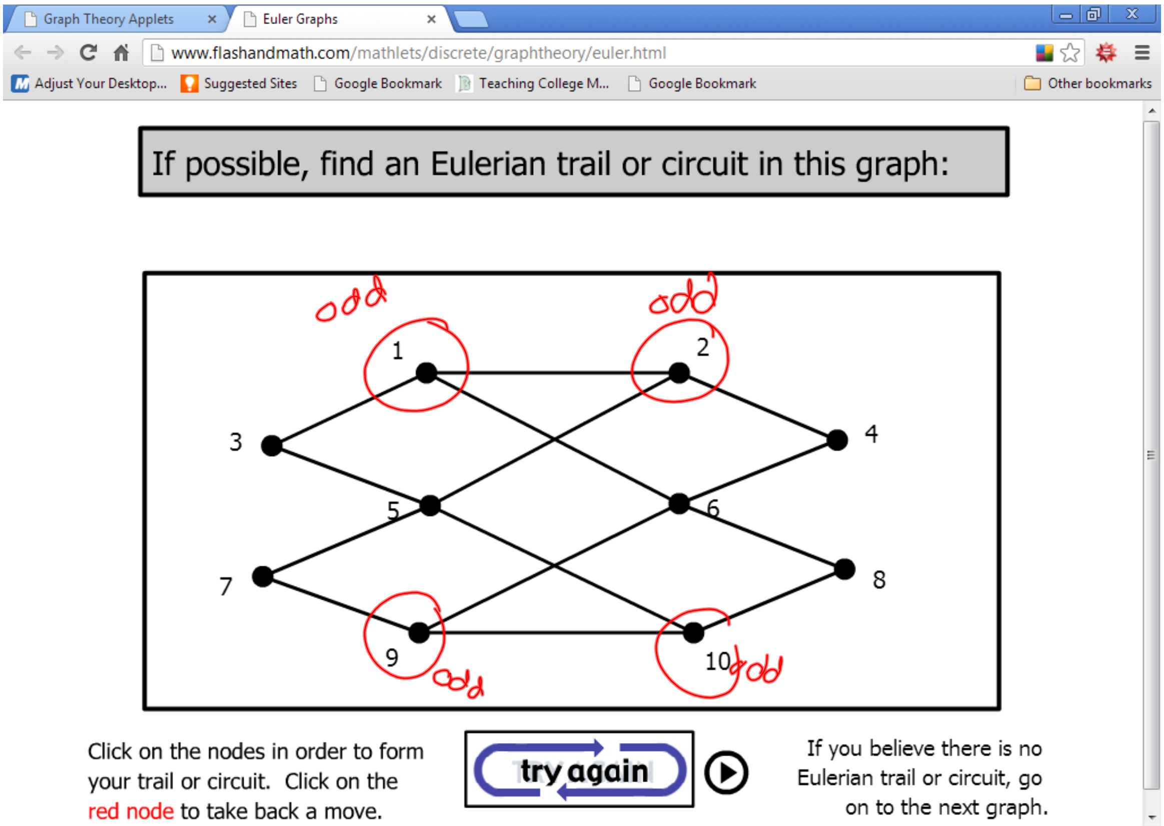
