The Seven Bridges of Konigsberg-Euler's solution

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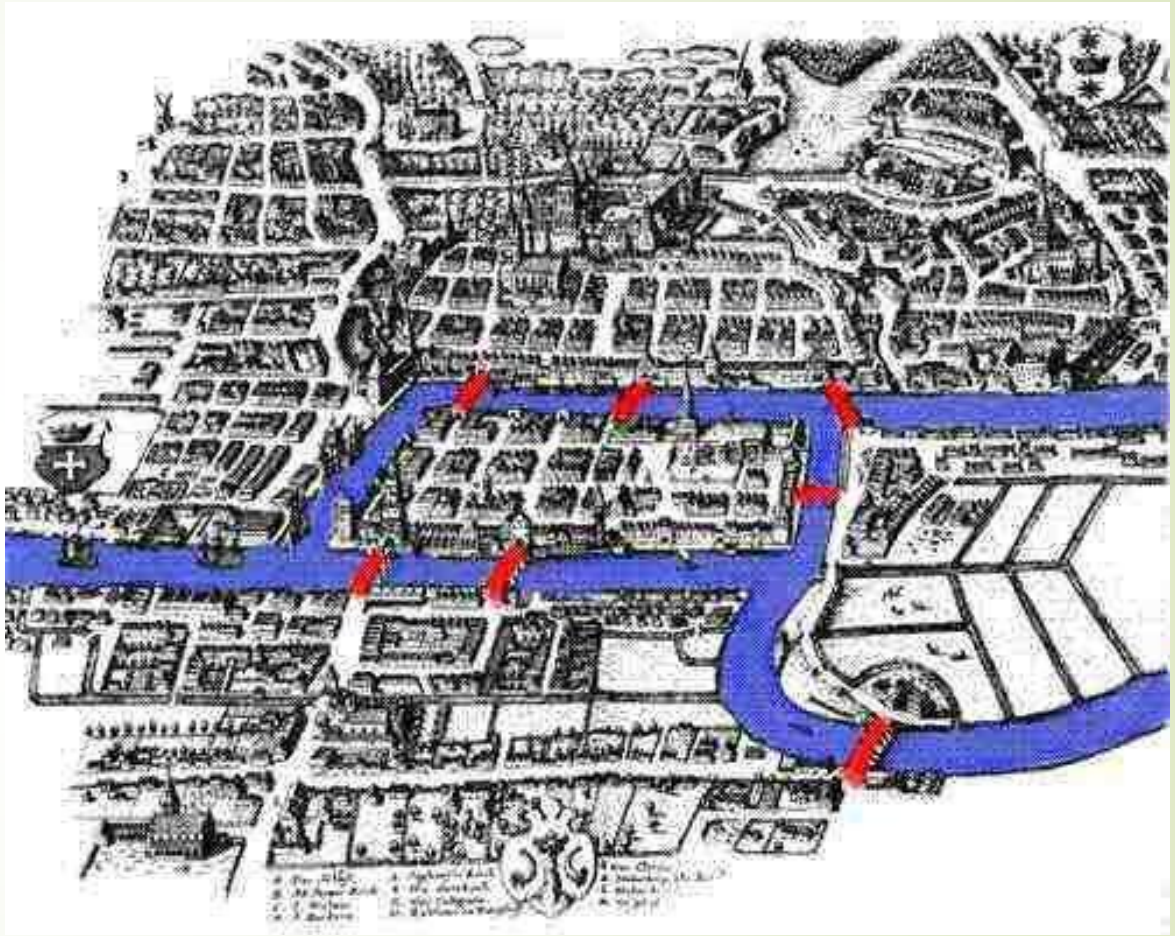
The Seven Bridges of Konigsberg

