD**

1 **What do you understand by trip inter-change modal split (3 marks) and what are the advantages of it?(2 marks)**

Modal split is considered after trip distribution stage
Zone to zone home based trips are known.
Using this as input, zone to zone public transport travels are determined based on
Characteristics of the person making trips
Characteristics of destination end of journey
Characteristic of transport system
Relative travel time and cost- parameters considered.

By subtracting zone to zone public transport trips from total zone to zone trips, the person-trips made by motor vehicles are derived.

This has the advantage that it is possible to include the characteristics of the journey and that of the modes available to undertake them.
It is also possible to include policy decisions.
This is beneficial for long term modeling

2. What are the factors influencing mode choice?

Characteristics of the trip maker -car availability and/or ownership; possession of a driving license; household structure (young couple, couple with children, retired people etc.);income
decisions made elsewhere, for example the need to use a car at work, take children to school, etc; residential density.
Characteristics of the journey: The trip purpose; for example, the journey to work is normally easier to undertake by public transport than other journeys because of its regularity and the adjustment possible in the long run; Time of the day when the journey is undertaken. Late trips are more difficult to accommodate by public transport.
Characteristics of the transport facility: Quantitative factors :relative travel time: in-vehicle, waiting and walking times by each mode, relative monetary costs (fares, fuel and direct costs);availability and cost of parking
Qualitative factors :comfort and convenience, reliability and regularity, protection, security

3.

The capacity restraint method considers the link travel time as a function of traffic volume going through the link. The volume of traffic to be assigned to each link of the network is decided based on the travel times. The travel time is variable and it will depend on factors like vehicle counts and number of lanes.

$$T = T_0\left[1+0.15\left(\frac{v}{c}\right)^4\right]$$

T_0= free flow travel time

4.

$$P = 50 + \frac{50(d + 0.5t)}{[(d-0.5t)^2 + 4.5]^{0.5}}$$

$$= 50 + \frac{50(1 + 0.5(1))}{[(1 - 0.5*1)^2 + 4.5]^{0.5}}$$

$$\boxed{P = 84.41\ y.}$$

5. Moore developed a method to deal with telephone calls on the basis of shortest path and this method was exploited in many computer programmes designed to assign traffic in street network.

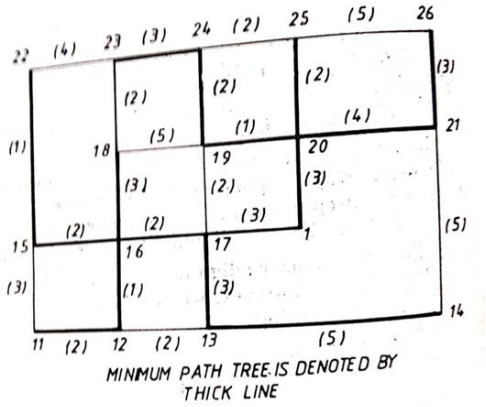
Network in figure consists of a zone centroid 1 and number of links and nodes.
The travel time on each link is shown in brackets

It is required to build minimum path tree from zone centroid 1

$T_{1\text{-}20} = 3$
$T_{1\text{-}17} = 3$

$T_{1\text{-}17\text{-}19} = 5$
$T_{1\text{-}17\text{-}16} = 5$
$T_{1\text{-}17\text{-}13} = 6.$

$T_{1\text{-}20\text{-}19} = 4$
$T_{1\text{-}20\text{-}25} = 6$
$T_{1\text{-}20\text{-}21} = 7.$



There are two possible routes to reach node 19.
1-17-19
1-20-19
The latter is shorter in time, so chosen
This process is repeated until all nodes have been covered by shortest path.

6.

Cost of travel by each mode

C_{car} cost of travel by car, $C_{car} = 0.02\times25 + 0.1\times15 + 0.1\times5$

$= 2.5$

Cost of travel by bus, $C_{bus} = 0.02\times30 + 0.03\times6 + 0.05\times4 + 0.1\times5$

$= 1.48$

Cost of travel by train, $C_{train} = 0.02\times15 + 0.03\times12 + 0.05\times3 + 0.1\times4$

$= 1.21$

Probability of choosing mode car $= P_{ij}^{car} = \dfrac{e^{-2.5}}{e^{-2.5}+e^{-1.48}+e^{-1.21}} = 0.1350$

Probability of choosing mode bus $= P_{ij}^{bus} = \dfrac{e^{-1.48}}{e^{-2.5}+e^{-1.48}+e^{-1.21}} = 0.3744$

Probability of choosing mode train $= P_{ij}^{train} = \dfrac{e^{-1.21}}{e^{-2.5}+e^{-1.48}+e^{-1.21}} = 0.4905$

Proportion of trip by car $T_{ij}^{car} = 4000 \times 0.1350$

$= 540$

Proportion of trip by bus $T_{ij}^{bus} = 4000 \times 0.3744$

$= 1497.6$

Proportion of trip by train $T_{ij}^{train} = 4000 \times 0.4905$

$= 1962$

7.

$$\min (z(x)) = \int_0^{x_1} (12 + 2x_1) \cdot dx + \int_0^{x_2} (18 + 2x_2) \cdot dx$$

$$= 12 \cdot x_1 + \frac{2x_1^2}{2} + 18x_2 + \frac{2 \cdot x_2^2}{2}$$

$$= 12x_1 + x_1^2 + 18x_2 + x_2^2$$

substituting $x_2 = 12 - x_1$

$$= 12x_1 + x_1^2 + 18(12 - x_1) + (12 - x_1)^2$$

$$= 12x_1 + x_1^2 + 216 - 18x_1 + 144 + x_1^2 - 24x_1$$

$$\min z(x) = 2x_1^2 - 30x_1 + 360$$

differentiating the above equation

$$0 = 4x_1 - 30$$

$$4x_1 = 30$$

$$\boxed{x_1 = 7.5}$$

$$x_2 = 12 - 7.5$$

$$= 12 - 7.5$$

$$\boxed{x_2 = 4.5}$$