
Example Use of SITUATION

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Modified for IEOR151, UC Berkeley, Fall 2013

What is SITUATION?

- Software to solve location problems
 - Set covering
 - P-median
 - Maximal Covering
 - Uncap. Fixed charge
 - P-center
 - Partial covering P-center
 - Partial covering Set covering
 - Covering-Median Tradeoff

Options include

- Forcing sites in/out of solution
- Different solution algorithms
 - Heuristic
 - Improvement
 - Lagrangian relaxation in branch and bound (*optimal*)
- Mapping
- Reporting
- Manual facility exchanges (for some objectives)

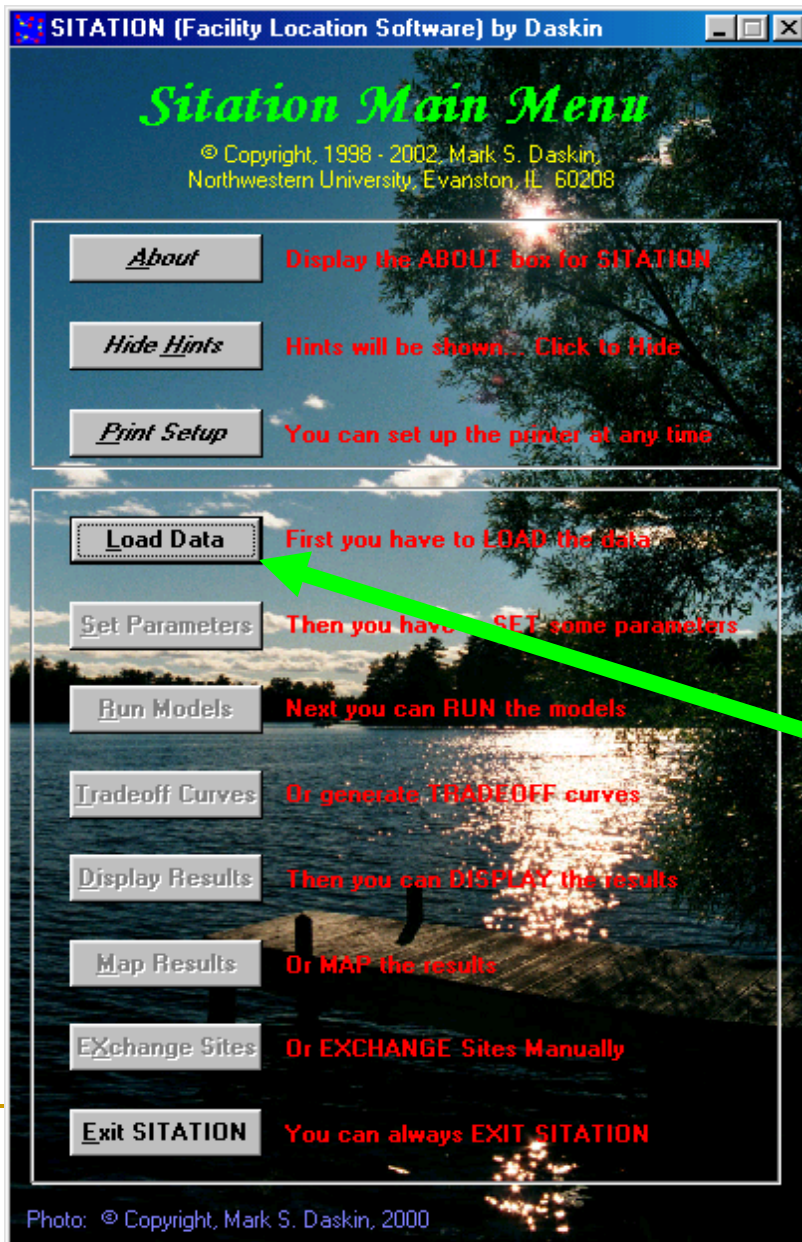
Problem to be solved (P-median)

- Minimize the demand weighted total distance (or average distance)
 - Using 10 facilities
 - To serve the 150 largest demands in the continental US

First step

- Double click on the **SITATION Class 58019.exe** software. This will load the software. You will see an ABOUT box for about 2-3 seconds followed by the main menu

Here is the main menu



- First you have to load the dataset you want to load.
- Click on **Load Data**

To load the data

SITATION Load Data Form

Specify Distance Metric *Begin by specifying the distance metric*

Euclidean

Great Circle

Manhattan

Network

Specify Demand File *Then specify the demand file name*

Specify Weight On Demand Set 1

Specify Candidate Sites *Then specify additional candidate sites if desired*

Dist. File Creation *Then specify how distances will be obtained*

Compute Distances

Read Distance File

Specify Distance File *Next specify the name of the distance file*

Exit and Load Data *Finally click here to load the data*

Cancel *Or ... Click here to cancel*

- First tell SITATION what kind of distances you are using
 - ❑ Euclidean (straight line)
 - ❑ Great Circle (shortest distance on a sphere)
 - ❑ Manhattan (right angle)
 - ❑ Network
- Click on **GREAT CIRCLE**

Now

SITATION Load Data Form

Specify Distance Metric Begin by specifying the distance metric

Euclidean
 Great Circle
 Manhattan
 Network

Specify Demand File Then specify the demand file name

Specify Weight On Demand Set 1

Specify Candidate Sites Then specify additional candidate sites if desired

Dist. File Creation Then specify how distances will be obtained

Compute Distances
 Read Distance File

Specify Distance File Next specify the name of the distance file

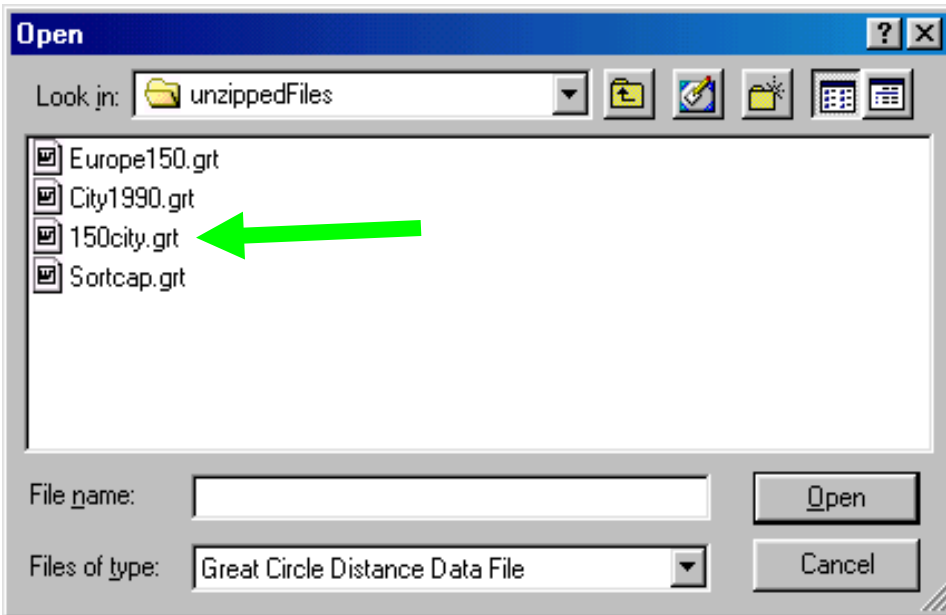
Exit and Load Data Finally click here to load the data

Cancel Or ... Click here to cancel

- Click on **Specify Demand File**

Now tell it which file to read

- Either double click on a file name or type the file name into the box labeled File name and then click Open
- Double click on **150city.grt** in this example



Basic input file format

**1 73.945478 40.670543 7322564 2819401 189600 < New York
NY >**

Node number longitude latitude demand 1 demand 2 fixed cost <city name >

Demand 2 is usually ignored,
but you can take a weighted sum of Demand 1 and
Demand 2
if you want to do so

Now tell it how to get the distances

SITATION Load Data Form

Specify Distance Metric Begin by specifying the distance metric

Euclidean
 Great Circle
 Manhattan
 Network

*File to Read = 150city.grt
150 Nodes in file with names*

Specify Demand File Then specify the demand file name

Line 1 (Dem. Node File) = 1 73.94548 40.67054 7322564

Specify Weight on Demand 1 (W=1)

Specify Candidate Sites Then specify additional candidate sites if desired

Dist. File Creation Then specify how distances will be obtained

Compute Distances
 Read Distance File

Specify Distance File Next specify the name of the distance file

Exit and Load Data Finally click here to load the data

Cancel Or ... Click here to cancel

- You can either have SITATION compute the distances or you can give it a file name containing the actual distances. Most of the time I let it compute the distances
- In this example click on **Compute Distances**

Now you are almost done loading the data

SITATION Load Data Form

Specify Distance Metric Begin by specifying the distance metric

Euclidean
 Great Circle
 Manhattan
 Network

*File to Read = 150city.grf
150 Nodes in file with names*

Specify Demand File Then specify the demand file name

Line 1 (Dem. Node File) = 1 73.94548 40.67054 7322564

Specify Weight on Demand 1 (W=1)

Specify Candidate Sites Then specify additional candidate sites if desired

Dist. File Creation Then specify how distances will be obtained

Compute Distances
 Read Distance File

Check to Use Kilometers

Specify Distance File Next specify the name of the distance file

Exit and Load Data Finally click here to load the data

Cancel Or ... Click here to cancel

- If you want the distances computed in kilometers instead of the default of miles, click on the box asking it to use kilometers.

Note that the labels throughout SITATION will still read miles even though distances are in km.

- We will NOT do this in this example

Also note

SITATION Load Data Form

Specify Distance Metric Begin by specifying the distance metric

Euclidean
 Great Circle
 Manhattan
 Network

File to Read = 150city.grt
150 Nodes in file with names

Specify Demand File Then specify the demand file name

Line 1 (Dem. Node File) = 1 73.94548 40.67054 7322564

Specify Weight on Demand 1 (W=1)

Specify Candidate Sites Then specify additional candidate sites if desired

Dist. File Creation Then specify how distances will be obtained

Compute Distances
 Read Distance File

Check to Use Kilometers

Specify Distance File Next specify the name of the distance file

Exit and Load Data Finally click here to load the data

Cancel Or ... Click here to cancel

- SITATION tells you the name of the file it will read and the number of nodes to be read.

Finally,....

SITATION Load Data Form

Specify Distance Metric **Begin by specifying the distance metric**

Euclidean
 Great Circle
 Manhattan
 Network

*File to Read = 150city.grt
150 Nodes in file with names*

Specify Demand File **Then specify the demand file name**

Line 1 (Dem. Node File) = 1 73.94548 40.67054 7322564

Specify Weight on Demand 1 (W=1)

Specify Candidate Sites **Then specify additional candidate sites if desired**

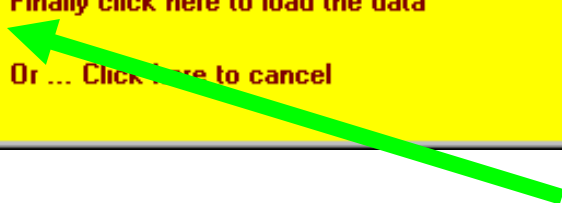
Dist. File Creation **Then specify how distances will be obtained**

Compute Distances
 Read Distance File Check to Use Kilometers

Specify Distance File **Next specify the name of the distance file**

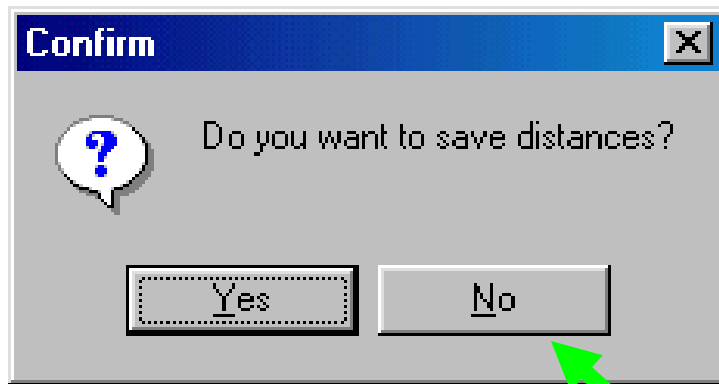
Exit and Load Data **Finally click here to load the data**

Cancel **Or ... Click here to cancel**



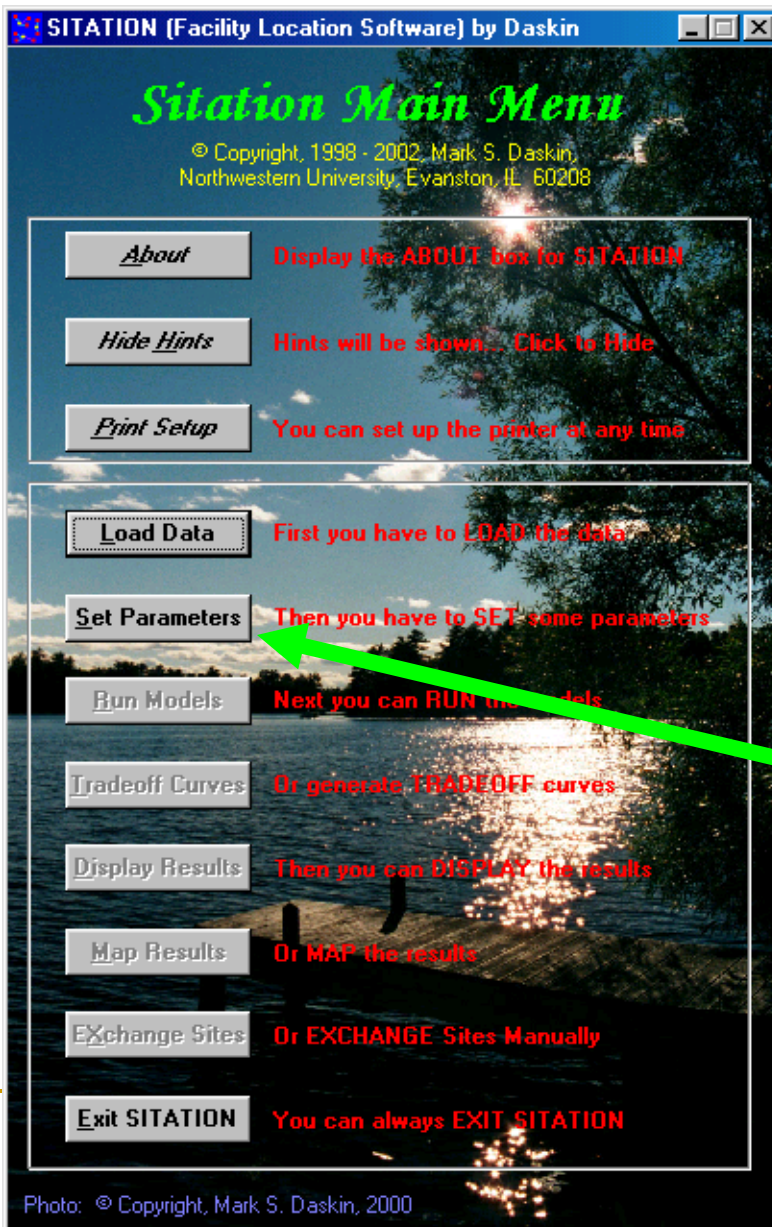
- To actually compute the distances and get back to the main menu, simply click on **Exit and Load Data**

But first ...