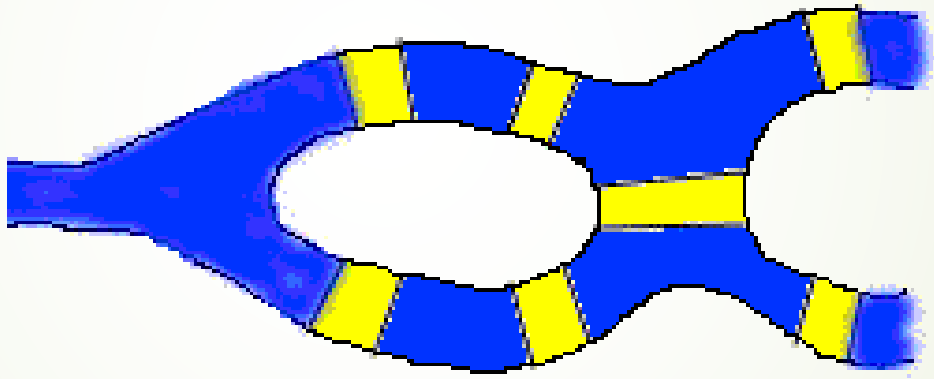
- The problem goes back to year 1736.
- This problem lead to the foundation of graph theory.
- In Konigsberg, a river ran through the city such that in its center was an island, and after passing the island, the river broke into two parts.

R-W Problem

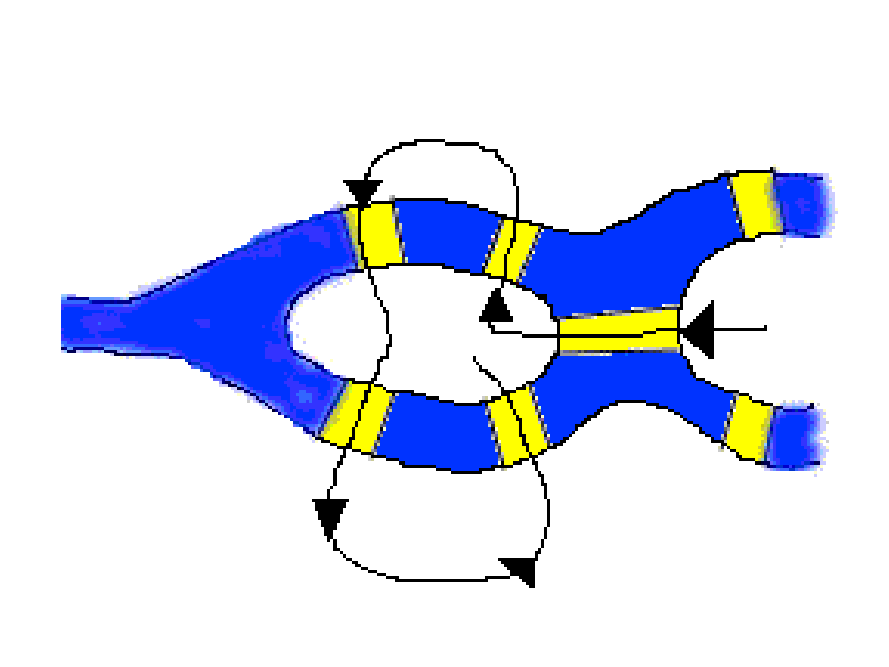
- We have seven bridges for people of the city to get from one part to another
- The people wondered whether or not one could walk around the city in a way that would involve crossing each bridge exactly once.

