

M.Sc. Remote Sensing and GIS

RT-202

Geographic Information System

Unit-IV

4.4 Network Analysis in GIS

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NETWORK ANALYSIS

- What is Network Analysis?

Network analysis enables you to solve problems, such as finding the most efficient travel route, generating travel directions, finding the closest facility, defining service areas based on travel time.

- Widely they are

- » Transportation network
- » Utility network

NETWORK ANALYSIS

- Rivers, Roadways, Telecommunication line, sewage, rail route etc.
- Network classification based on route,
 - Directed
 - Undirected

TRANSPORTATION NETWORK:

- Undirected networks.
- edge on a network may have a direction assigned to it, the person or resource being transported is free to decide the direction, speed, and destination of traversal. example-person in a car travelling on street.



UTILITY NETWORK:

- Directed network
- Path is predetermined
- It can be change but not by agent.



- In ArcGIS ,Transportation network modeled using network dataset.
- For Utility Dataset in ArcGIS modeled using geometric dataset.



NETWORK ANALYSIS:

- Network analysis analyze the way 'goods' can be transported along these lines (telecommunication lines , road etc)
Example: undirected roads.
- Network analysis can be done in raster or in vector.



TYPES OF OPERATION:

- Shortest path analysis
- Best Route
- Closest facility
- Allocation
- location-Allocation
- OD-cost matrix
- Network-partitioning



BEST ROUTE:

- Whether finding a simple route between two locations or one that visits several locations, people usually try to take the best route. But "best route" can mean different things in different situations.
- Best route can be the quickest, shortest, or most scenic route, depending on the impedance chosen.
- Impedance \rightarrow time, distance.





We use time as an impedance. The quickest path is shown in blue and has a total length of 4.5 miles, which takes 8 minutes to traverse.






We choose distance is chosen as the impedance. Consequently, the length of the shortest path is 4.4 miles, which takes 9 minutes to traverse.




Directions (Route)

[-] Route: Graphic Pick 1 - Graphic Pick 2 4.5 mi 8 min

- 1: Start at Graphic Pick 1 [Map](#)
- 2: Go west on 26th St toward Dolores St < 0.1 mi < 1 min [Map](#)
- 3: Turn right on Dolores St 1.1 mi 2 min [Map](#)
- 4: Turn left on 16th St 0.5 mi < 1 min [Map](#)
- 5: Turn right on Castro St 0.4 mi < 1 min [Hide](#)



- 6: Continue on Divisadero St 0.9 mi 2 min [Map](#)
- 7: Turn left on Geary Blvd 1.3 mi 2 min [Hide](#)



- 8: Turn right on 4th Ave 0.2 mi < 1 min [Map](#)
- 9: Finish at Graphic Pick 2, on the left [Map](#)

Total time: 8 min
Total distance: 4.5 mi

[+] Route: Graphic Pick 3 - Graphic Pick 4 0.6 mi 1 min

Options... Print Preview... Save As... Print Close

Along with the best route, ArcGIS Network Analyst provides directions with turn-by-turn maps that can be printed.



CLOSEST FACILITY:



Closest facility finds the closest facility, such as a hospital, fire station, or ATM, to any location on a network.



ALLOCATION:

- Allocation measures the efficiency of public facilities, such as fire stations, or school resources, in terms of their service areas.