- SITUATION will ask if you want to save the distances. You almost never do, so just click No

Now you are back at the Main Menu



- You must now specify the coverage distance and a cost per mile *even if the model to be run does not call for these values.* They are used for reporting purposes
- Click on **Set Parameters**

Now ...

Set Parameters

Use this form to set parameters. You must set the coverage distance and the cost per mile before you can run any algorithms.

Coverage Distance

Cost per Mile

- Type in a coverage distance (e.g., 300)
- And a cost per mile (e.g., 1)

Now

Set Parameters

Use this form to set parameters. You must set the coverage distance and the cost per mile before you can run any algorithms.

Coverage Distance

Cost per Mile

- If you notice the Done and Run box is now available. Clicking this will allow you to go back to the Main Menu. You can also force sites in or out of the solution using the Force Nodes option. We will not do that in this example.
- Click Done and Run

Also force nodes into/out of solution

Force Nodes Menu

1	ALLOWED	New York NY
2	ALLOWED	Los Angeles CA
3	ALLOWED	Chicago IL
4	ALLOWED	Houston TX
5	ALLOWED	Philadelphia PA
6	ALLOWED	San Diego CA
7	ALLOWED	Detroit MI
8	ALLOWED	Dallas TX
9	ALLOWED	Phoenix AZ
10	ALLOWED	San Antonio TX
11	ALLOWED	San Jose CA
12	ALLOWED	Baltimore MD
13	ALLOWED	Indianapolis IN

Disallow All Nodes

Permit All Nodes

Force Site (s)

Unforce Site (s)

Exclude Site (s)

Allow Site (s)

Write Status to Disk

Read Status from Disk

Close

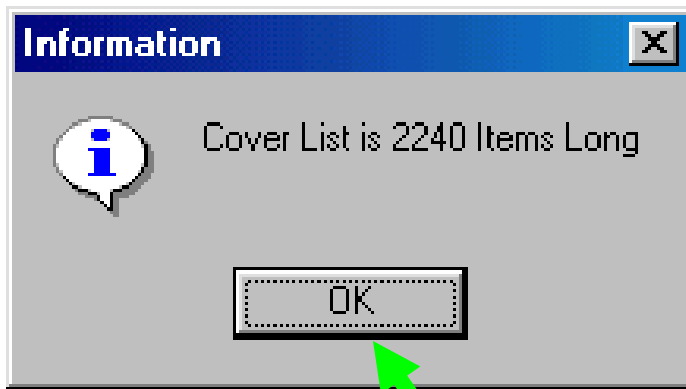
150 Allowed Nodes

0 Excluded Nodes

0 Required Nodes

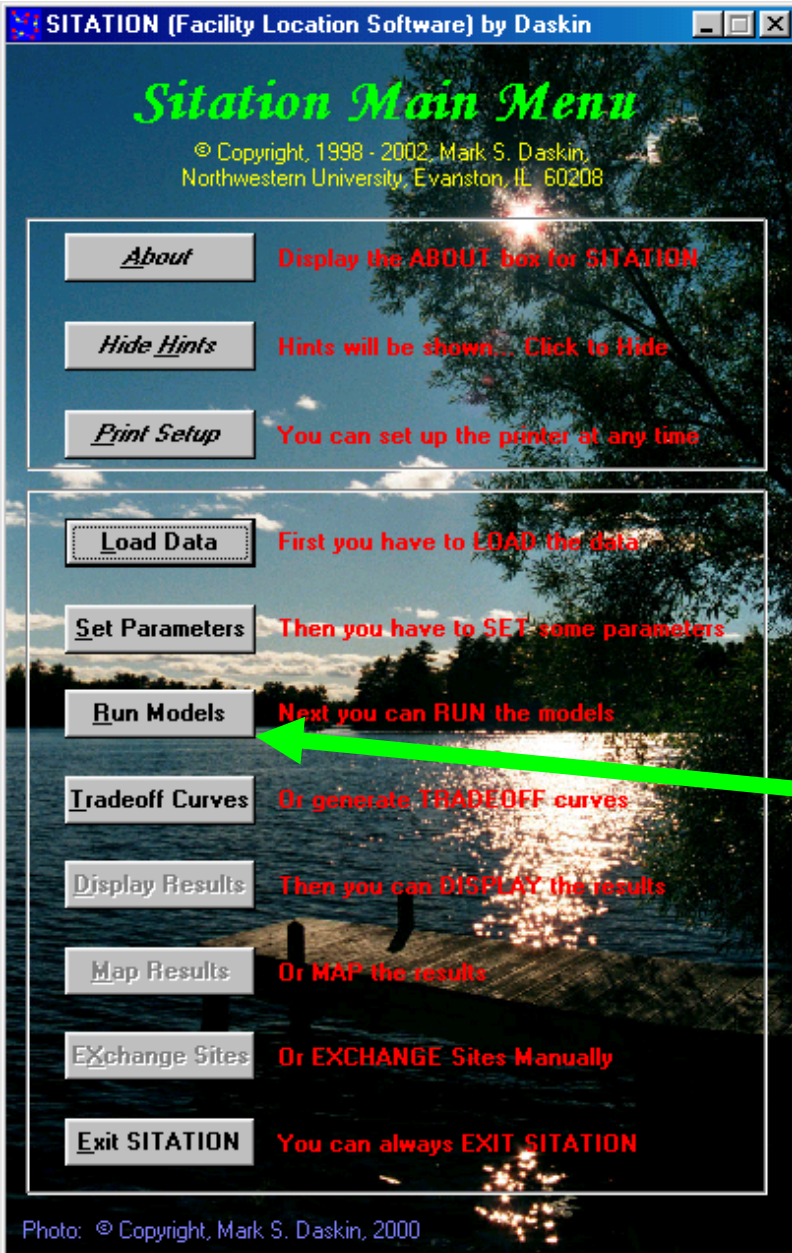
0 Initialized Nodes

Before getting back to the Main Menu



- SITUATION tells you how large the cover list is. This is just for information purposes and you can usually ignore it.
- Click **OK**

Now



- SITUATION will let you run either single or multiple objective (Tradeoff Curve) problems. We want a single objective problem (the P-median problem) so click on **Run Models**

First you must tell SITUATION which problem to solve

Run Models Form

Select a Problem to Solve

MaXimum Covering Set Covering PArTial P-Center

P-Median P-Center Integrated InV/Loc (SCD) Model

Un Capacitated Fixed Charge ParTial Set Covering

■ Click on the problem to be solved. In our case we want the **P-median problem**

Cancel Quit and Run

Problem available: P-Median

P-median – minimize the demand weighted total distance by locating a fixed number of facilities

IP Formulation

- h_i : demand at customer i
- D_{ij} : distance between customer i and site j
- P : number of facilities
- x_j : 1, if we locate at site j ; 0, otherwise
- y_{ij} : 1, if customer i is served by site j ; 0, otherwise

P-Median Problem

➤ IP Formulation

$$\min \sum_j \sum_i d_{ij} h_i y_{ij}$$

st.

$$\sum_j x_j = p$$

$$y_{ij} \leq x_j, \forall i, j$$

$$\sum_j y_{ij} = 1, \forall i$$

$$x_j, y_{ij} \text{ binary}$$

Other Problems available

- **Maximal covering** – maximize the number of covered demands in the specified coverage distance with a fixed number of facilities
- **Uncapacitated fixed charge** – minimize the sum of the fixed costs and demand weighted transport costs

And

- **Set covering** – find locations of the minimum number of facilities needed to cover all demands within the specified coverage distance
- **P-center** – find locations of a user-specified number of facilities to minimize the coverage distance needed to cover all demands
- **Partial set covering** – same as set covering but the model can exclude (not cover) a user-specified number of nodes or fraction of the total demand

And

- **Partial P-center** – like the P-center except that the model will allow a user-specified number of nodes or fraction of demand to be outside the reported coverage distance
- **Inventory/Location (SCD) model** – find the DC locations, market assignments to DCs and DC inventory policy to minimize fixed DC costs, inventory costs at the DC, shipment costs to markets and shipment costs from plants to DCs

How do you want to solve the problem?

- You must now tell S_ITATION which of several algorithms to use to solve the problem. In general, you should use **Lagrangian Relaxation**. This embeds LR in branch and bound and guarantees optimal solutions.

Run Models Form

Select a Problem to Solve

MaXimum Covering Set Covering PArTial P-Center

P-Median P-Center Integrated InV/Loc (SCD) Model

Uncapacitated Fixed Charge ParTial Set Covering

Select an Algorithm

Myopic Neighborhood GeneTic Algorithm

Exchange Lagrangian Relaxation

Cancel Quit and Run

Specify the number to locate

Run Models Form

Select a Problem to Solve

Maximum Covering Set Covering Partial P-Center
 P-Median P-Center Integrated InV/Loc (SCD) Model
 Uncapacitated Fixed Charge Partial Set Covering

Select an Algorithm

Myopic Neighborhood Genetic Algorithm
 Exchange Lagrangian Relaxation

Number to Locate

- Tell the model how many sites to locate. For some models (e.g., the uncapacitated fixed charge problem, specifying -1 tells SITATON to find the best number)
- Type **10** in the indicated box

Now...

Run Models Form

Select a Problem to Solve

Maximum Covering Set Covering Partial P-Center

P-Median P-Center Integrated InV/Loc (SCD) Model

Uncapacitated Fixed Charge Partial Set Covering

Select an Algorithm

Myopic Neighborhood Genetic Algorithm

Exchange Lagrangian Relaxation

Number to Locate

- You can set the parameters of the Lagrangian Relaxation algorithm. This is a bit complex and we will **skip** it in this example.
- Do NOT click on View and Set Lagrangian Options

We are now ready to run the model

- By clicking on **Quit and Run** you ask SITUATION to solve the problem

Run Models Form

Select a Problem to Solve

MaXimum Covering Set Covering PArtil P-Center

P-Median P-Center Integrated InY/Loc (SCD) Model

Uncapacitated Fixed Charge ParTial Set Covering

Select an Algorithm

Myopic Neighborhood GeneTic Algorithm

Exchange Lagrangian Relaxation

Number to Locate:

Lagrangian Progress Form

Lagrangian Progress Form MEDIAN OBJECTIVE

Locations	10	B+B Nodes	1
Iterations	101	Lag. Iterations	101
Upper Bound	16,362,939,473.0	B+B Level	0
Lower Bound	3,268,219,622.0		
Percent	400.6682955		
Alpha	1.0000000000		
Failures	5		
Step Size	17,412,498.129		

EXCHANGE ON
Branch and Bound Tree Below

	1234567890 1234567890
0	0000000000 0000000000
20	0000000000 0000000000
40	0000000000 0000000000
60	0000000000 0000000000
80	0000000000 0000000000
100	0000000000 0000000000
120	0000000000 0000000000
140	0000000000

Forced Nodes Info
<-----

Time So Far
0.27

0%

% of tree explored

Click to Abort Branching (And Lose Results)

- This form tells you information about the progress of the algorithm including the bounds on the solution

The total number of iterations

Lagrangian Progress Form MEDIAN OBJECTIVE

Locations **B+B Nodes**

Iterations **Lag. Iterations**

Upper Bound **B+B Level**

Lower Bound

Percent

Alpha

Failures

Step Size

EXCHANGE ON

Branch and Bound Tree Below

	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Forced Nodes Info
<-----

Time So Far

% of tree explored

And

Lagrangian Progress Form MEDIAN OBJECTIVE

Locations	10	B+B Nodes	1
Iterations	101	Lag. Iterations	101
Upper Bound	16,362,939,473.0	B+B Level	0
Lower Bound	3,268,219,622.0		
Percent	400.6682955		
Alpha	1.0000000000		
Failures	5		
Step Size	17,412,498.129		

EXCHANGE ON

Branch and Bound Tree Below

```
1234567890|1234567890
0 000000000|000000000
20 000000000|000000000
40 000000000|000000000
60 000000000|000000000
80 000000000|000000000
100 000000000|000000000
120 000000000|000000000
140 000000000|
```

Forced Nodes Info
<-----

Time So Far
0.27

0%

% of tree explored

Click to Abort Branching (And Lose Results)

- Information on the branch and bound tree

And ...

Lagrangian Progress Form MEDIAN OBJECTIVE

Locations	10	B+B Nodes	1
Iterations	101	Lag. Iterations	101
Upper Bound	16,362,939,473.0	B+B Level	0
Lower Bound	3,268,219,622.0		
Percent	400.6682955		
Alpha	1.0000000000		
Failures	5		
Step Size	17,412,498.129		

EXCHANGE ON

Branch and Bound Tree Below

	1234567890	1234567890
0	0000000000	0000000000
20	0000000000	0000000000
40	0000000000	0000000000
60	0000000000	0000000000
80	0000000000	0000000000
100	0000000000	0000000000
120	0000000000	0000000000
140	0000000000	0000000000

Forced Nodes Info
<-----

Time So Far
0.27

0%

% of tree explored

Click to Abort Branching (And Lose Results)

- Which nodes are forced in (+) out (-) and undecided (0) at this point in the branch and bound algorithm

And ...