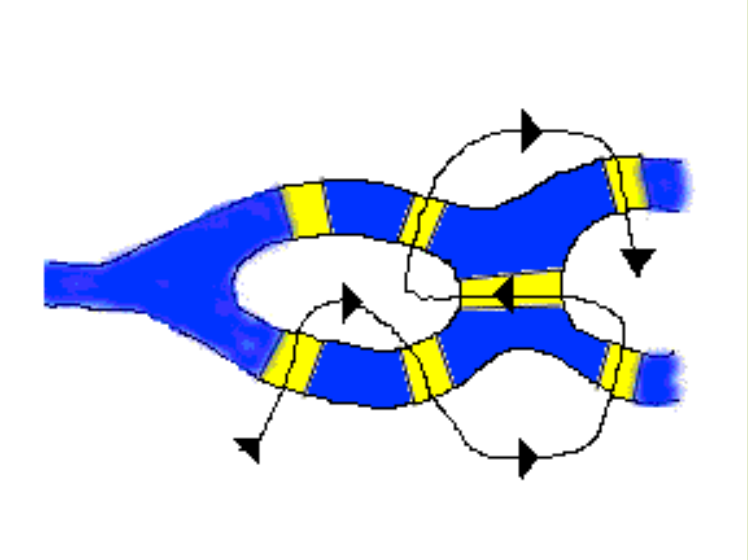


Try solving it

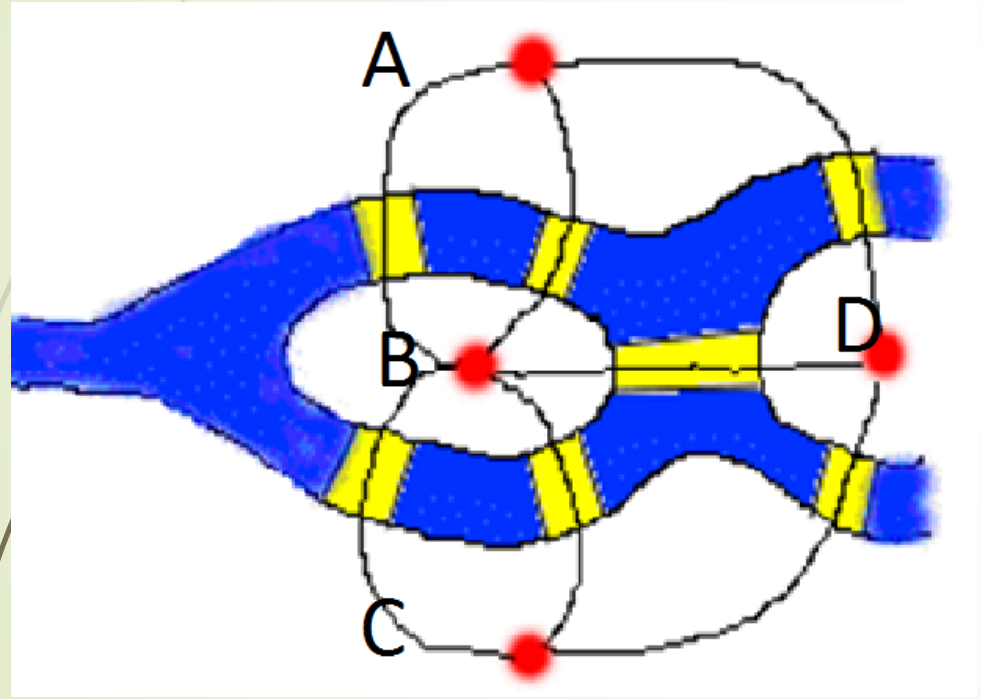


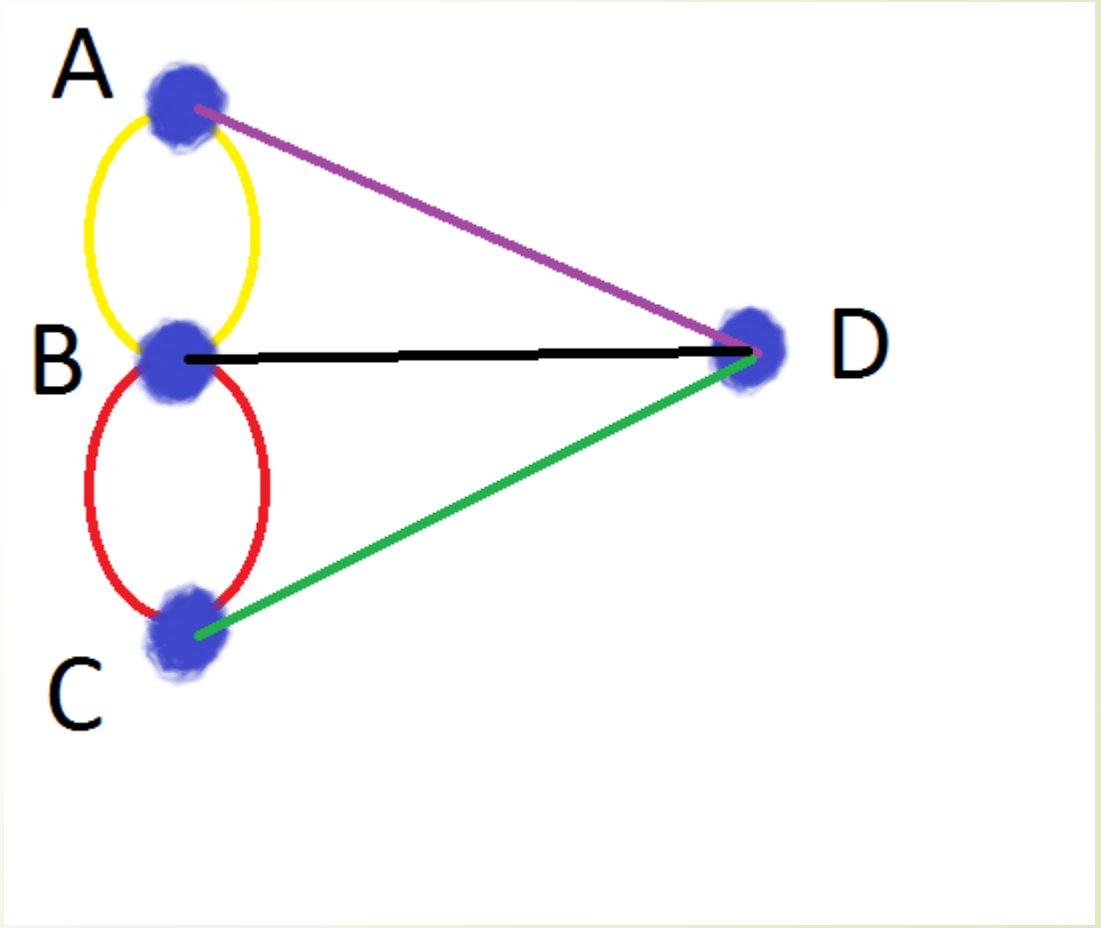
Few tries





Lets construct a graph from that R-W problem

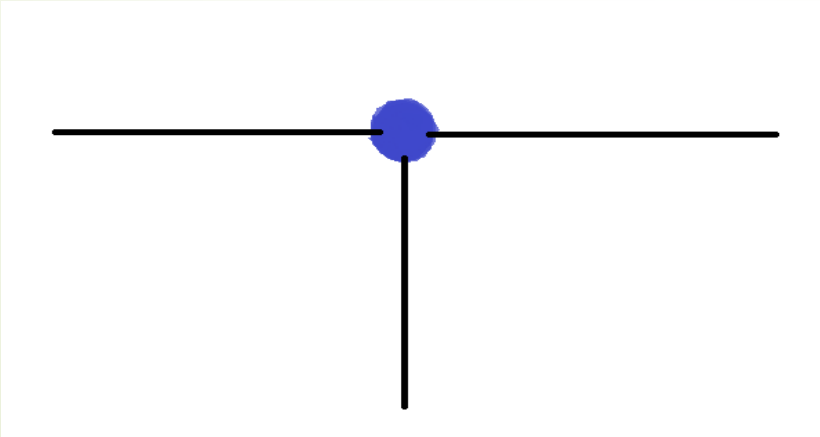




