Topological Data Models (Section 6.5)

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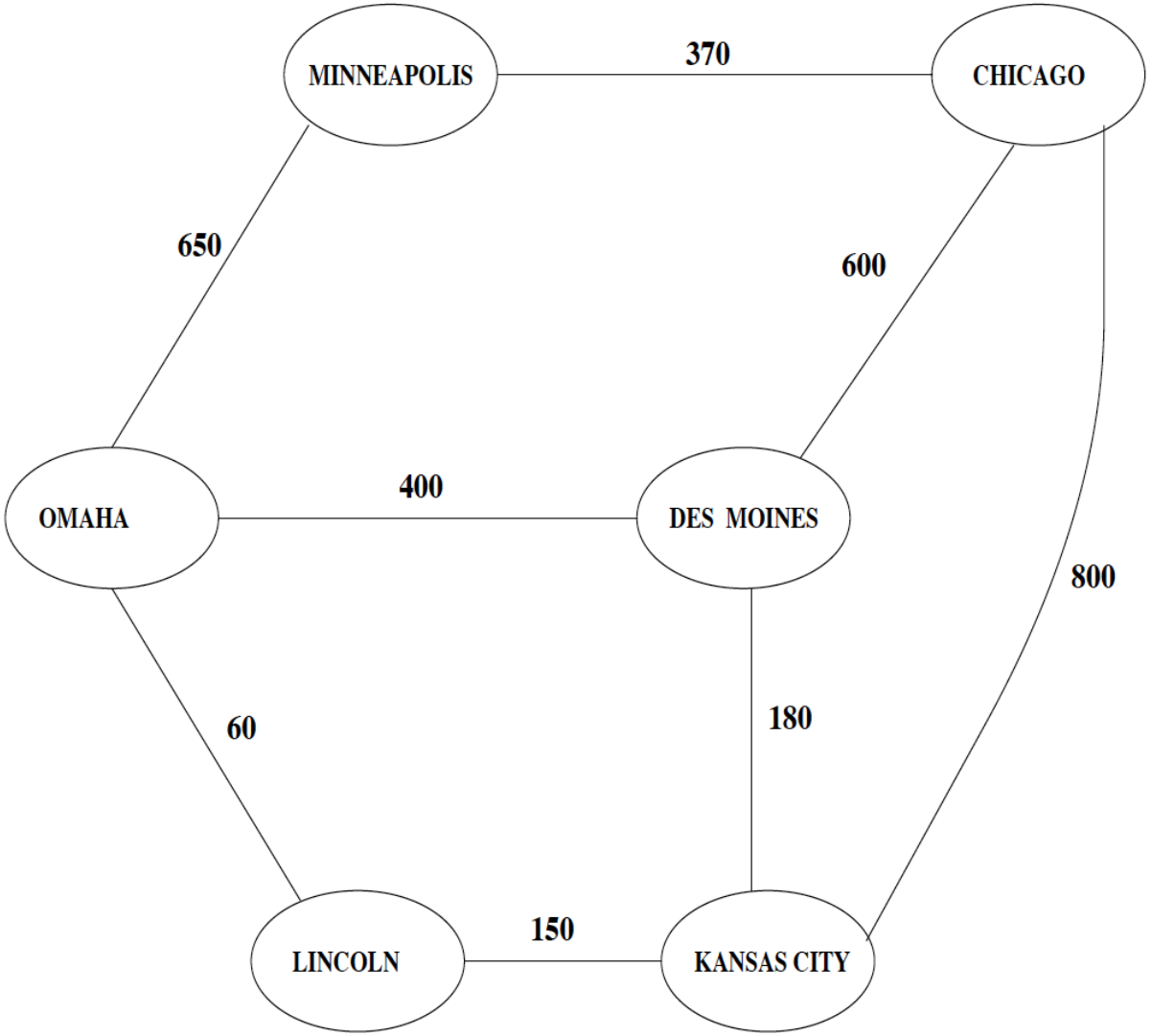
The following are the shortest distances in miles between some Midwestern cities.



Relational Database Representation

Edge

City1	City2	Miles
Chicago	Des_Moines	600
Chicago	Kansas_City	800
Chicago	Minneapolis	370
Des_Moines	Chicago	600
Des_Moines	Kansas_City	180
Des_Moines	Omaha	400
Kansas_City	Chicago	800
Kansas_City	Des_Moines	180
Kansas_City	Lincoln	150
Lincoln	Kansas_City	150
Lincoln	Omaha	60
Minneapolis	Chicago	370
Minneapolis	Omaha	650
Omaha	Des_Moines	400
Omaha	Minneapolis	650
Omaha	Lincoln	60

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Problem:

We do not always take the shortest path. There can be detours. Therefore, we need to represent that the value is the shortest distance but greater distances may be possible.