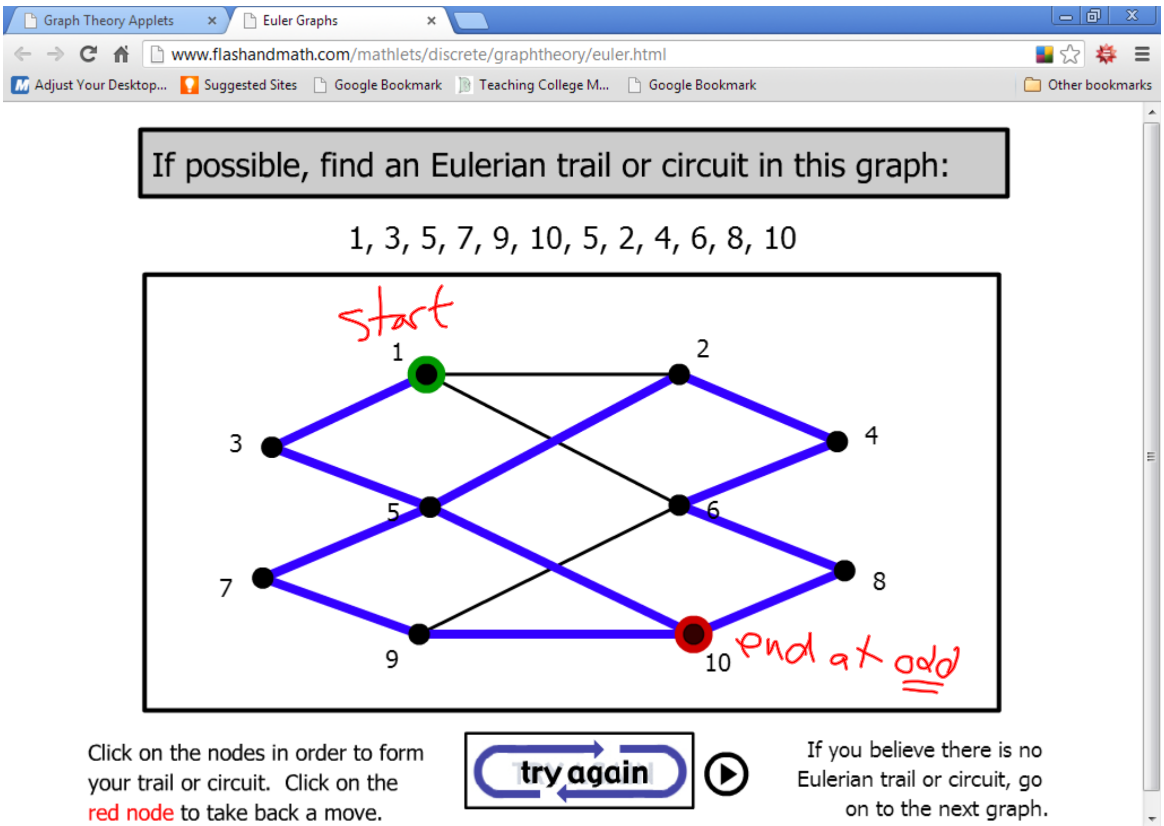