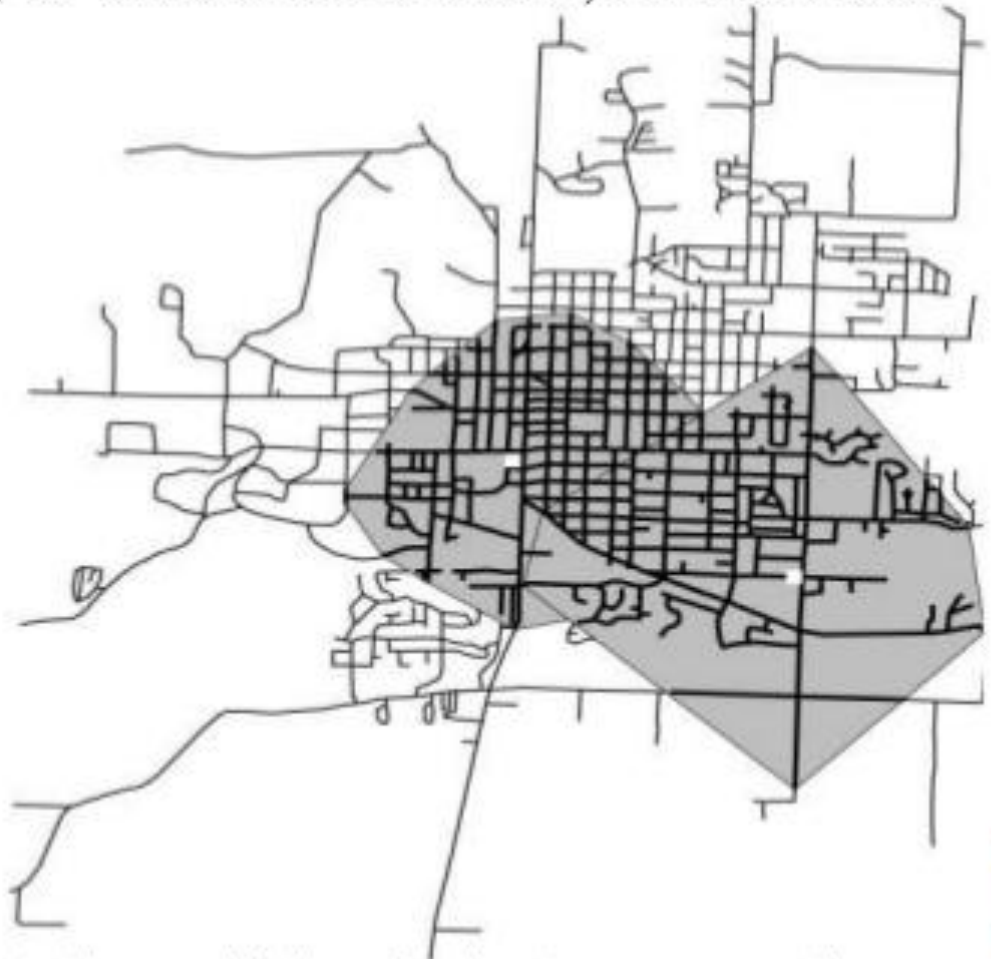


Figure:

Service areas of two fire stations within a 2-minute response time.

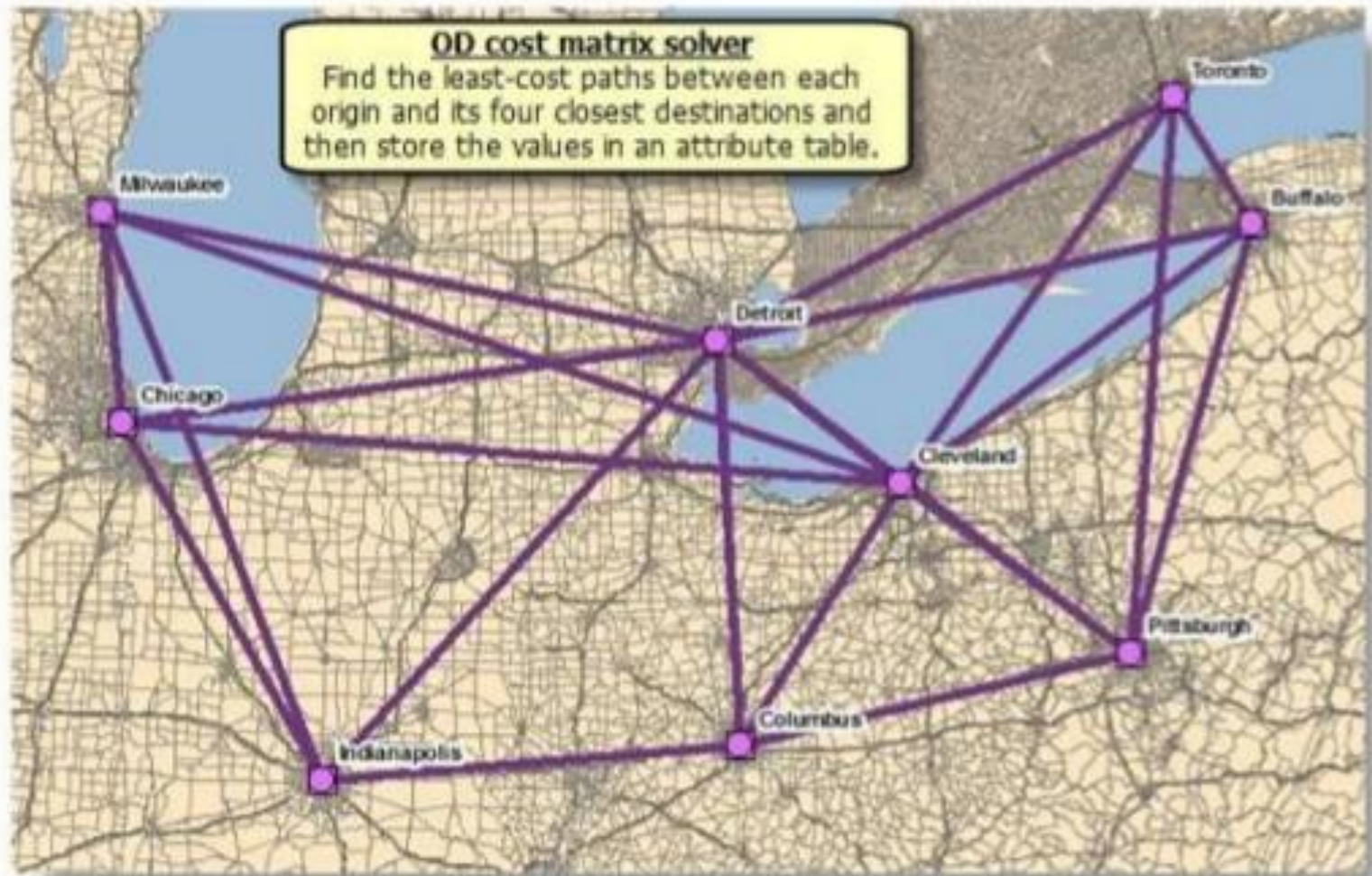
LOCATION-ALLOCATION:

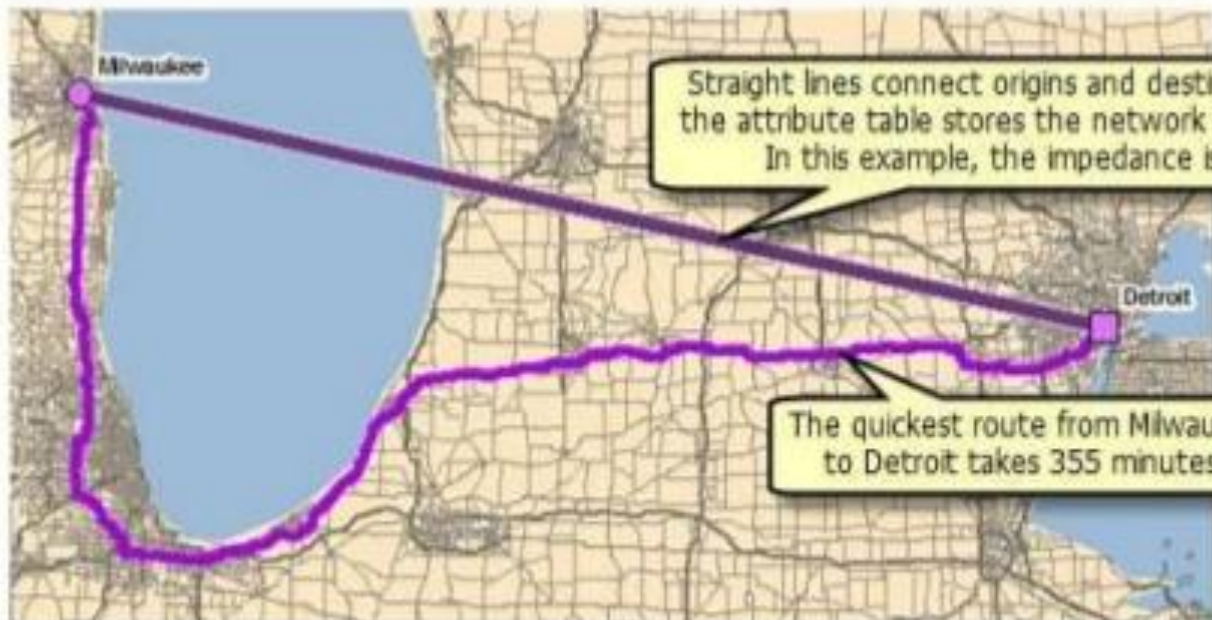
- Location-allocation helps you choose which facilities from a set of facilities to operate based on their potential interaction with demand points.