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Problem:

We do not always take the shortest path. There can be detours. Therefore, we need to represent that the value is the shortest distance but greater distances may be possible.

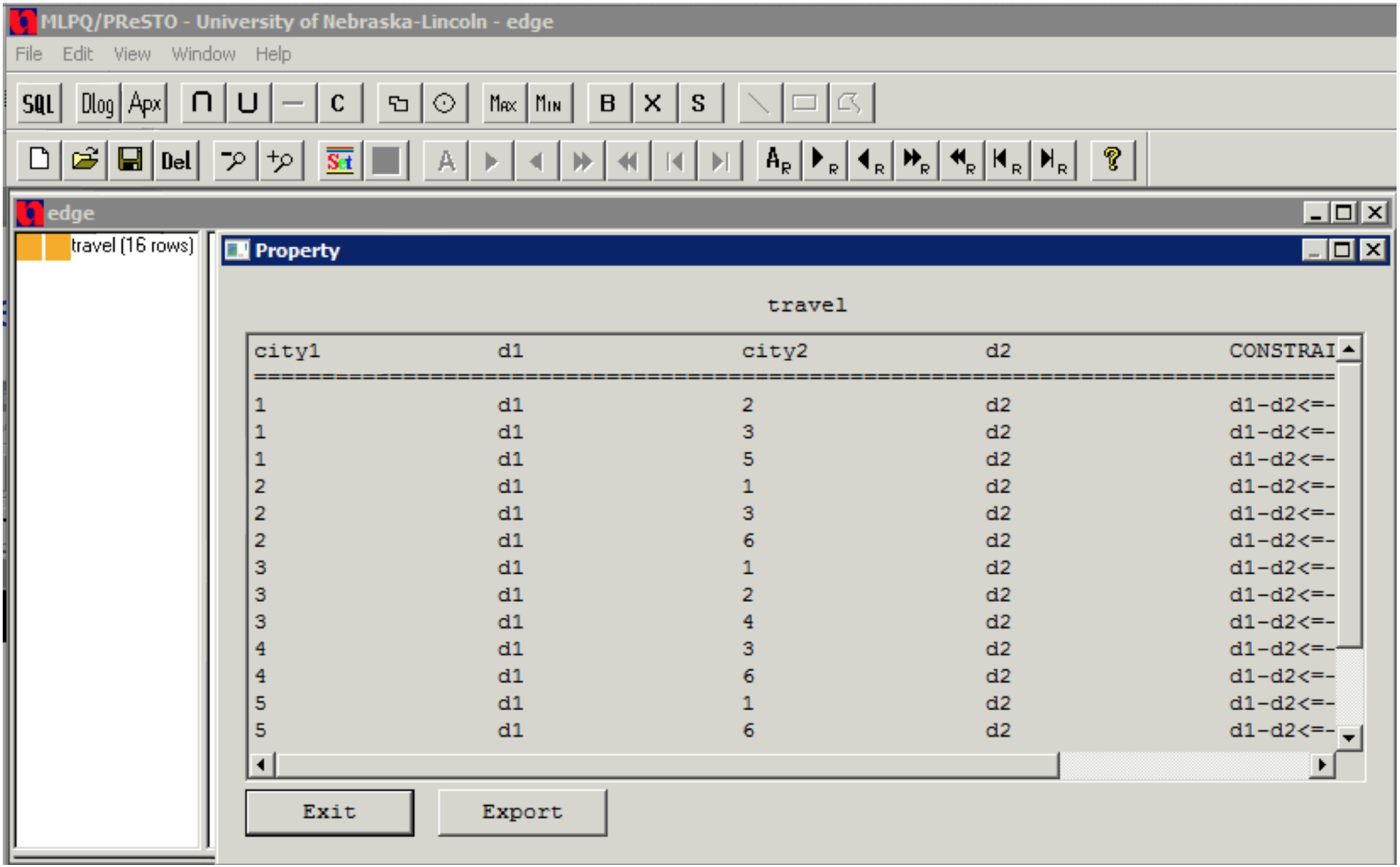
Constraint Database Representation

Travel

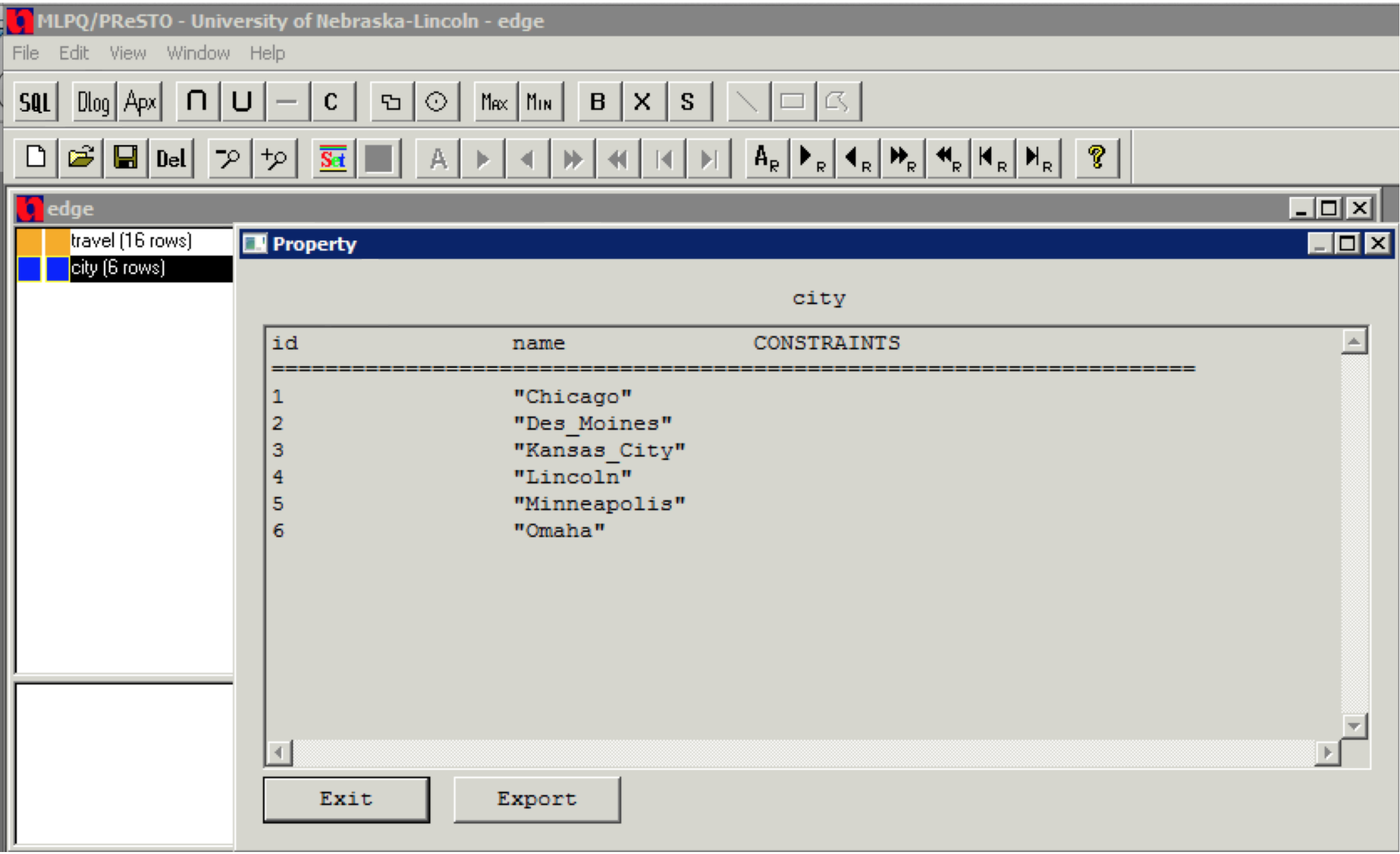
City1	Miles1	City2	Miles2	
Chicago	d_1	Des_Moines	d_2	$d_2 - d_1 \geq 600$
Chicago	d_1	Kansas_City	d_2	$d_2 - d_1 \geq 800$
Chicago	d_1	Minneapolis	d_2	$d_2 - d_1 \geq 370$
Des_Moines	d_1	Chicago	d_2	$d_2 - d_1 \geq 600$
Des_Moines	d_1	Kansas_City	d_2	$d_2 - d_1 \geq 180$
Des_Moines	d_1	Omaha	d_2	$d_2 - d_1 \geq 400$
Kansas_City	d_1	Chicago	d_2	$d_2 - d_1 \geq 800$
Kansas_City	d_1	Des_Moines	d_2	$d_2 - d_1 \geq 180$
Kansas_City	d_1	Lincoln	d_2	$d_2 - d_1 \geq 150$
Lincoln	d_1	Kansas_City	d_2	$d_2 - d_1 \geq 150$
Lincoln	d_1	Omaha	d_2	$d_2 - d_1 \geq 60$
Minneapolis	d_1	Chicago	d_2	$d_2 - d_1 \geq 370$
Minneapolis	d_1	Omaha	d_2	$d_2 - d_1 \geq 650$
Omaha	d_1	Des_Moines	d_2	$d_2 - d_1 \geq 400$
Omaha	d_1	Minneapolis	d_2	$d_2 - d_1 \geq 650$
Omaha	d_1	Lincoln	d_2	$d_2 - d_1 \geq 60$