Graph Theory Applets
Euler Graphs
www.flashandmath.com/mathlets/discrete/graphtheory/euler.html
Adjust Your Desktop... Suggested Sites Google Bookmark Teaching College M... Google Bookmark Other bookmarks
If possible, find an Eulerian trail or circuit in this graph:
odd
odd
1
2
3
4
5
6
7
8
9
10
odd
odd
Click on the nodes in order to form your trail or circuit. Click on the red node to take back a move.
try again
If you believe there is no Eulerian trail or circuit, go on to the next graph.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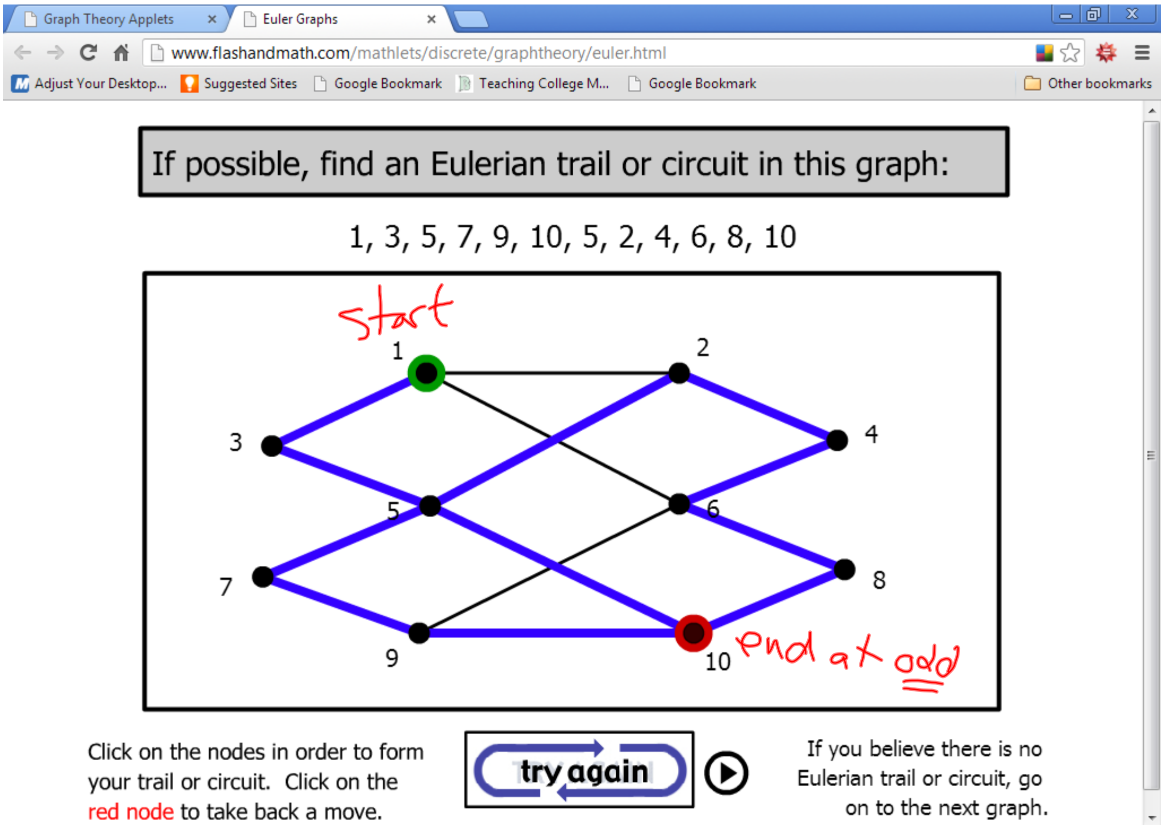
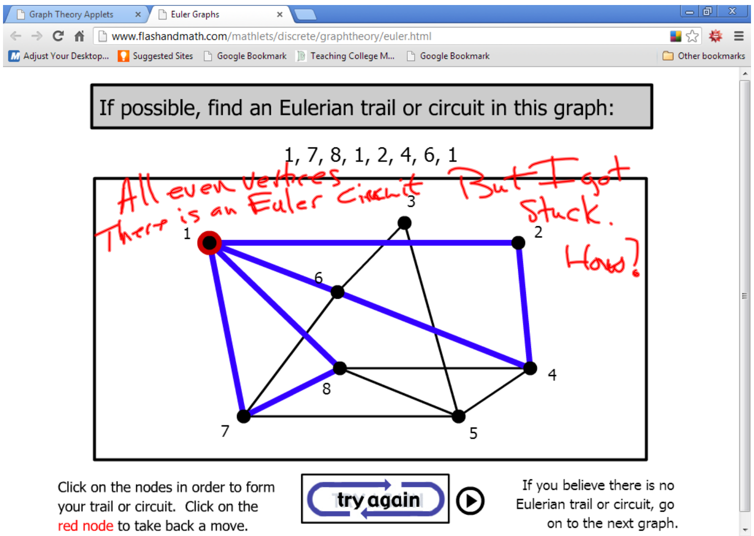
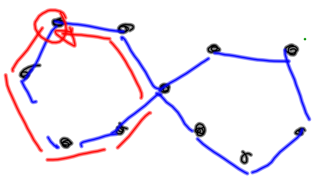
If possible, find an Eulerian trail or circuit in this graph:
1, 3, 5, 7, 9, 10, 5, 2, 4, 6, 8, 10
start
1
2
3
4
5
6
7
8
9
10
end at odd
Click on the nodes in order to form your trail or circuit. Click on the red node to take back a move.
try again
If you believe there is no Eulerian trail or circuit, go on to the next graph.





