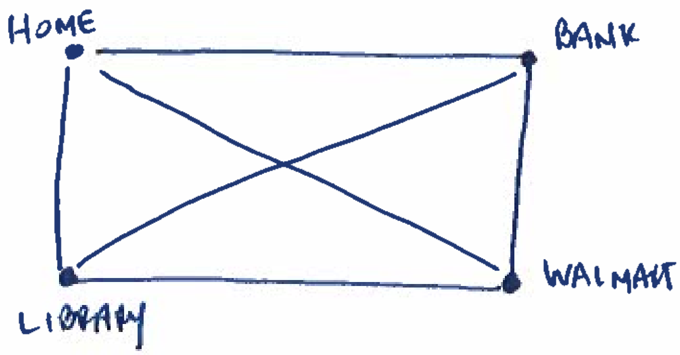
## Part III (Section 7.2): Hamilton Circuits

A Hamilton Circuit is a closed circuit that:

✓1. Starts and ends at the same node

✓2. Visits each other node only once and returns to the beginning node.

**Examples:** SATURDAY MORNING ERRANDS




HAMILTON CIRCUITS

| | |
|---|---|
| ✓H - B - W - L - H | ✓H - L - W - B - H |
| ✓H - W - B - L - H | ✓H - L - B - W - H |
| ✓H - W - L - B - H | ✓H - B - L - W - H |

TOTAL NUMBER OF HAMILTON CIRCUITS : $(n-1)! = (4-1)! = 3! = 3 \cdot 2 \cdot 1 = 6$

NUMBER OF NODES

$n = 4$

UNIQUE HAMILTON CIRCUITS : $\frac{(n-1)!}{2} = \frac{(4-1)!}{2} = \frac{3!}{2} = \frac{3 \cdot 2 \cdot 1}{2} = 3$

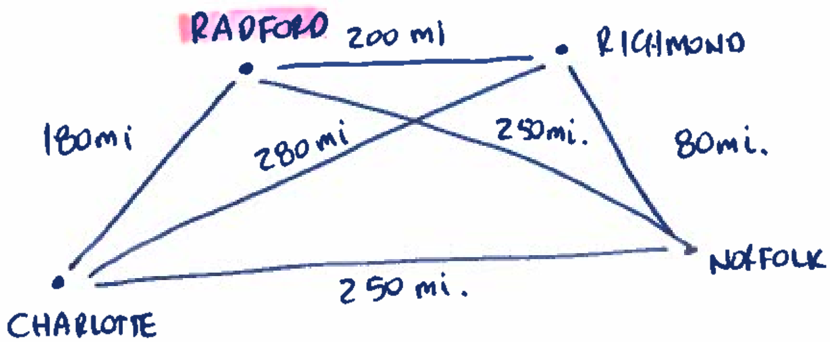
**<u>Part IV:</u> Finding the all Hamilton Circuits and the "best" Hamilton Circuit**

Option 1: The Brute Force Algorithm : LISTS ALL HAMILTON CIRCUITS TO SEE WHICH IS THE MOST OPTIMAL. (PAINFUL .....)

Option 2: The Nearest Neighbor Algorithm

1. Start at "home".
2. Pick the closest node (vertex) to visit from home.
3. After step 2, pick the nearest neighbor again until all nodes have been visited.
4. Return home.

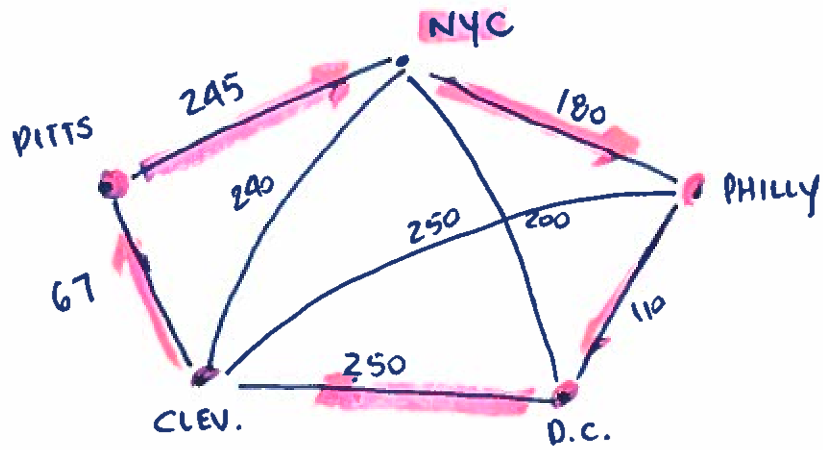
EXAMPLE:




BRUTE FORCE ALGORITHM: $(n-1)! = (4-1)! = 3! = 6$ ROUTES

NEAREST NEIGHBOR ALGORITHM: $R \overset{180}{-} C \overset{250}{-} N \overset{80}{-} RICH \overset{200}{-} R = 710$ MILES

# The Traveling Salesman Problem Example




NYC $\xrightarrow{180}$ PHILLY $\xrightarrow{110}$ DC $\xrightarrow{250}$ CLEV $\xrightarrow{67}$ PITTS $\xrightarrow{245}$ NYC (NEAREST NEIGHBOR) = 847

BRUTE FORE ALGORITHM : $(n-1)! = (5-1)! = 4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$ TOTAL

$= 12$ UNIQUE