Lagrangian Progress Form MEDIAN OBJECTIVE

Locations	10	B+B Nodes	1
Iterations	101	Lag. Iterations	101
Upper Bound	16,362,939,473.0	B+B Level	0
Lower Bound	3,268,219,622.0		
Percent	400.6682955		
Alpha	1.0000000000		
Failures	5		
Step Size	17,412,498.129		

EXCHANGE ON

Branch and Bound Tree Below

	1234567890 1234567890
0	0000000000 0000000000
20	0000000000 0000000000
40	0000000000 0000000000
60	0000000000 0000000000
80	0000000000 0000000000
100	0000000000 0000000000
120	0000000000 0000000000
140	0000000000

Forced Nodes Info
<-----

Time So Far
0.27

0%

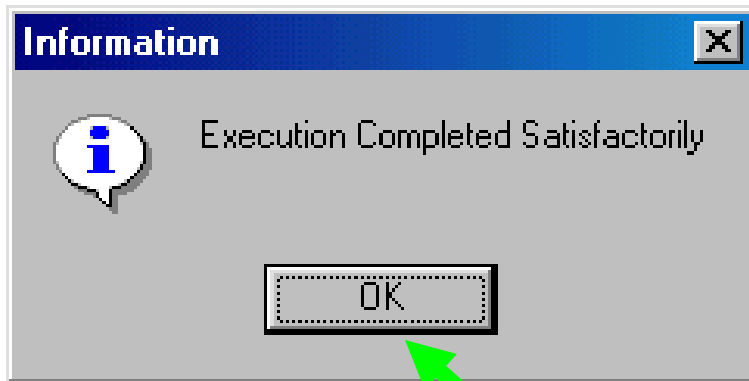
% of tree explored

Click to Abort Branching (And Lose Results)

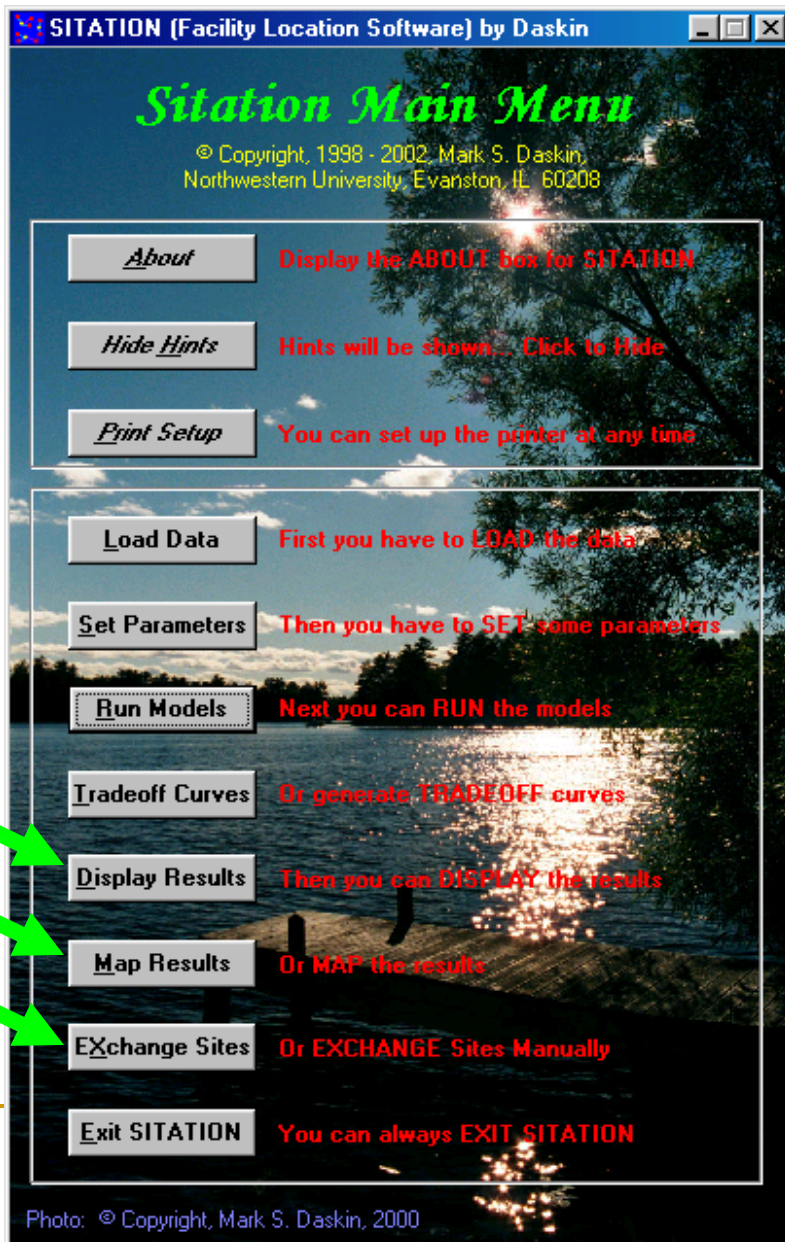
- What percent of the branch and bound tree has been explored so far

When the algorithm finishes ...

- You should see this information box.
- Click **OK**

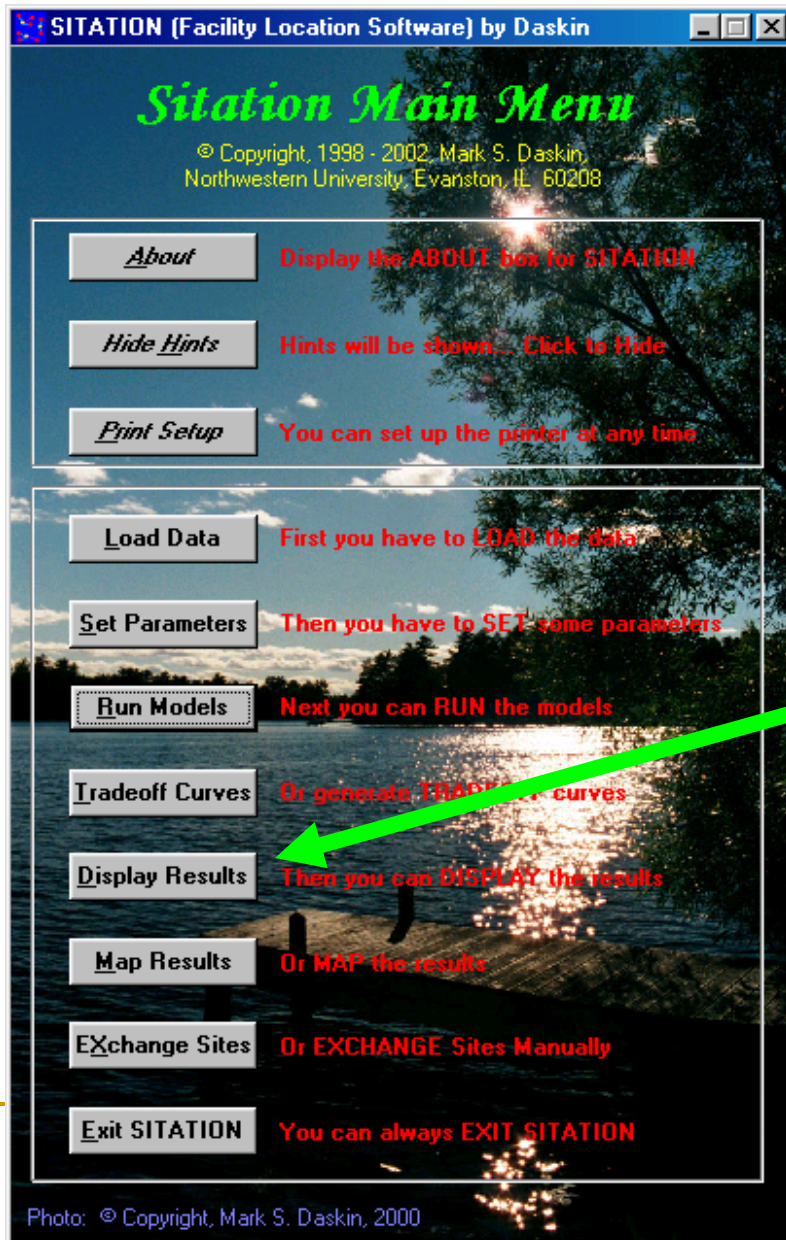


You can now



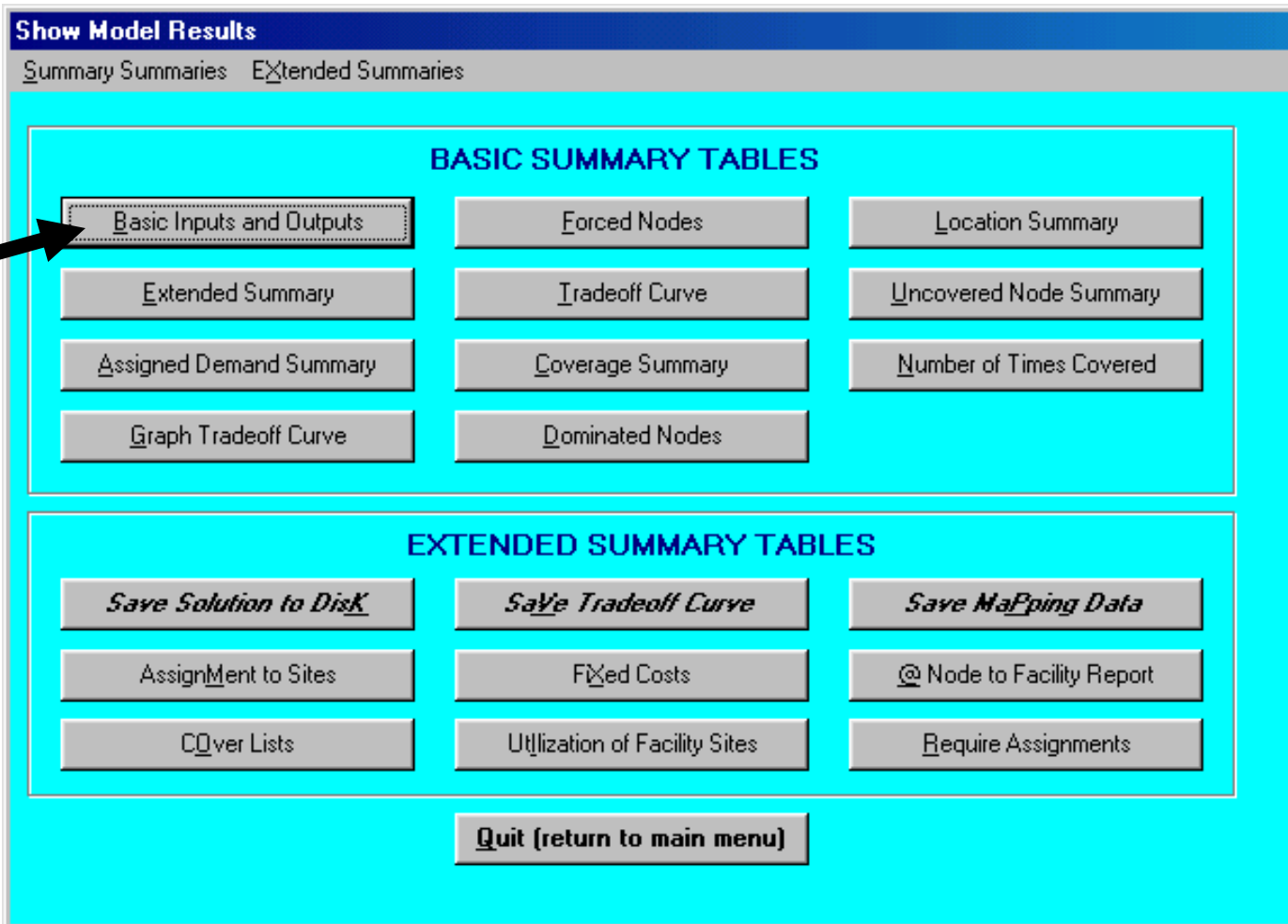
- Display the results
- Map the results
- Manually modify the results for some objectives

First



- We will display some results. Click on Display Results

You can now



- Display a lot of results.
- First click on **Basic Inputs and Outputs**

This summary shows

Basic Results Form			
Name of Main File	150city.grt	# Forced In	0
Name of Secondary File	N/A	# Forced Out	0
Distance File Name	N/A	# Initialized	0
Initial File Name	N/A	Added Constant	N/A
Number of Nodes	150 / 150		
Demand Fraction	1.0000		
Number of Facilities	10		
Coverage Distance	300.00		
Solution Approach	MEDIAN - LAGRANGIAN		N/A
Dominated Nodes?	N/A		
Upper Bound	127.128922171	7,398,462,133.00	Root Node Forcing IN 10
Lower Bound	127.128922171	7,398,462,133.00	OUT 140
Percent Difference	0.0	Cost/Mile	1.000000000000
Iterations	444		
B+B Nodes	1		
Solution Time	1.04		

- A summary of the basic model **inputs**
- Model **outputs** including the problem and algorithm being solved, statistics on how long it took to solve it, and the objective function values

Go back

Basic Results Form

Name of Main File	150city.grt	Last Report			
Name of Secondary File	N/A	Next Report			
Distance File Name	N/A	Cancel			
Initial File Name	N/A	Print Form			
Number of Nodes	150 / 150	# Forced In	0	LaGrangian Param	
Demand Fraction	1.0000	# Forced Out	0		
Number of Facilities	10	# Initialized	0		
Coverage Distance	300.00	Added Constant	N/A		
Solution Approach	MEDIAN - LAGRANGIAN		N/A		
Dominated Nodes?	N/A			Root Node Forcing	
Upper Bound	127.128922171	7,398,462,133.00		IN	10
Lower Bound	127.128922171	7,398,462,133.00		OUT	140
Percent Difference	0.0		Cost/Mile	1.000000000000	
Iterations	444				
B+B Nodes	1				
Solution Time	1.04				

- Once you have studied this report click **Cancel** to return to the menu of reports

Now see where you locate

Show Model Results

Summary Summaries Extended Summaries

BASIC SUMMARY TABLES

- Basic Inputs and Outputs
- Extended Summary
- Assigned Demand Summary
- Graph Tradeoff Curve
- Forced Nodes
- Tradeoff Curve
- Coverage Summary
- Dominated Nodes
- Location Summary
- Uncovered Node Summary
- Number of Times Covered

EXTENDED SUMMARY TABLES

- Save Solution to Disk
- Assignment to Sites
- Cover Lists
- Save Tradeoff Curve
- Fixed Costs
- Utilization of Facility Sites
- Save Mapping Data
- @ Node to Facility Report
- Require Assignments

Quit (return to main menu)

- Click on **Extended Summary** to see where SITUATION located facilities

Extended Summary

Extended Location Summary

#	=>	Node #	X-Loc	Y-Loc	Coverage	Name	
1	=>	1	73.95	40.67	14,613,185	New York	NY
2	=>	2	118.41	34.11	9,401,537	Los Angeles	CA
3	=>	3	87.68	41.84	8,580,904	Chicago	IL
4	=>	4	95.39	29.77	5,682,877	Houston	TX
5	=>	49	97.34	37.69	2,489,089	Wichita	KS
6	=>	51	111.74	33.42	2,479,929	Mesa	AZ
7	=>	91	122.46	47.25	1,307,438	Tacoma	WA
8	=>	94	122.00	37.53	3,601,914	Fremont	CA
9	=>	101	81.37	28.50	2,398,526	Orlando	FL
10	=>	110	85.26	35.07	3,947,338	Chattanooga	TN

Total Covered Demands ←

Percent Covered Demands ←

Average Weighted Distance ←

Average Covered Distance

Average Uncovered Distance

Fixed Cost **Mileage Cost** **Total Cost** ←

- This tells you where you locate facilities, the number of covered demands, the % of demands covered, the average weighted distance, and the total cost

And the verdict is...