I can get stuck if I go back to start too soon.

Start here



missed half of the graph.

Fleury's Algorithm for Finding an Euler Circuit (Path)

- **Preliminaries.** Make sure that the graph is connected and either (1) has no odd vertices (circuit), or (2) has two odd vertices (path).

start at one odd
end at the other

- **Start.** Choose a starting vertex. [In case (1) this can be any vertex; in case (2) it must be one of the two odd vertices.]

More than 2 odds cant do it.

Intermediate steps. At each step, if you have a choice, don't choose a bridge of the yet-to-be-traveled part of the graph. However, if you have only one choice, take it.

edge that cuts untraveled part of graph.

- **End.** When you can't travel any more, the circuit (path) is complete. [In case (1) you will be back at the starting vertex; in case (2) you will end at the other odd vertex.]

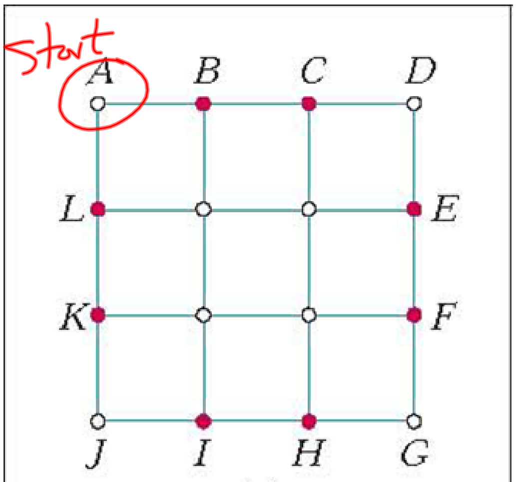
Eulerizing Graphs

Suppose you wanted to plow the snow off the following streets. You only have to go over each road once (in either direction).

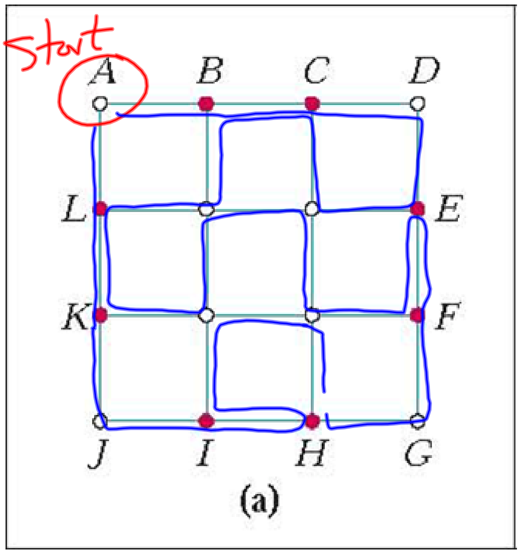
An Euler circuit would give you an optimal route. What do you do if you don't have an Euler circuit?

8 odd vertices so no euler circuit or path

You want a circuit with as few backtracks as possible.

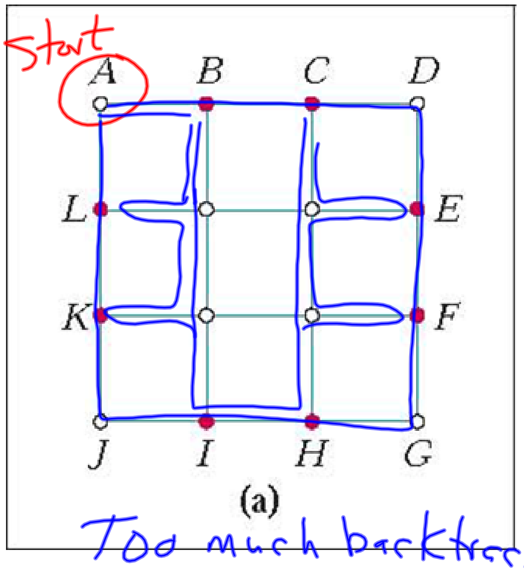


(a)



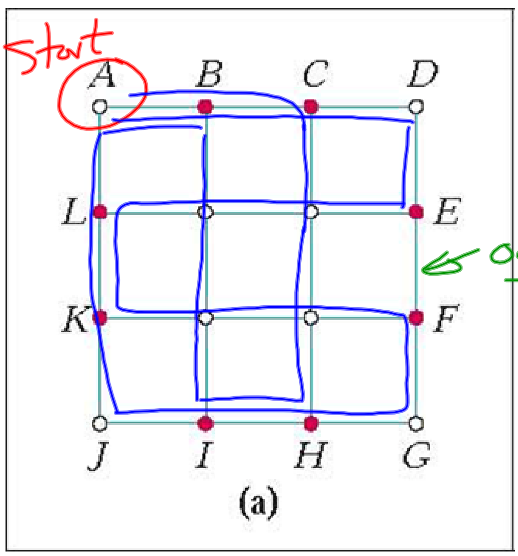
(a)

EF doubled
HI doubled
KL "
BC "



