In this exercise, we will both examine the processes of network analysis as well as the command-line interface of ArcGIS. For more information about network analysis, begin your exploration at Start ➔ All Programs ➔ ArcGIS ➔ ArcINFO Workstation ➔ ArcDoc ➔ Working with linear features ➔ Network Analysis ➔ Introduction to NETWORK

**PATH**

How long would it take to knock off all of the local banks in Salisbury? In the first test, we have picked, using our extensive bank-robbing experience, the order in which we’re going to “visit” each bank. We’re assuming that we’re going to be approaching Salisbury on US 50 from the west.

**Step 1: (Create) Examine data**

STREETS – Network coverage of Metro Salisbury

Key Data Items in AAT:
- **SP_LIMIT** – speed limit
  - 40 mph for thoroughfares
  - 35 mph for in-town major streets
  - 30 mph for in-town minor streets
  - 25 mph for neighborhood streets
- **FR_TO_IMP** – from-to impedance
  - Number of seconds necessary to traverse the link
  - Based on length and speed limit
- **TO_FR_IMP** – to-from impedance
  - These are the same for all streets (not reality)

BANKS2ROB – Destinations in Salisbury

Key Data Items in PAT:
- **STREETS-ID** – Matching Node-ID in STREETS
  - Picked nodes from STREETS network closest to bank locations
- **ORDER_1** – Visiting order
  - Essentially random order
  - Might be alphabetical
  - Starting point is order_1 = 1
- **IMP_1** – Impedance at stops
Assumes we can knock off a bank in 3 minutes (180 seconds)

**Step 2: Set up network**

Arc: ArcPlot
Arcplot: netcover streets path1
Arcplot: stops banks2rob.pat order_1 # imp_1 # # cum_imp
Arcplot: impedance fr_to_imp to_fr_imp

**Step 3: Run analysis**

Arcplot: path stops

**Step 4: Examine results**

In ArcMap, display the route by single-clicking on STREETS and choosing the path. Display the path with arrows.
Add the banks2rob coverage.
Open the theme table, find cum_imp and determine the time it will take to hit all the banks using our pre-defined order (in hours and minutes…data is in seconds).
To find the directions, Arcplot: directions # name meters

**Step 5: Change and explore**

Copy banks2rob to banks_orig
Using the Editor, remove a couple of banks that are obviously out of the way. (Make a note of which ones you are removing.
Run again with a different pathname and see what happens.

*Use path2 in place of path 1*
*Use b2rminus2_b.pat in place of banks2rob.pat*

**TOUR**

What if we let the GIS pick the best route for our crime spree?

**Step 1: Set up network**

Arc: ArcPlot
Arcplot: netcover streets tour1
Arcplot: stops banks2rob.pat order_1 # imp_1 # outord_1 cum_imp
Arcplot: impedance fr_to_imp to_fr_imp

**Step 2: Run analysis**

Arcplot: tour stops
Step 3: Examine results

In ArcMap, display the route by single-clicking on STREETS and choosing the path.
Display the path with arrows
Add the banks2rob coverage
Open the theme table, find cum_imp and determine the time it will take to hit all the banks using our pre-defined order (in hours and minutes…data is in seconds)
To find the directions, Arcplot: directions # name meters

Step 4: Change and explore:

In ArcCatalog, copy STREETS STREETS_ORIG
Using the Editor in ArcMap, remove the Main St Bridge, the US 50 Bridge, and the Isabella St Bridge from STREETS
Run the analysis again and see what happens

Use streets_b in place of streets
Use tour2 in place of tour1
Use banks2rob_b.pat in place of banks2rob.pat

ALLOCATE

We questioned the wisdom of Sam Walton (God Rest His Soul), putting two Wal-Mart stores so close together in Salisbury. Let’s take a look at the potential service areas of these stores and see if there is a logical reason to do so.

Step 1: Examine data

SHOPPING – Network coverage of Metro Salisbury with demand per link

Key Data Items in AAT:
   SP_LIMIT – speed limit
       40 mph for thoroughfares
       35 mph for in-town major streets
       30 mph for in-town minor streets
       25 mph for neighborhood streets
   FR_TO_IMP – from-to impedance
       Number of seconds necessary to traverse the link
       Based on length and speed limit
   TO_FR_IMP – to-from impedance
       These are the same for all streets (not reality)
   DEMAND_1 – demand for shopping per link
       Represented as number of people per link
       Estimated as one “person” every 25 meters
       “Calc demand_1 = length / 25”

SHOPCENT – Shopping centers in Salisbury (Wal-Mart locations)
Key Data Items in PAT:

- **SHOPPING-ID** – Matching Node-ID in SHOPPING
  Picked nodes from SHOPPING network closest to center locations
- **ROUTE-ID** – Number that distinguishes one allocation area from another
- **MAX_TIME** – Maximum amount of travel time to a store
  Number of customers is not our main constraint but amount of travel time. This item sets the maximum about of time that customers will take to travel to that store. Set at 100 seconds (completely contrived)
  - MAX_TIME2 – 200
  - MAX_TIME3 – 400
  - MAX_TIME4 – 500
- **CUST** – Maximum amount of customers
  Bogus variable for this analysis, set to be very large number

**Step 2: Set up network**

Arcplot: netcover shopping areas1
Arcplot: impedance fr_to_imp to_fr_imp
Arcplot: demand demand_1
Arcplot: centers shopcent.pat route-id max_time cust total_time shoppers

**Step 3: Run analysis**

Arcplot: allocate centers out

**Step 4: Examine results**

In ArcMap, display the allocated links by single-clicking on SHOPPING and choosing areas1.
Display the using Unique Value on Areas1-id
Add the shopcent coverage
Open the theme table. How many shoppers are within 100 seconds of each store? Why so different?

**Step 5: Change and explore:**

Run the analysis 4 times using different MAX_TIMEs.
Be sure to name them differently in the netcover command.
Display all at once.
Is this what you expected?

In ArcCatalog, copy SHOPPING SHOPPING_OR
Using the ArcMap Editor, remove the Main St Bridge, the US 50 Bridge, and the Isabella St Bridge
Run again using MAX_TIME 4 and see what happens.
Use shopping_b in place of shopping
Use areas2 in place of areas1
Use shopcent_b.pat in place of shopcent.pat