#	==>	Node #	X-Loc	Y-Loc	Coverage	Name	
1	==>	1	73.95	40.67	14,613,185	New York	NY
2	==>	2	118.41	34.11	9,401,537	Los Angeles	CA
3	==>	3	87.68	41.84	8,580,904	Chicago	IL
4	==>	4	95.39	29.77	5,682,877	Houston	TX
5	==>	49	97.34	37.69	2,489,089	Wichita	KS
6	==>	51	111.74	33.42	2,479,929	Mesa	AZ
7	==>	91	122.46	47.25	1,307,438	Tacoma	WA
8	==>	94	122.00	37.53	3,601,914	Fremont	CA
9	==>	101	81.37	28.50	2,398,526	Orlando	FL
10	==>	110	85.26	35.07	3,947,338	Chattanooga	TN

Total Covered Demands	<input type="text" value="51,742,169"/>
Percent Covered Demands	<input type="text" value="88.9093714"/>
Average Weighted Distance	<input type="text" value="127.128922"/>
Average Covered Distance	<input type="text" value="99.0885689"/>
Average Uncovered Distance	<input type="text" value="351.917820"/>

Fixed Cost	<input type="text" value="\$1,000,000"/>	Mileage Cost	<input type="text" value="\$7,398,462,133"/>	Total Cost	<input type="text" value="\$7,399,462,133"/>
-------------------	------------------------------------------	---------------------	----------------------------------------------	-------------------	----------------------------------------------

- Note that the average weighted distance should be 127.13 miles if you solved this correctly

And now...

#	=>	Node #	X-Loc	Y-Loc	Coverage	Name	
1	=>	1	73.95	40.67	14,613,185	New York	NY
2	=>	2	118.41	34.11	9,401,537	Los Angeles	CA
3	=>	3	87.68	41.84	8,580,904	Chicago	IL
4	=>	4	95.39	29.77	5,682,877	Houston	TX
5	=>	49	97.34	37.69	2,489,089	Wichita	KS
6	=>	51	111.74	33.42	2,479,929	Mesa	AZ
7	=>	91	122.46	47.25	1,307,438	Tacoma	WA
8	=>	94	122.00	37.53	3,601,914	Fremont	CA
9	=>	101	81.37	28.50	2,398,526	Orlando	FL
10	=>	110	85.26	35.07	3,947,338	Chattanooga	TN

Total Covered Demands	51,742,169
Percent Covered Demands	88.9093714
Average Weighted Distance	127.128922
Average Covered Distance	99.0885689
Average Uncovered Distance	351.917820
Fixed Cost	\$1,000,000
Mileage Cost	\$7,398,462,133
Total Cost	\$7,399,462,133

- After studying this report click **Cancel**

Show the number of nodes covered X times

- Click on Number of Times Covered

Show Model Results

Summary Summaries Extended Summaries

BASIC SUMMARY TABLES

Basic Inputs and Outputs Forced Nodes Location Summary

Extended Summary Tradeoff Curve Uncovered Node Summary

Assigned Demand Summary Coverage Summary Number of Times Covered

Graph Tradeoff Curve Dominated Nodes

EXTENDED SUMMARY TABLES

Save Solution to Disk Save Tradeoff Curve Save Mapping Data

Assignment to Sites Fixed Costs @ Node to Facility Report

Cover Lists Utilization of Facility Sites Require Assignments

Quit (return to main menu)

This report shows

Coverage Summary Report

No. Times	No. Nodes	Number of Demands	Percent Coverage
0	25	6,454,361.000	11.0906
1	115	48,981,601.000	84.1658
2	10	2,760,568.000	4.7435

TOTAL	150	58,196,530.000	100.0000

88.9094 PERCENT OF DEMANDS COVERED

- That in this solution 25 nodes (and 6,454,361 demands) are not covered at all, 115 nodes are covered once and 10 are covered twice

And now

- When you are done looking at this click Cancel

Coverage Summary Report

No. Times	No. Nodes	Number of Demands	Percent Coverage
0	25	6,454,361.000	11.0906
1	115	48,981,601.000	84.1658
2	10	2,760,568.000	4.7435

TOTAL	150	58,196,530.000	100.0000

88.9094 PERCENT OF DEMANDS COVERED

Now find out how demands are assigned to facilities

- Click on **AssignMent to Sites**

Show Model Results

Summary Summaries Extended Summaries

BASIC SUMMARY TABLES

Basic Inputs and Outputs Forced Nodes Location Summary

Extended Summary Tradeoff Curve Uncovered Node Summary

Assigned Demand Summary Coverage Summary Number of Times Covered

Graph Tradeoff Curve Dominated Nodes

EXTENDED SUMMARY TABLES

Save Solution to Disk Save Tradeoff Curve Save Mapping Data

Assignment to Sites Fixed Costs @ Node to Facility Report

Cover Lists Utilization of Facility Sites Require Assignments

Quit (return to main menu)

Assignment to Sites

Demand Area	Facility Site	Distance	Covered?	Demand	Dem*dist
1	1	0.0	YES	7,322,564	0
2	2	0.0	YES	3,485,398	0
3	3	0.0	YES	2,783,726	0
4	4	0.0	YES	1,630,553	0
5	1	78.0	YES	1,585,577	123,675,006
6	2	116.0	YES	1,110,549	128,823,684
7	3	238.0	YES	1,027,974	244,657,812
8	4	224.0	YES	1,006,877	225,540,448
9	51	21.0	YES	983,403	20,651,463
10	4	189.0	YES	935,933	176,891,337
11	94	17.0	YES	782,248	13,298,216
12	1	170.0	YES	736,014	125,122,380

COVERAGE DISTANCE = 300.00
Total demand weighted distance = 7,398,462,133.00
MAXIMUM DISTANCE = 509.00

Last Report Next Report Cancel Print Form

- This shows which facility is assigned to serve each demand area, the distance between them, whether the demand area is covered, the demand there, etc.

Assignment to Sites

Assignment of Demands to Sites

Demand Area	Facility Site	Distance	Covered?	Demand	Dem*dist
1	1	0.0	YES	7,322,564	0
2	2	0.0	YES	3,485,398	0
3	3	0.0	YES	2,783,726	0
4	4	0.0	YES	1,630,553	0
5	1	78.0	YES	1,585,577	123,675,006
6	2	116.0	YES	1,110,549	128,823,684
7	3	238.0	YES	1,027,974	244,657,812
8	4	224.0	YES	1,006,877	225,540,448
9	51	21.0	YES	983,403	20,651,463
10	4	189.0	YES	935,933	176,891,337
11	94	17.0	YES	782,248	13,298,216
12	1	170.0	YES	736,014	125,122,380

COVERAGE DISTANCE = 300.00
Total demand weighted distance = 7,398,462,133.00
MAXIMUM DISTANCE = 509.00

Last Report Next Report Cancel Print Form


- As well as the maximum assigned distance and the total demand weighted distance

Go back

Assignment of Demands to Sites

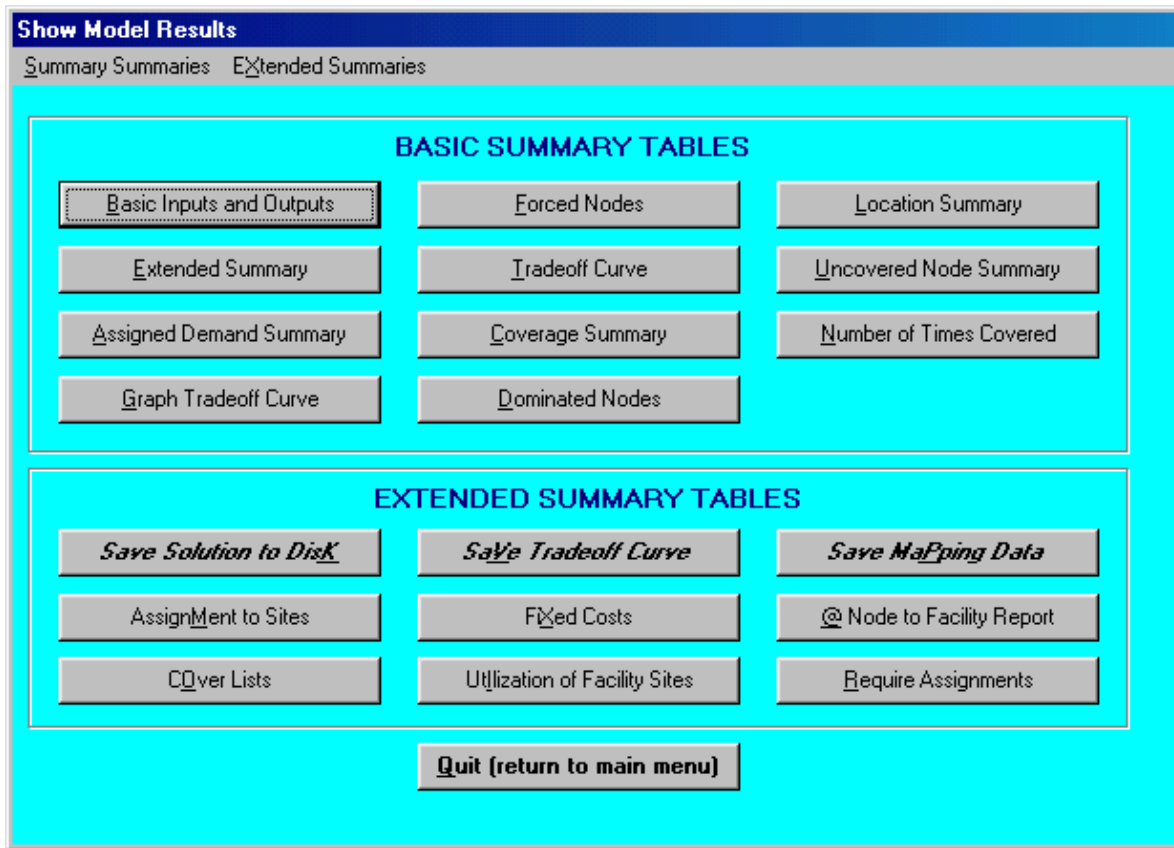
Demand Area	Facility Site	Distance	Covered?	Demand	Dem*dist
1	1	0.0	YES	7,322,564	0
2	2	0.0	YES	3,485,398	0
3	3	0.0	YES	2,783,726	0
4	4	0.0	YES	1,630,553	0
5	1	78.0	YES	1,585,577	123,675,006
6	2	116.0	YES	1,110,549	128,823,684
7	3	238.0	YES	1,027,974	244,657,812
8	4	224.0	YES	1,006,877	225,540,448
9	51	21.0	YES	983,403	20,651,463
10	4	189.0	YES	935,933	176,891,337
11	94	17.0	YES	782,248	13,298,216
12	1	170.0	YES	736,014	125,122,380

COVERAGE DISTANCE = 300.00
Total demand weighted distance = 7,398,462,133.00
MAXIMUM DISTANCE = 509.00



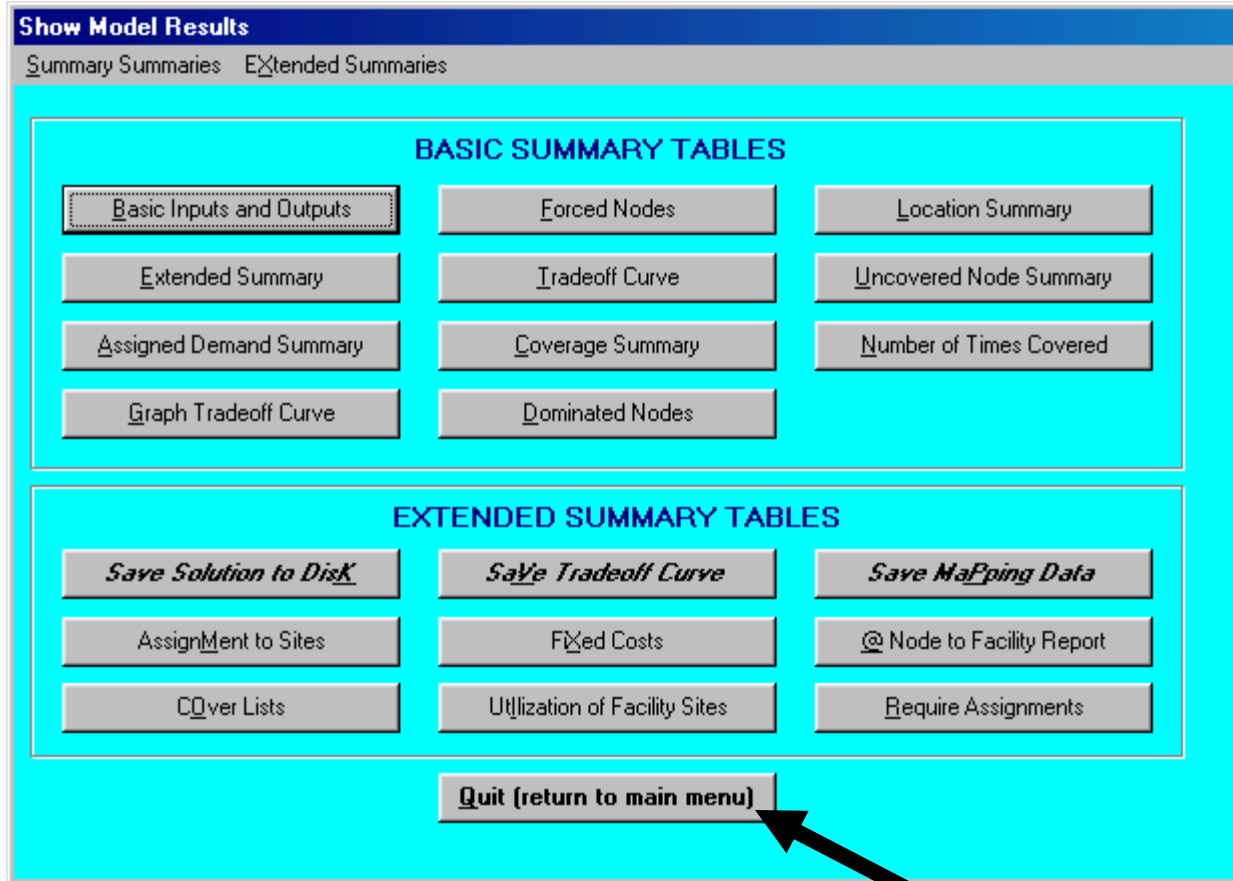
- Click on **C**ancel to go back to the reports menu