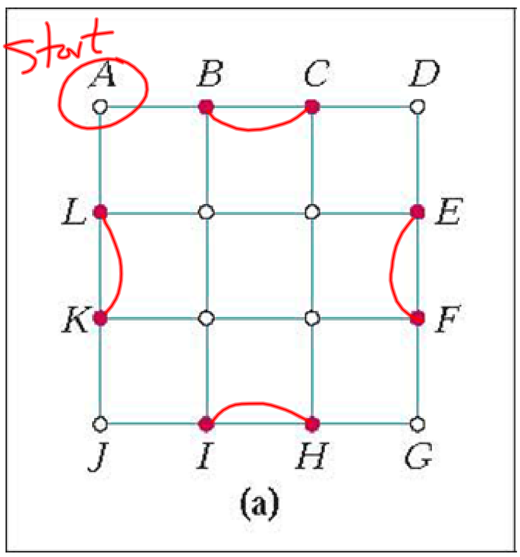
(a)

Too much backtracking.



(a)

oops

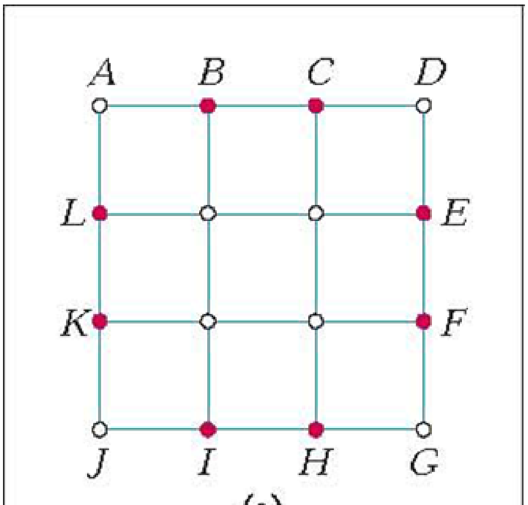


(a)

"Eulerizing a network"
add some "doubled edges" to make all vertices even.

Double some edges to make everything even.
Then do circuit.

Our first step is to identify the odd vertices. This graph has eight odd vertices (B,C,E,F,H,I,K,and L), shown in red.



(a)

Add some extra (double) edges.
The edges that you would have to plow twice.
So that you never "get stuck" at an odd degree vertex.

How many such edges do you have to add?
What is the fewest?

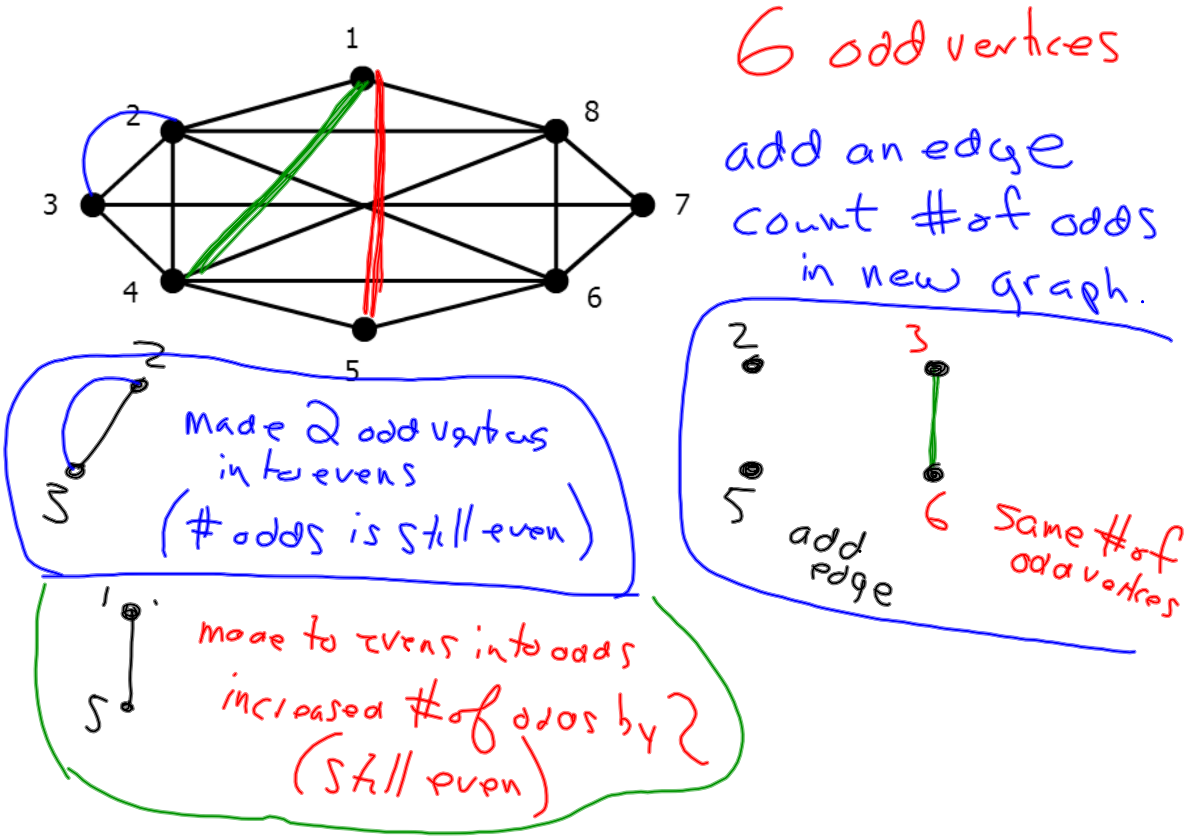
1. How many odd vertices are there in a graph?