If we start in City1 with odometer d_1, then we can arrive at City2 with odometer d_2.

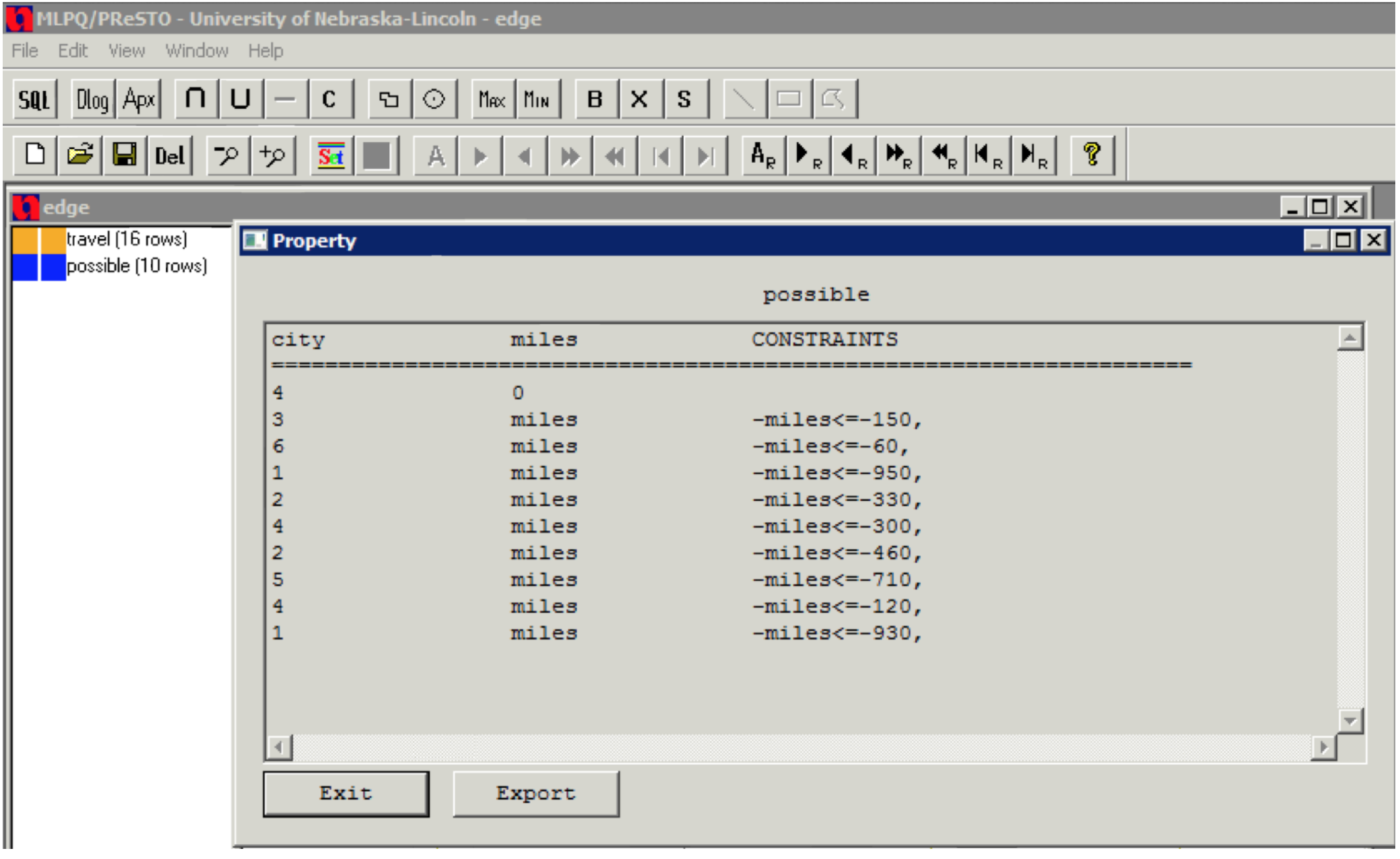
MLPQ Representation with city names encoded by id numbers



The id encoding may be recorded in a separate relation.