And so on



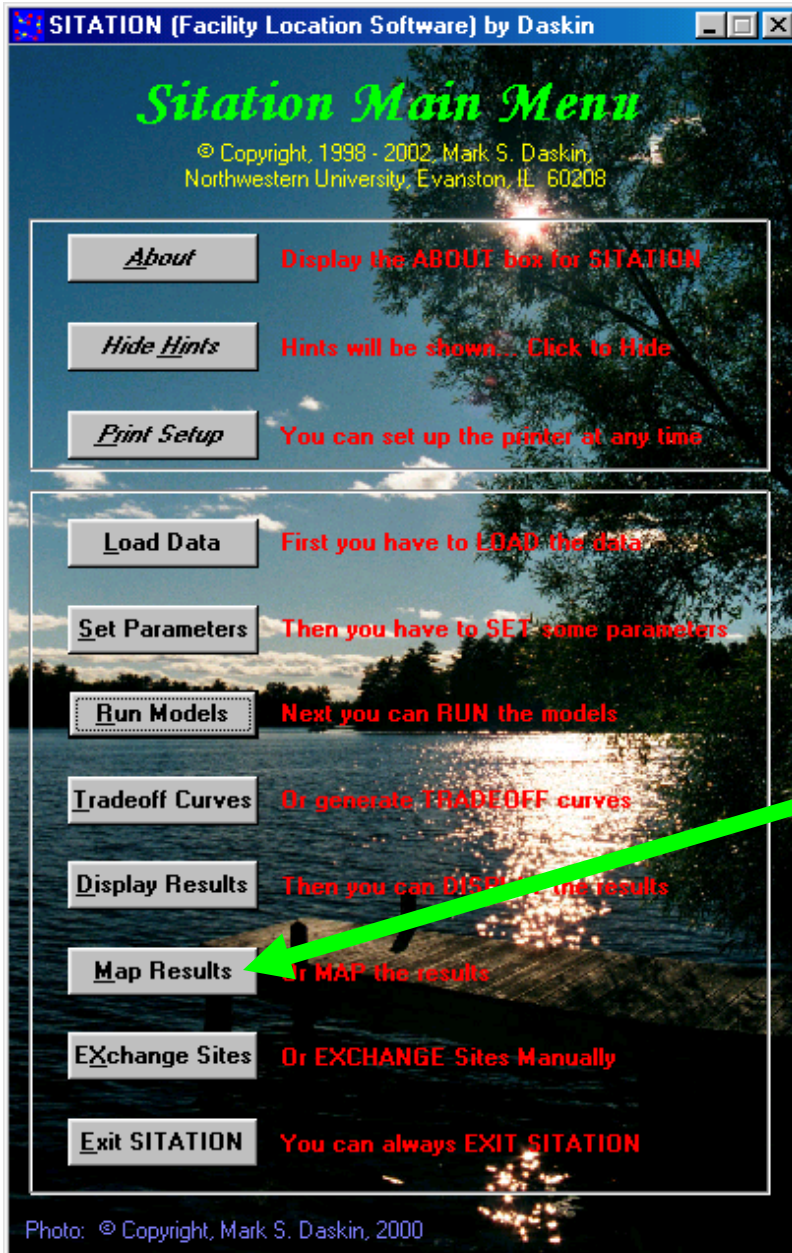
- There are many other reports, graphs (for some problems) and options to save results. Experiment with them. They should be self explanatory.

Go back to the Main Menu



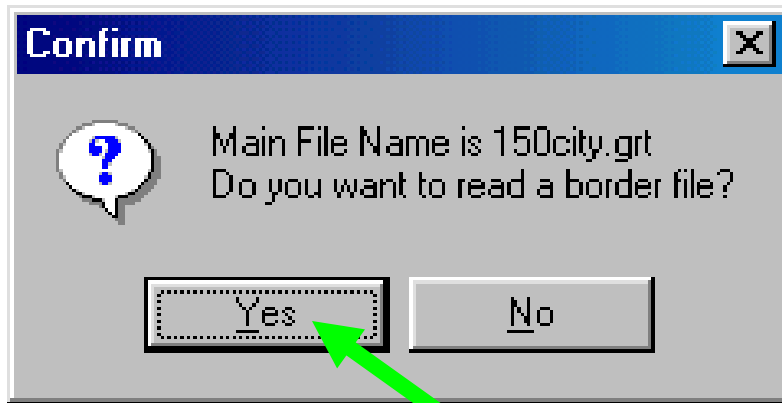
- To get back to the main menu, click **Quit (return to main menu)**

Now we can Map the solution



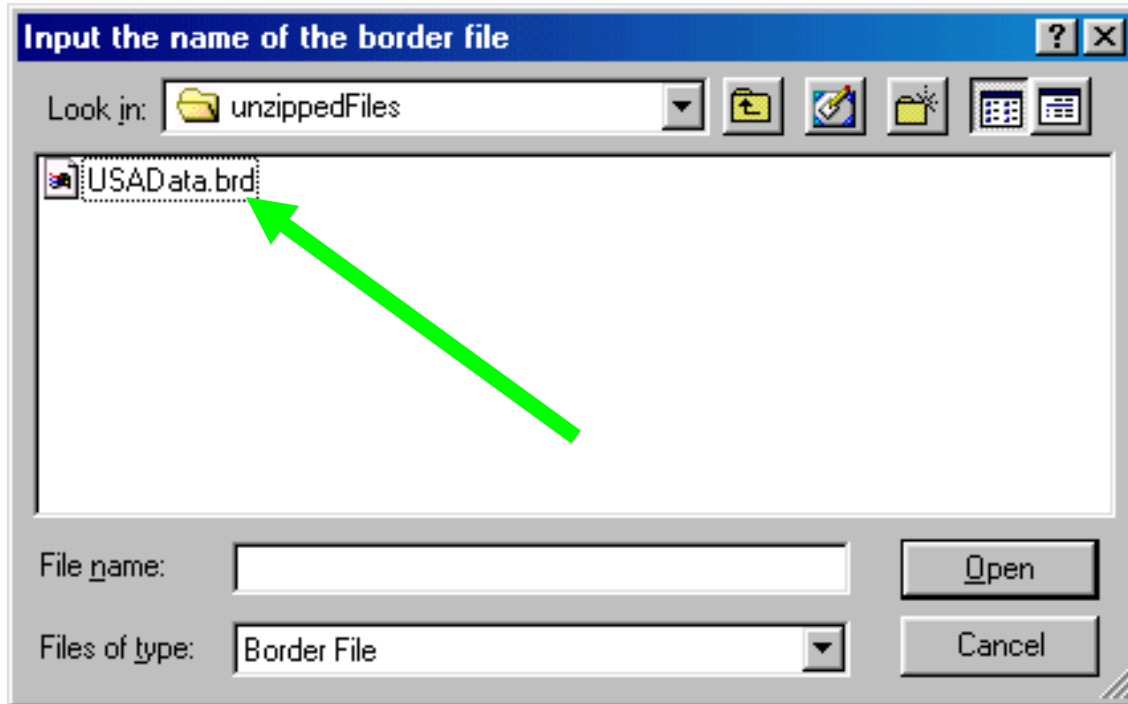
- Click on **Map Results**

Tell it what the border file is



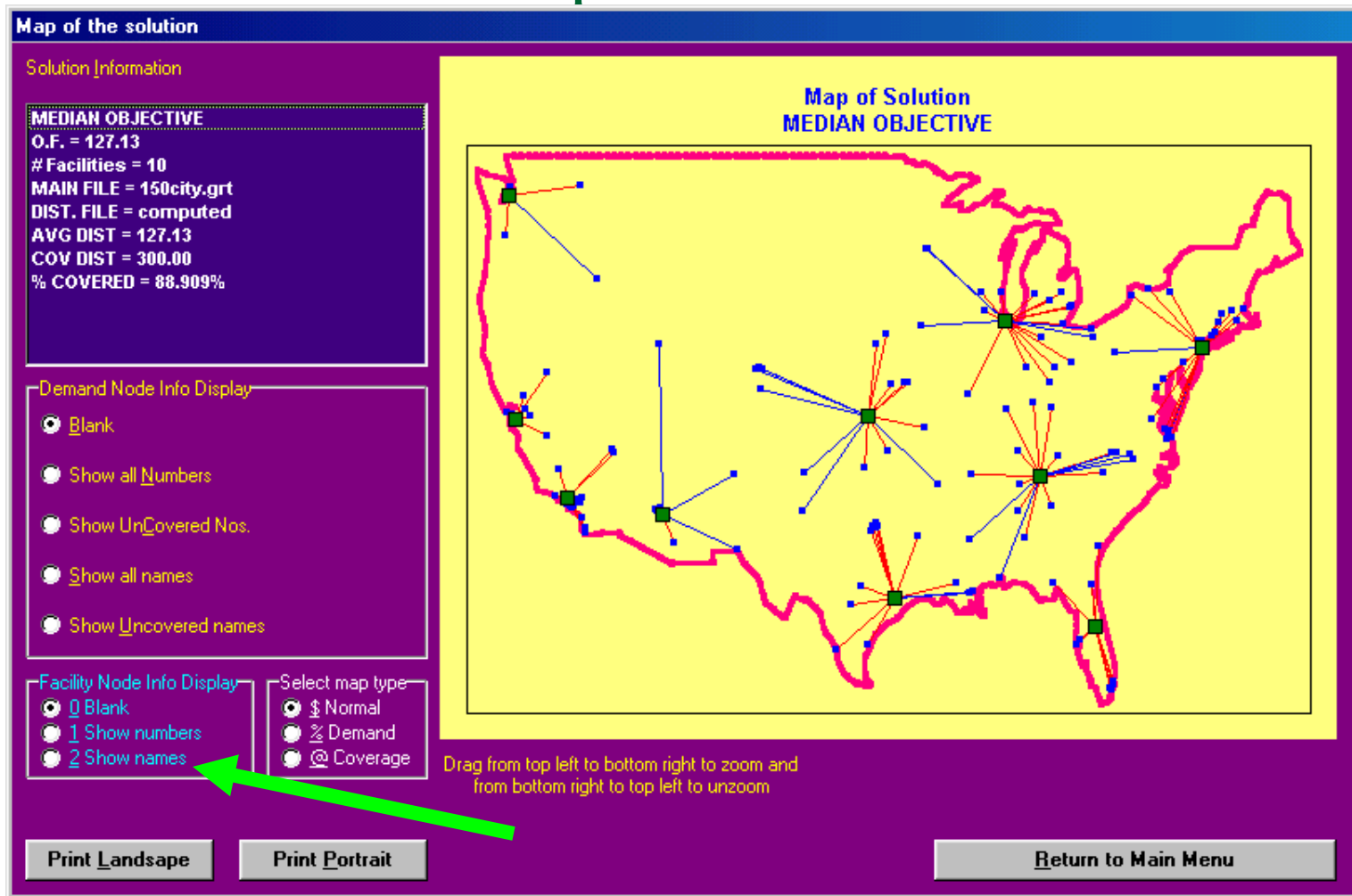
- If you have a file giving the coordinates of the border of the region under study, click Yes; otherwise click No
- Click Yes now

Tell it which file to read



- Double click on the name of the desired border file

Here is the map



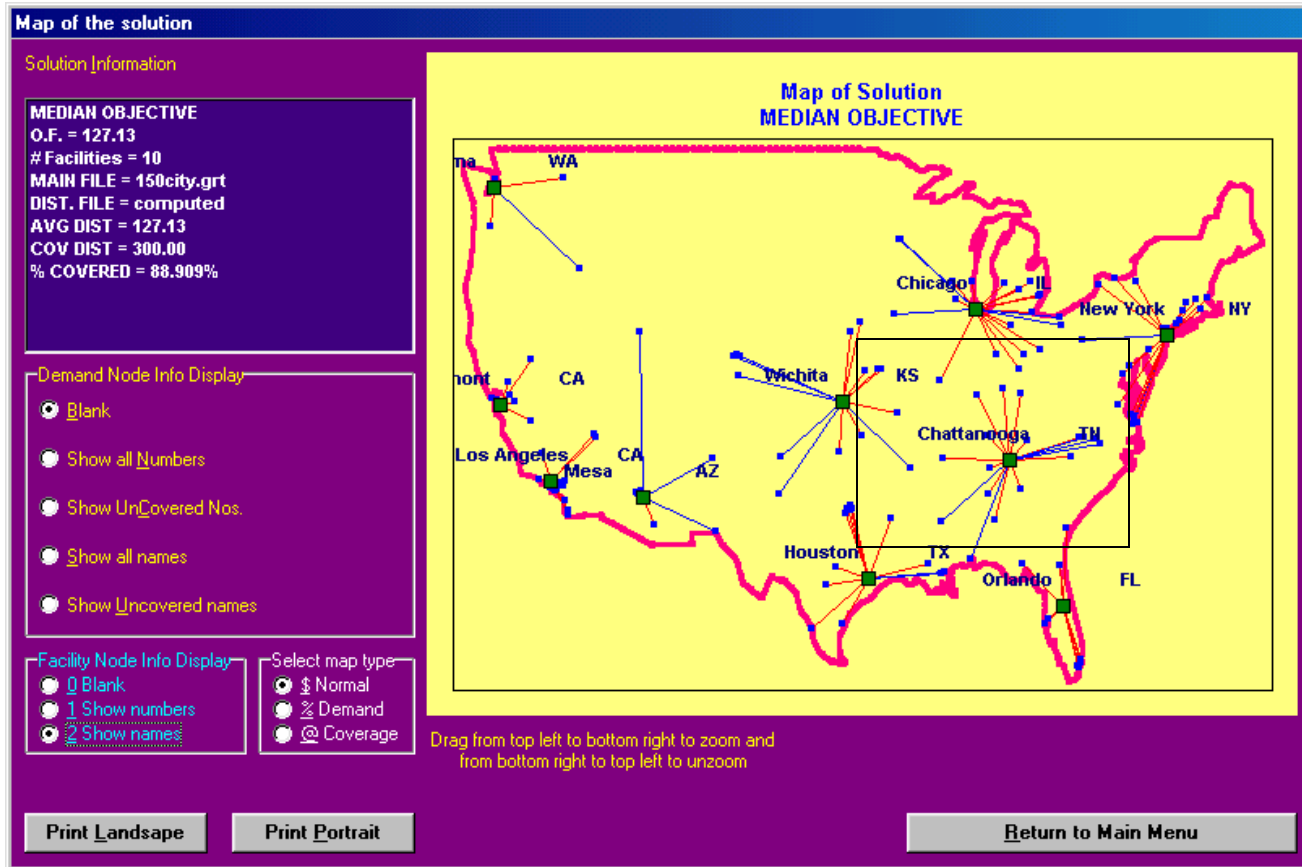
- This shows the locations of the facilities and the demand nodes assigned to each facility
- Click on option **2 Show Names** to see the facility names

Here we are



- Here are the names. Other options let you change what is displayed on the map

Zoom in



- To zoom in, drag the mouse from top left to bottom right of the region to zoom on

Zoomed map

Map of the solution

Solution Information

MEDIAN OBJECTIVE
O.F. = 127.13
Facilities = 10
MAIN FILE = 150city.grt
DIST. FILE = computed
AVG DIST = 127.13
COV DIST = 300.00
% COVERED = 88.909%

Demand Node Info Display

Blank

Show all Numbers

Show UnCovered Nos.