Can there ever be only 1? No
Can there be 3 odd vertices?

There is always an even # of odd vertices.

(so we can always pair them up to Eulerize a graph)

Can you think of a reason why this is true?



- **Concept of a graph**

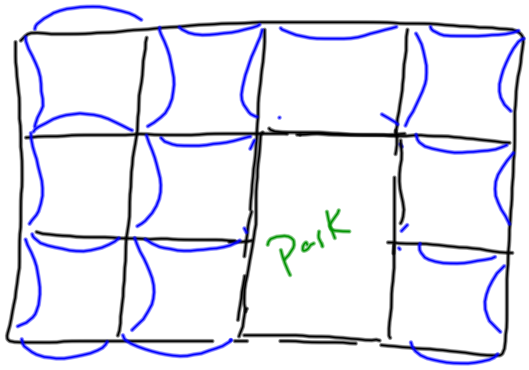
    This idea can be traced back to Euler some 270 years ago.

- **Concept of a graph model.**

    We used graphs and mathematical theory of graphs to solve certain types of routing problems.

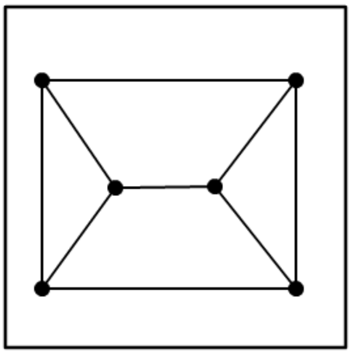
- **Concept of an algorithm**

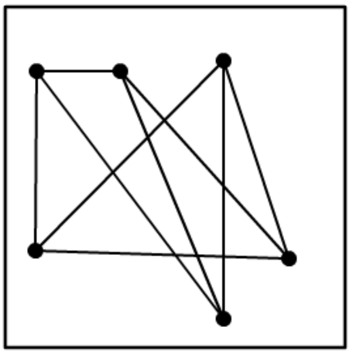
    A set of procedural rules that helps us find Euler circuits or Euler path in a graph

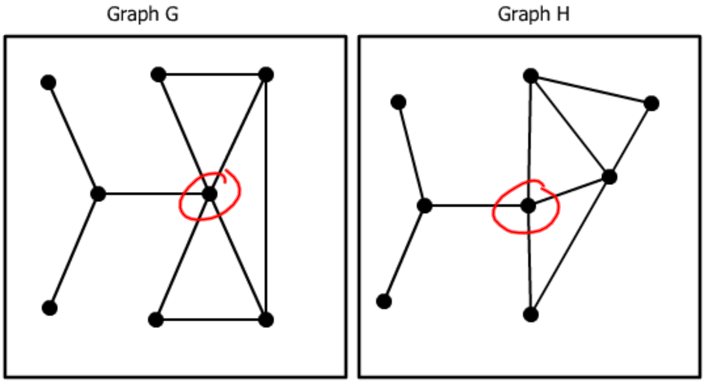


Streets on Park only have houses on one side.

Grid of streets to deliver mail.
(Hit each side of street as few as possible)
In this case every intersection has even degree
So easy to find Euler circuit.







Connecting edge hits vertices with diffrent degrees in H an G.

Not the same graph.

Attachments

- Web Pages as Graphs
- Euler Circuit
- TheHousesAndUtilitiesCrossingProblem.nbp