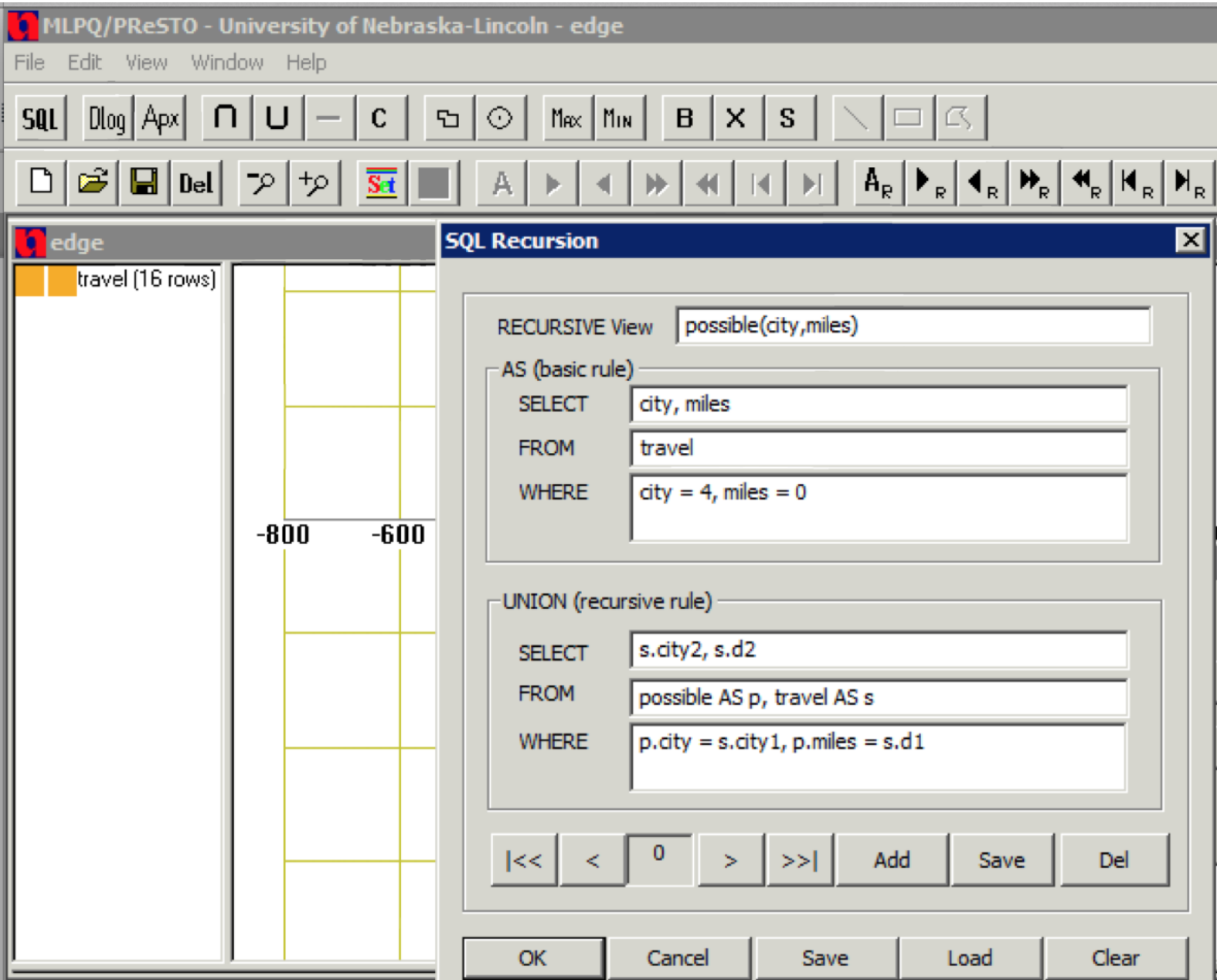


Find the length of the shortest paths from Lincoln = 4 using the Travel Relation.