Show all names

Show Uncovered names

Facility Node Info Display

Blank

Show numbers

Show names

Select map type

Normal

Demand

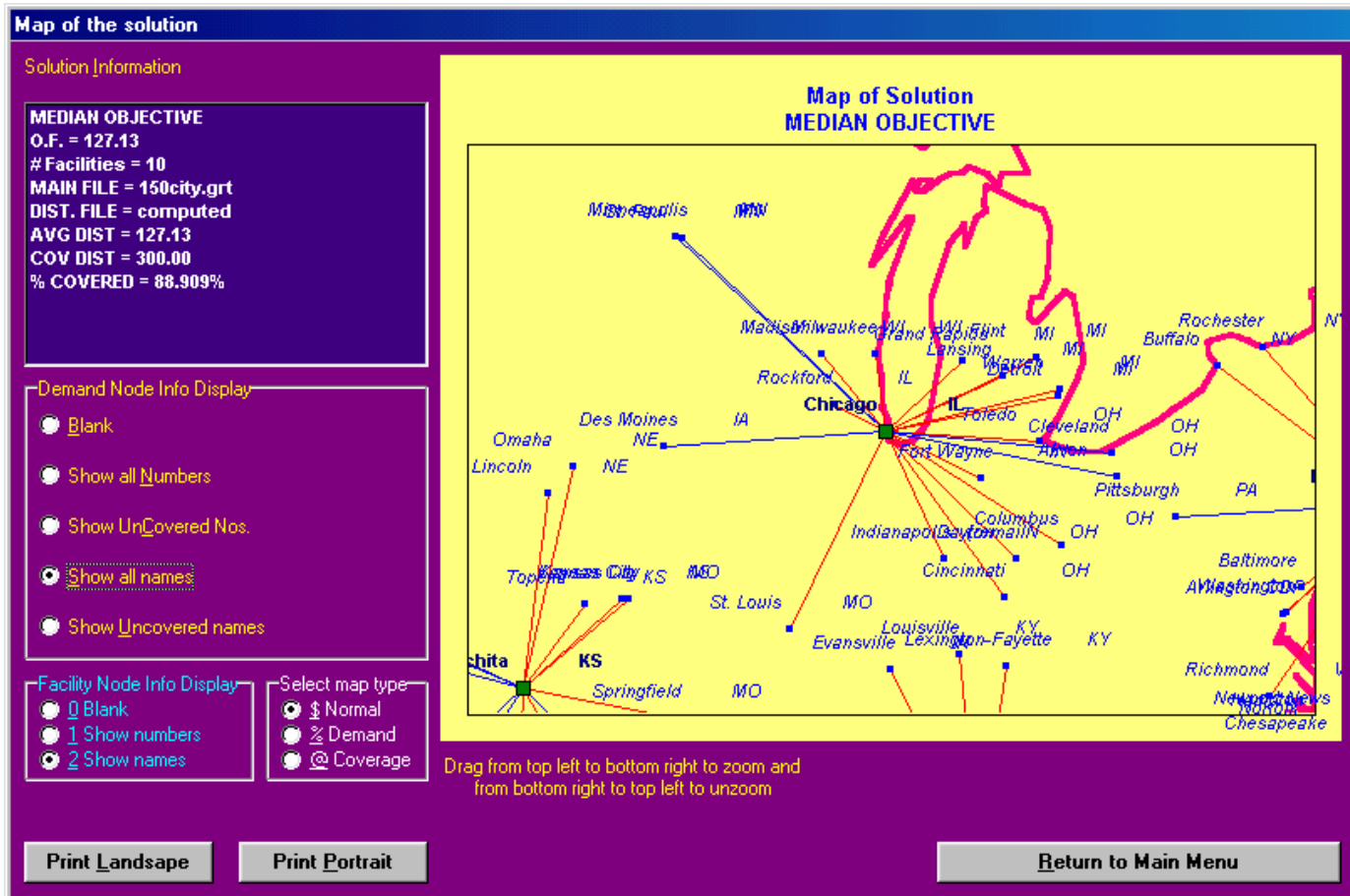
Coverage

Drag from top left to bottom right to zoom and
from bottom right to top left to unzoom

Print Landscape Print Portrait Return to Main Menu

- Click on **Show all names** to label all sites

Here are all the city names



- Cities connected to facilities by red lines are within the coverage distance
- Cities connected to facilities by blue lines are further than the coverage distance

Zoom out

Map of the solution

Solution Information

MEDIAN OBJECTIVE
O.F. = 127.13
Facilities = 10
MAIN FILE = 150city.grt
DIST. FILE = computed
AVG DIST = 127.13
COV DIST = 300.00
% COVERED = 88.909%

Demand Node Info Display

Blank
 Show all Numbers
 Show UnCovered Nos.
 Show all names
 Show UnCovered names

Facility Node Info Display

Blank
 1 Show numbers
 2 Show names

Select map type

Normal
 Demand
 Coverage

Map of Solution
MEDIAN OBJECTIVE

Drag from top left to bottom right to zoom and
from bottom right to top left to unzoom

Print Landscape **Print Portrait** **Return to Main Menu**

- To return to the original map, drag a box from the lower right to the upper left

Get rid of city names

Map of the solution

Solution Information

MEDIAN OBJECTIVE
O.F. = 127.13
Facilities = 10
MAIN FILE = 150city.grt
DIST. FILE = computed
AVG DIST = 127.13
COV DIST = 300.00
% COVERED = 88.909%

Demand Name - Info Display

- Blank
- Show all Numbers
- Show UnCovered Nos.
- Show all names
- Show Uncovered names

Facility Node Info Display

- Blank
- 1 Show numbers
- 2 Show names

Select map type

- Normal
- Demand
- Coverage

Map of Solution MEDIAN OBJECTIVE

Drag from top left to bottom right to zoom and from bottom right to top left to unzoom

Print Landscape **Print Portrait** **Return to Main Menu**

- Click on **Blank** to get rid of the city names

Now see other maps

Map of the solution

Solution Information

MEDIAN OBJECTIVE
O.F. = 127.13
Facilities = 10
MAIN FILE = 150city.grt
DIST. FILE = computed
AVG DIST = 127.13
COV DIST = 300.00
% COVERED = 88.909%

Demand Node Info Display

Blank

Show all Numbers

Show Uncovered Nos.

Show all names

Show Uncovered names

Facility Node Info Display

Blank

1 Show numbers

2 Show names

Select map type

Normal

Demand

Coverage

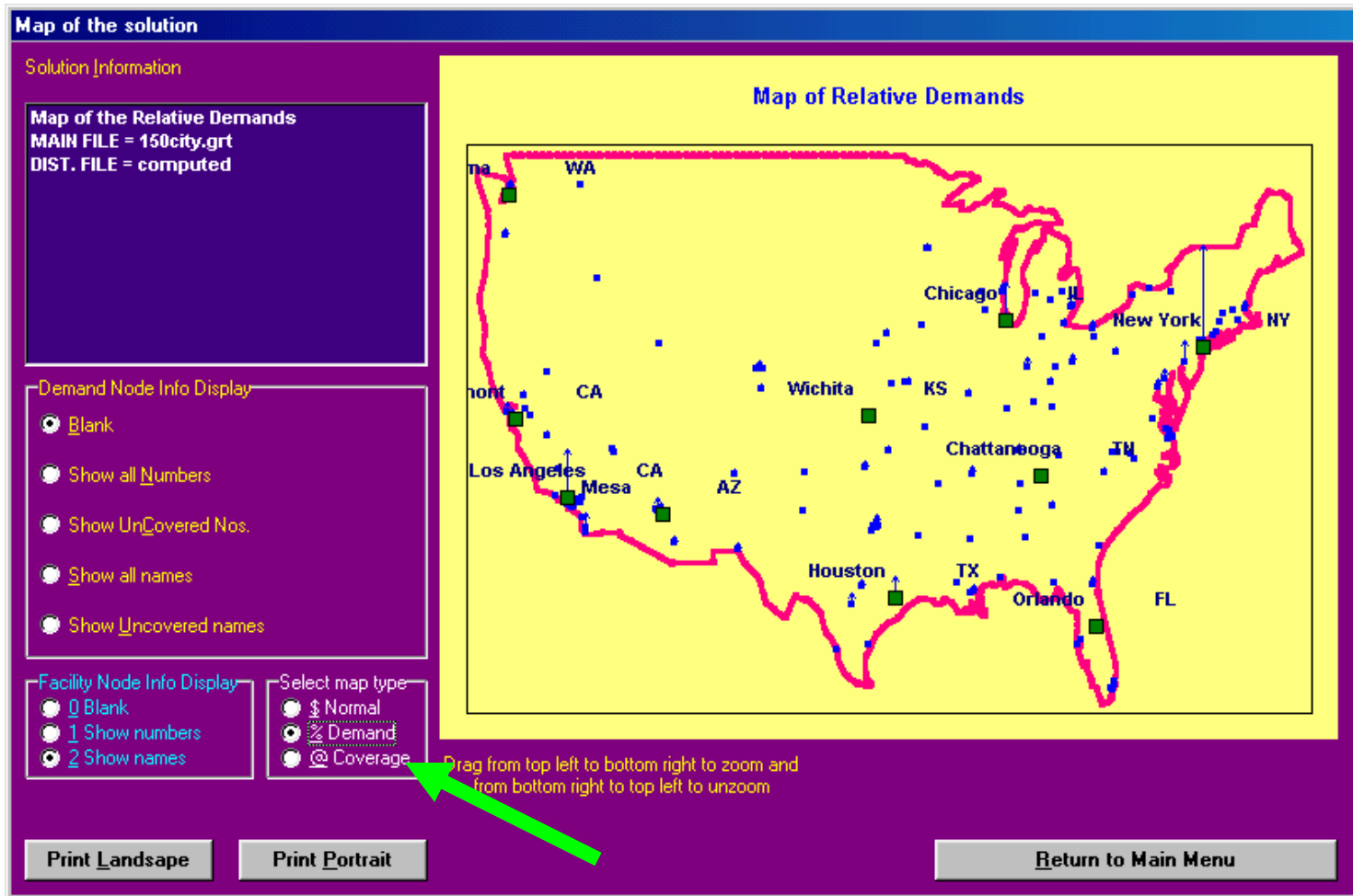
Drag from top left to bottom right to zoom and from bottom right to top left to unzoom

Map of Solution MEDIAN OBJECTIVE

Print Landscape **Print Portrait** **Return to Main Menu**

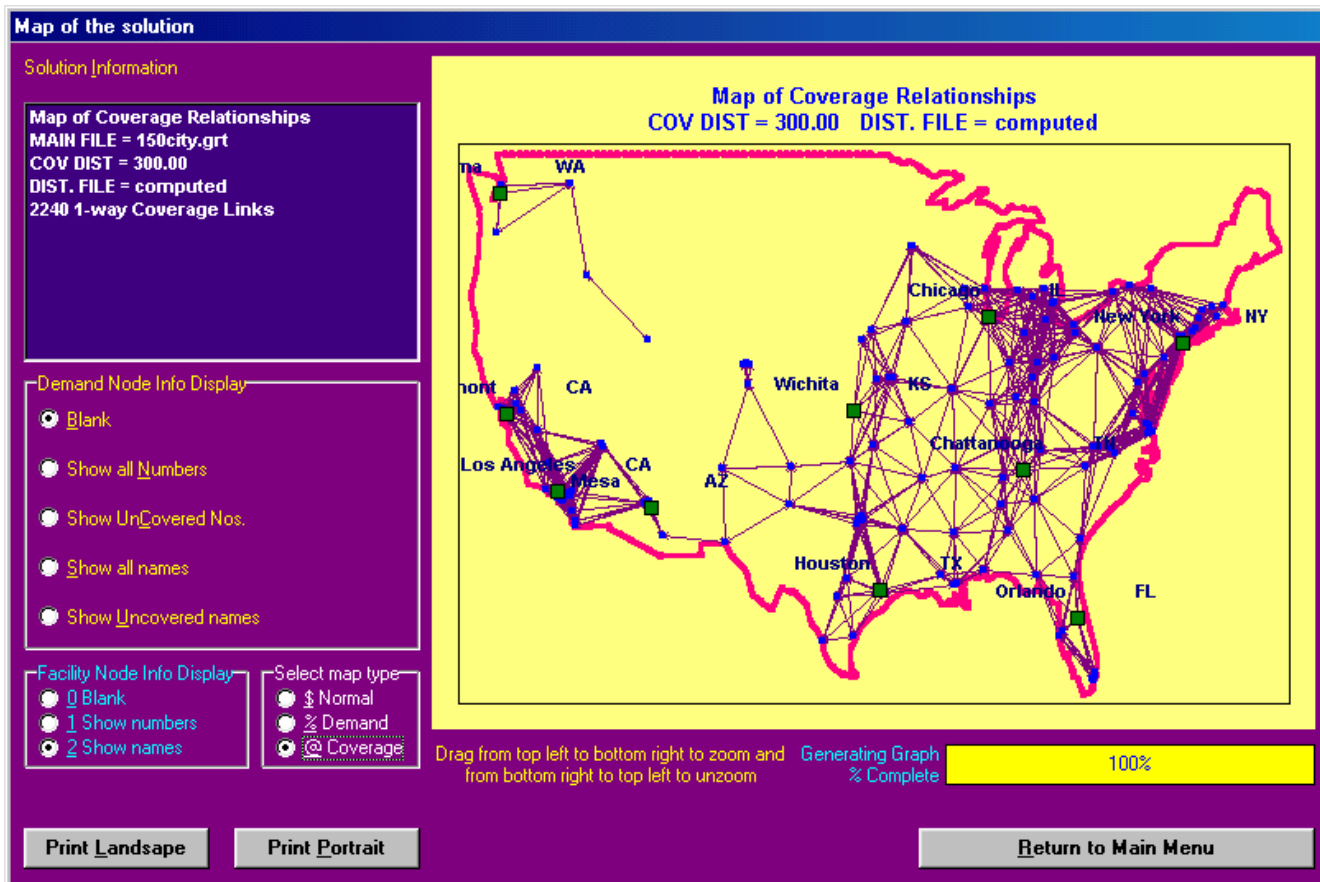
- Click on **% Demand** to see the relative demands