OD-COST MATRIX:

- OD cost matrix is a table that contains the network impedance from each origin to each destination.





Straight lines connect origins and destinations, but the attribute table stores the network impedances. In this example, the impedance is time.

The quickest route from Milwaukee to Detroit takes 355 minutes.

ObjectID	Shape	Name	OriginID	DestinationID	DestinationRank	Total_Time
133	Polyline	Buffalo - Detroit	5	2	5	252
134	Polyline	Milwaukee - Milwaukee	6	6	1	0
135	Polyline	Milwaukee - Chicago	6	1	2	98
136	Polyline	Milwaukee - Indianapolis	6	7	3	265
137	Polyline	Milwaukee - Detroit	6	2	4	355
138	Polyline	Milwaukee - Cleveland	6	3	5	419
139	Polyline	Indianapolis - Indianapolis	7	7	1	0
140	Polyline	Indianapolis - Columbus	7	9	2	100

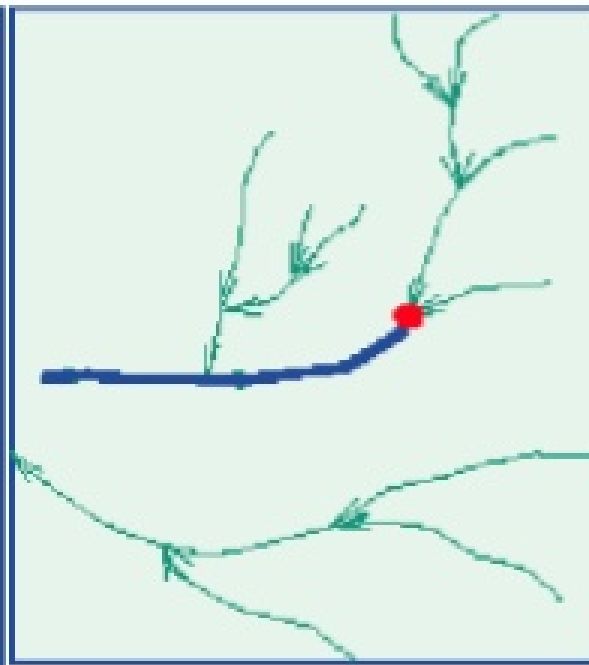


NETWORK PARTITIONING-TRACE

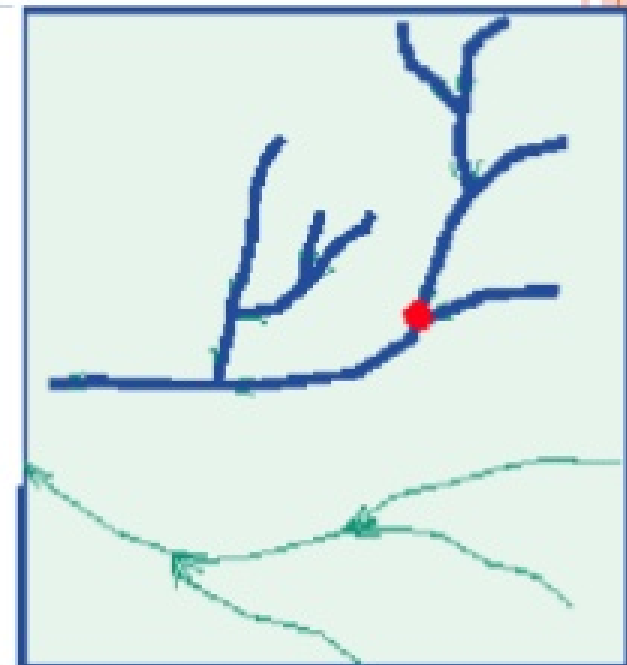
- Trace analysis is performed when we want to understand which part of network is 'conditionally connected' to a chosen node on the network, known as trace origin.



Tracing upstream



Tracing downstream



Tracing without condition
.. on direction

REFERENCES:

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- Spatial data analysis by Ms. Vandita Srivastava IIRS Dehradun, India
- ArcGIS 10 help