Find the length of the shortest paths from Lincoln = 4 using the Travel Relation.

(1st step: calculate all possible distances)

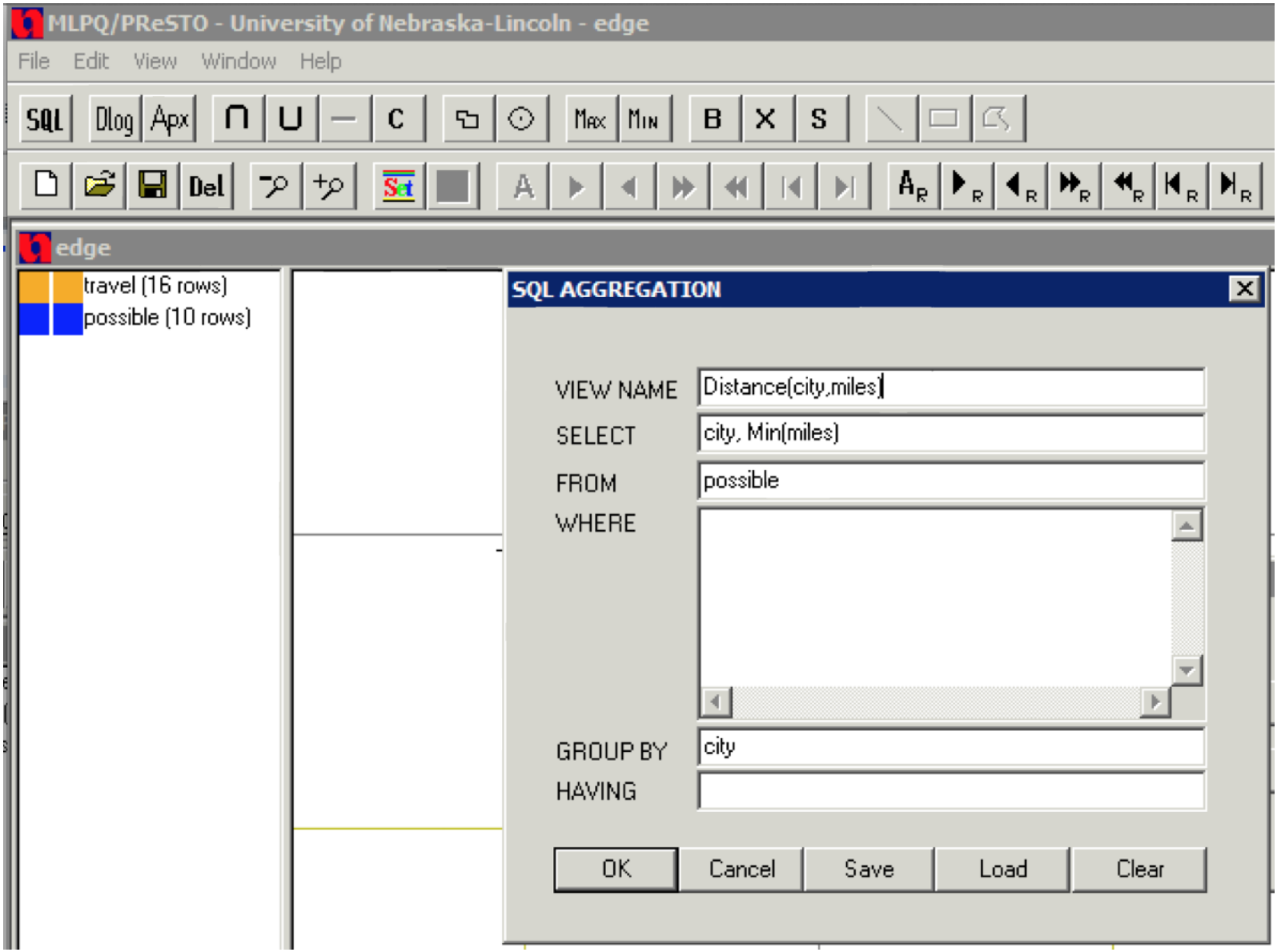


It is possible to travel to Lincoln = 4 in 0 miles.

If it is possible to travel to city1 in d1 miles and travel(city1,d1,city2,d2) holds, then it is possible to travel to city2 in d2 miles.

Find the length of the shortest paths from Lincoln = 4 using the Travel Relation.

(2nd step: find minimum distance out of all possible distances for each city)



Find (using MLPQ) the length of the shortest paths from Lincoln = 4 using the Travel Relation.