Map of relative demands



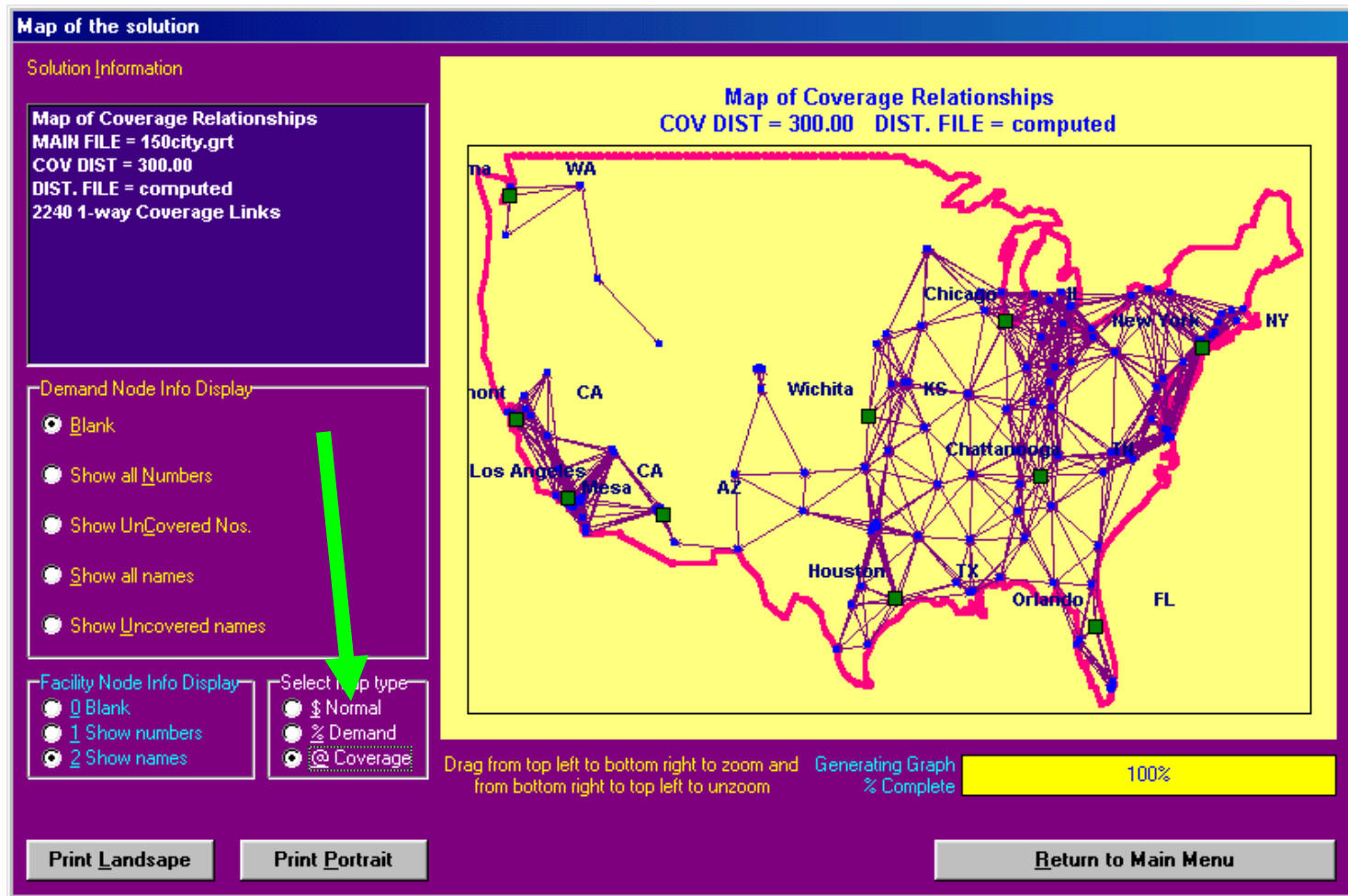
- Note the high bars at New York and Los Angeles
- Now click @ Coverage

Coverage map



- This map draws a line between any pair of cities that are within the coverage distance of each other.

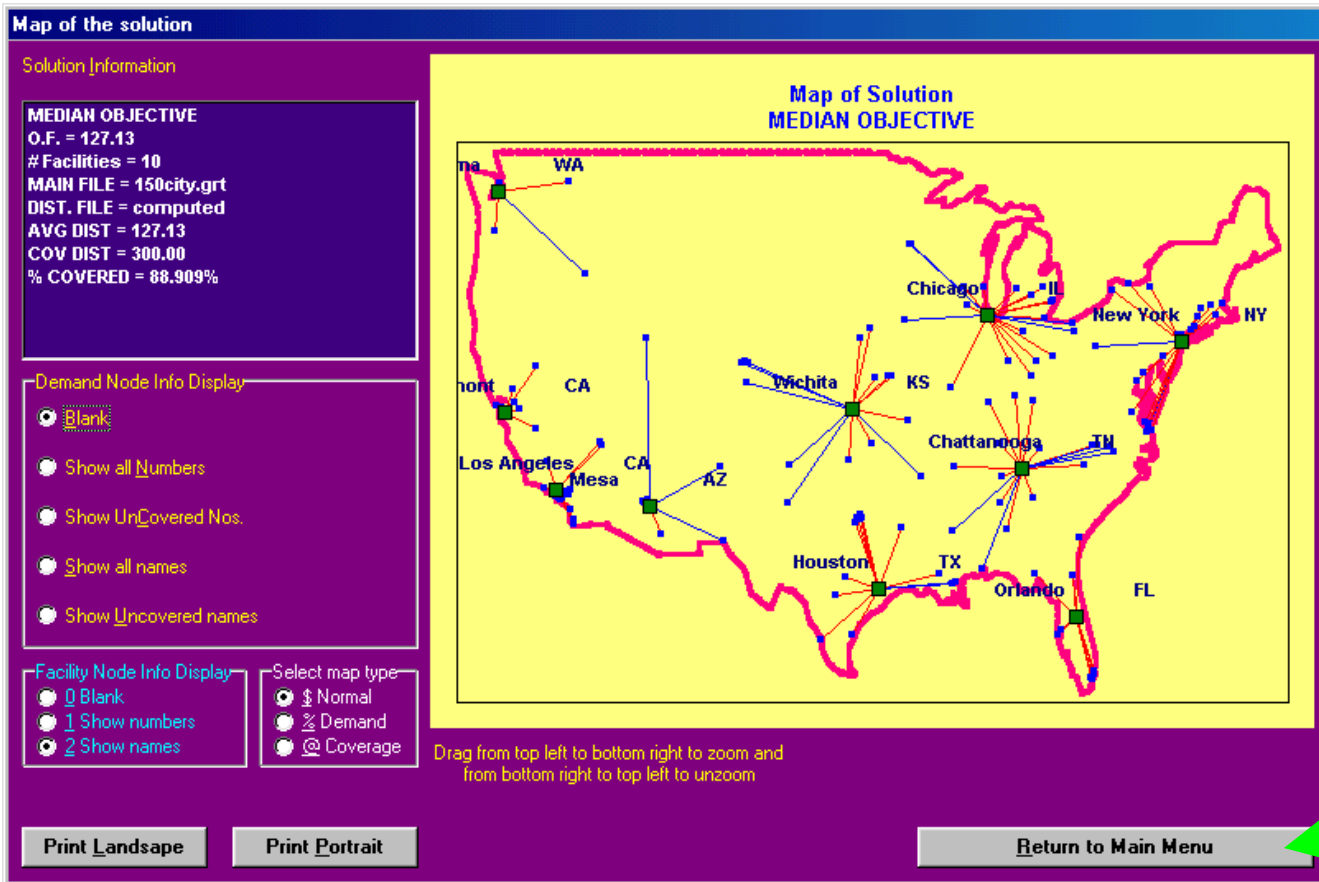
Go back



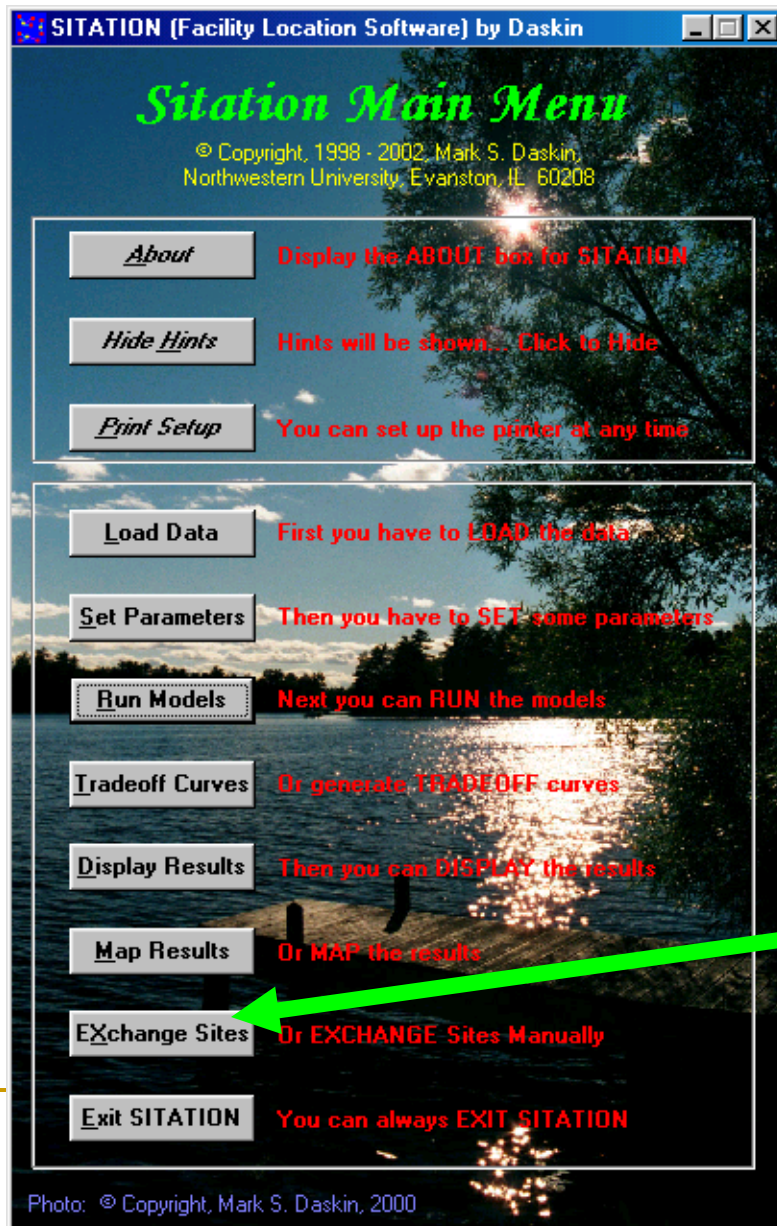
- Click on **\$ Normal** to see the map of the solution again.

Go back again...

- Click on Return to Main Menu to go back to the Main Menu



Now try exchanging sites



- Click on **Exchange Sites** to manually change the solution.
- Note that this option is not available with all objectives.

Exchange sites

Exchange Facilities Form

List of Facilities

1	LOCATION	73.95	40.67	New York	NY
2	LOCATION	118.41	34.11	Los Angeles	CA
3	LOCATION	87.68	41.84	Chicago	IL
4	LOCATION	95.39	29.77	Houston	TX
5	ALLOWED	75.13	40.01	Philadelphia	PA
6	ALLOWED	117.14	32.81	San Diego	CA
7	ALLOWED	83.10	42.38	Detroit	MI
8	ALLOWED	96.77	32.79	Dallas	TX
9	ALLOWED	112.07	33.54	Phoenix	AZ
10	ALLOWED	98.51	29.46	San Antonio	TX
11	ALLOWED	121.85	37.30	San Jose	CA
12	ALLOWED	76.61	39.30	Baltimore	MD

Message Area

Add Site to Solution Exchange 2 Sites Try and Do All Subs.

Delete Site from Solution Find Best Exchange Limited # of Exchanges Close

- In this example, we will see what happens if we locate in Philadelphia instead of New York
- Click Exchange 2 Sites

Add Philadelphia

Exchange Facilities Form

List of Facilities

5	ALLOWED	75.13	40.01	Philadelphia	PA
6	ALLOWED	117.14	32.81	San Diego	CA
7	ALLOWED	83.10	42.38	Detroit	MI
8	ALLOWED	96.77	32.79	Dallas	TX
9	ALLOWED	112.07	33.54	Phoenix	AZ
10	ALLOWED	98.51	29.46	San Antonio	TX
11	ALLOWED	121.85	37.30	San Jose	CA
12	ALLOWED	76.61	39.30	Baltimore	MD
13	ALLOWED	86.15	39.78	Indianapolis	(remainIN
14	ALLOWED	122.55	37.79	San Francisco	CA
15	ALLOWED	81.66	30.33	Jacksonville	(remainFL
16	ALLOWED	82.99	39.99	Columbus	OH
17	ALLOWED	83.83	48.88	Midland	TX

Message Area

Pick node to Add Pick node to Drop Cancel Exchange

Add Site to Solution Exchange 2 Sites Try and Do All Subs.

Delete Site from Solution Find Best Exchange Limited # of Exchanges Close

Click on Philadelphia

Tell SITUATION to add it

Exchange Facilities Form

List of Facilities

5	ALLOWED	75.13	40.01	Philadelphia	PA
6	ALLOWED	117.14	32.81	San Diego	CA
7	ALLOWED	83.10	42.38	Detroit	MI
8	ALLOWED	96.77	32.79	Dallas	TX
9	ALLOWED	112.07	33.54	Phoenix	AZ
10	ALLOWED	98.51	29.46	San Antonio	TX
11	ALLOWED	121.85	37.30	San Jose	CA
12	ALLOWED	76.61	39.30	Baltimore	MD
13	ALLOWED	86.15	39.78	Indianapolis	(remain
14	ALLOWED	122.55	37.79	San Francisco	CA
15	ALLOWED	81.66	30.33	Jacksonville	(remainFL
16	ALLOWED	82.99	39.99	Columbus	OH
17	ALLOWED	87.87	48.88	Midland	TX

Message Area

Pick node to Add Pick node to Drop CAncel Exchange

Add Site to Solution Exchange 2 Sites Try and Do All Subs.

Delete Site from Solution Find Best Exchange Limited # of Exchanges Close

- Click on **Pick node to Add**

Tell SITUATION which node to remove

Exchange Facilities Form

List of Facilities

1	LOCATION	73.95	40.67	New York	NY
2	LOCATION	118.41	34.11	Los Angeles	CA
3	LOCATION	87.68	41.84	Chicago	IL
4	LOCATION	95.39	29.77	Houston	TX
49	LOCATION	97.34	37.69	Wichita	KS
51	LOCATION	111.74	33.42	Mesa	AZ
91	LOCATION	122.46	47.25	Tacoma	WA
94	LOCATION	122.00	37.53	Fremont	CA
101	LOCATION	81.37	28.50	Orlando	FL
110	LOCATION	85.26	35.07	Chattanooga	TN

Message Area

Pick node to Add Pick node to Drop Cancel Exchange

Add Site to Solution Exchange 2 Sites Try and Do All Subs.

Delete Site from Solution Find Best Exchange Limited # of Exchanges Close

- Highlight New York (it should already be highlighted)

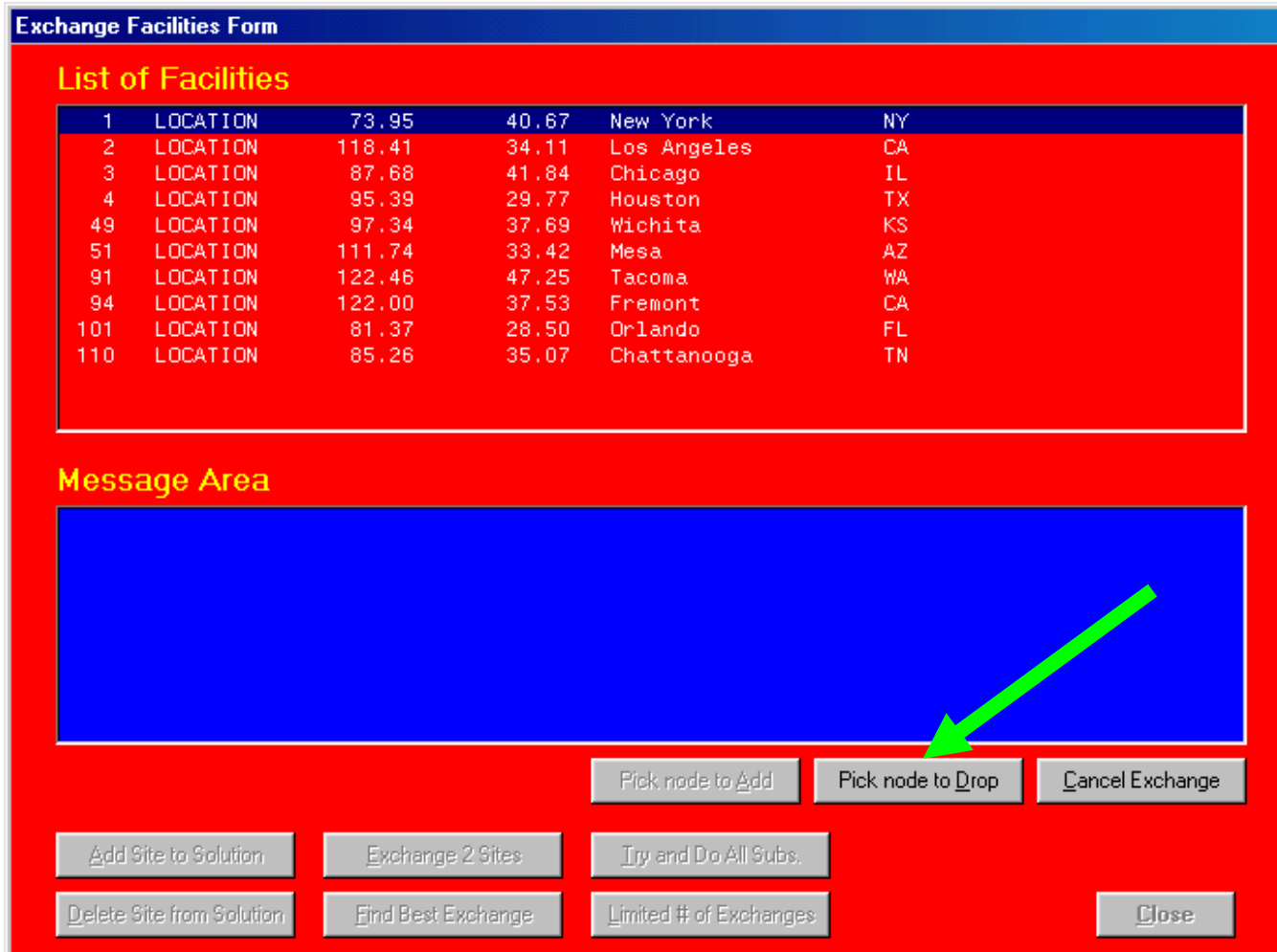
Tell it to delete New York

Exchange Facilities Form

List of Facilities

1	LOCATION	73.95	40.67	New York	NY
2	LOCATION	118.41	34.11	Los Angeles	CA
3	LOCATION	87.68	41.84	Chicago	IL
4	LOCATION	95.39	29.77	Houston	TX
49	LOCATION	97.34	37.69	Wichita	KS
51	LOCATION	111.74	33.42	Mesa	AZ
91	LOCATION	122.46	47.25	Tacoma	WA
94	LOCATION	122.00	37.53	Fremont	CA
101	LOCATION	81.37	28.50	Orlando	FL
110	LOCATION	85.26	35.07	Chattanooga	TN

Message Area



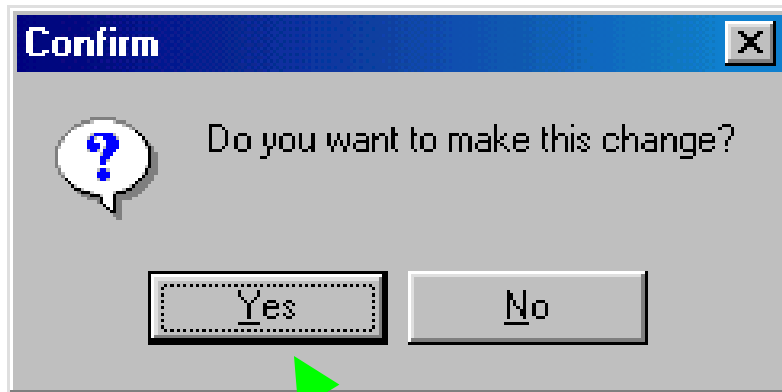
Pick node to Add Pick node to Drop Cancel Exchange

Add Site to Solution Exchange 2 Sites Try and Do All Subs.

Delete Site from Solution Find Best Exchange Limited # of Exchanges Close

- Click on **Pick node to Drop**

Now



- SITUATION will show you a message telling you the impact of the change (in this case, among other impacts, the average distance will go up by 6.45 miles)
- Tell SITUATION whether you want to make the change
- Click Yes in this case

Now

Exchange Facilities Form

List of Facilities

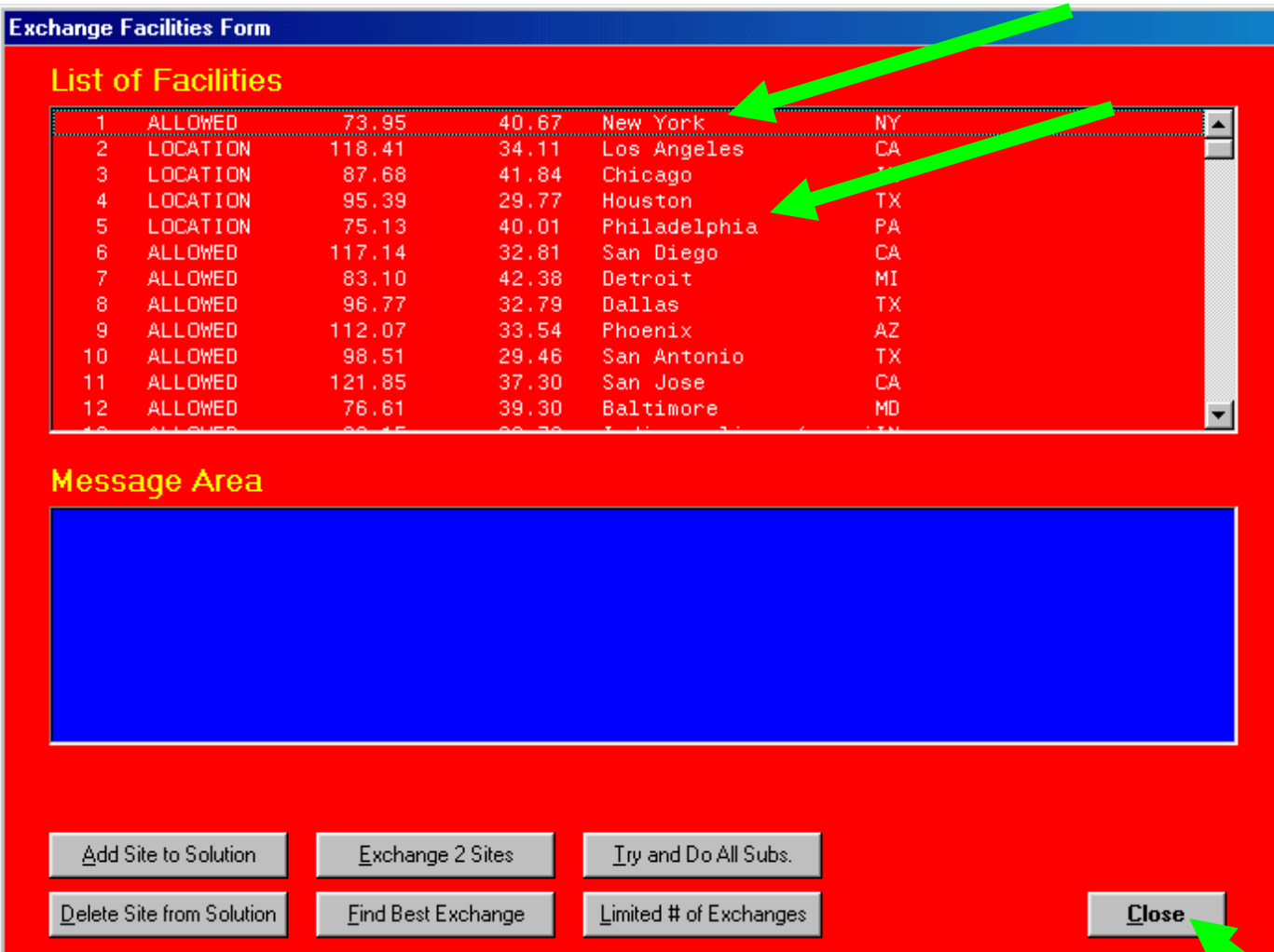
1	ALLOWED	73.95	40.67	New York	NY
2	LOCATION	118.41	34.11	Los Angeles	CA
3	LOCATION	87.68	41.84	Chicago	IL
4	LOCATION	95.39	29.77	Houston	TX
5	LOCATION	75.13	40.01	Philadelphia	PA
6	ALLOWED	117.14	32.81	San Diego	CA
7	ALLOWED	83.10	42.38	Detroit	MI
8	ALLOWED	96.77	32.79	Dallas	TX
9	ALLOWED	112.07	33.54	Phoenix	AZ
10	ALLOWED	98.51	29.46	San Antonio	TX
11	ALLOWED	121.85	37.30	San Jose	CA
12	ALLOWED	76.61	39.30	Baltimore	MD

Message Area

Add Site to Solution Exchange 2 Sites Try and Do All Subs.

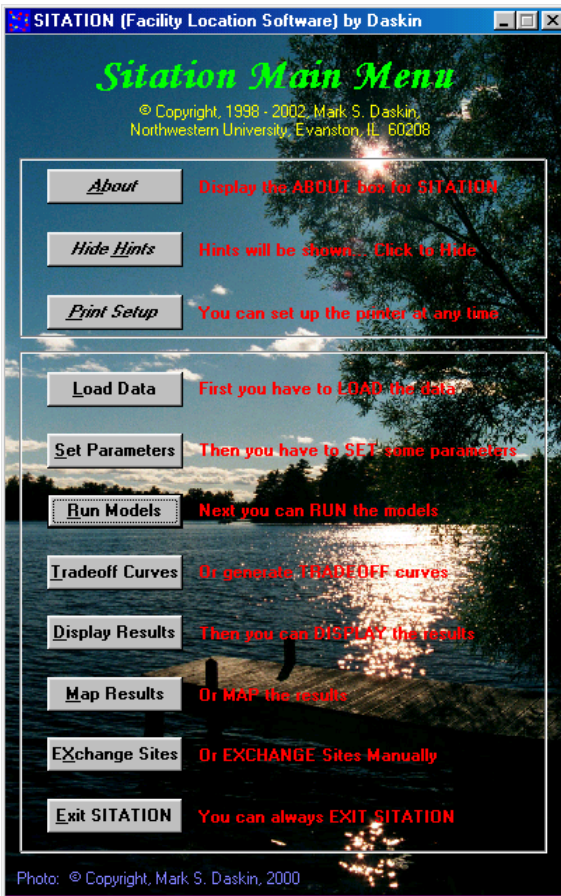
Delete Site from Solution Find Best Exchange Limited # of Exchanges

Close



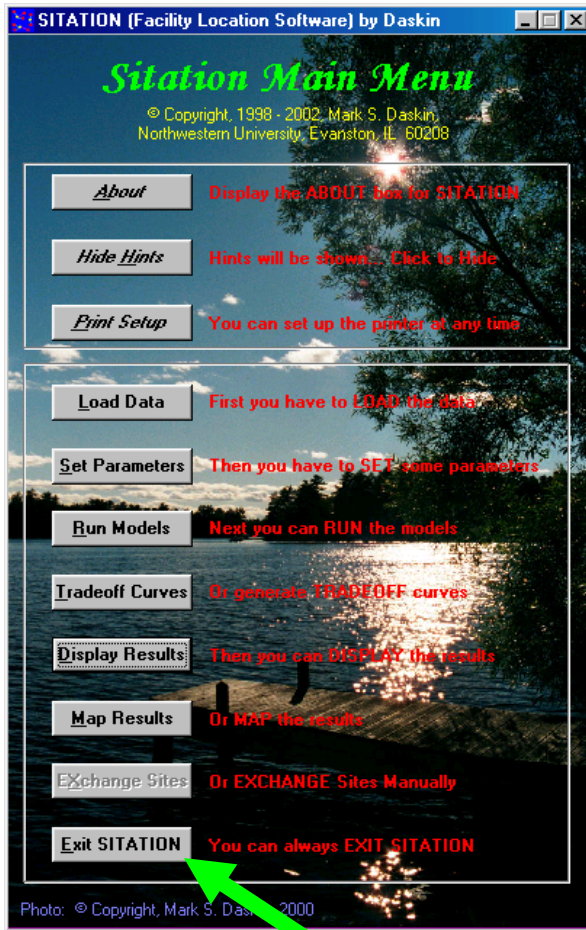
- Look carefully and there is now a facility in Philadelphia and no facility in New York
- Click **C**lose to go back to the Main Menu

You could now



- Display the results of these manual changes or map the new solution, etc.
- But we will skip all that. You should now know how to do all of that.

Now we can get out of SITUATION



- Click Exit SITUATION

Again



- To prevent you from inadvertently leaving before you want to, SITATION asks you to confirm that you really want to exit
- Click Yes

And finally

- Click **OK** to return to Windows



SITUATION is (hopefully)

- Relatively easy to understand if you know a bit about location models.
- Relatively bullet proof. It should be very hard to crash it.
- Try other options on your own

And note

- You can print any of the reports, graphs or maps just by clicking on the appropriate Print button.

Enjoy

- Have fun using SITUATION. Experiment with
 - Forcing facility sites into or out of the solution
 - Other objective functions
 - Etc.

Exercise

- You are working for a global chain company which just starts to expand their market into USA. They are planning to build 10 plants in USA. There are 150 candidate cities to choose from. You are given the demand information at each city (Please see 150city.grt file.) The current goal of the company is to minimize the demand weighted total distance since transportation expenses are the key factor to the company profits. Assume now you want to exclude New York and Los Angeles as candidate sites of your facility due to the consideration of the high probability of natural disaster. Please use Sitation software to find the best locations and show the results in map.