Odd and even vertex

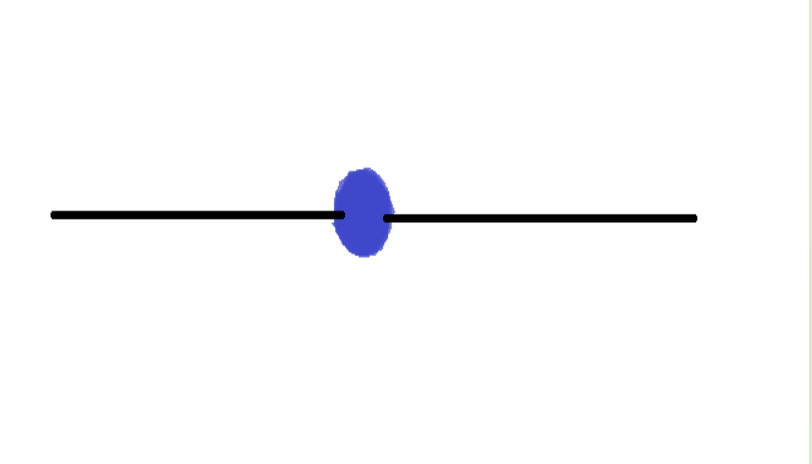
Odd vertex

- A vertex is called odd if it has an odd number of edges leading to it.



Even vertex

- A vertex is called even if it has an even number of edges leading to it.

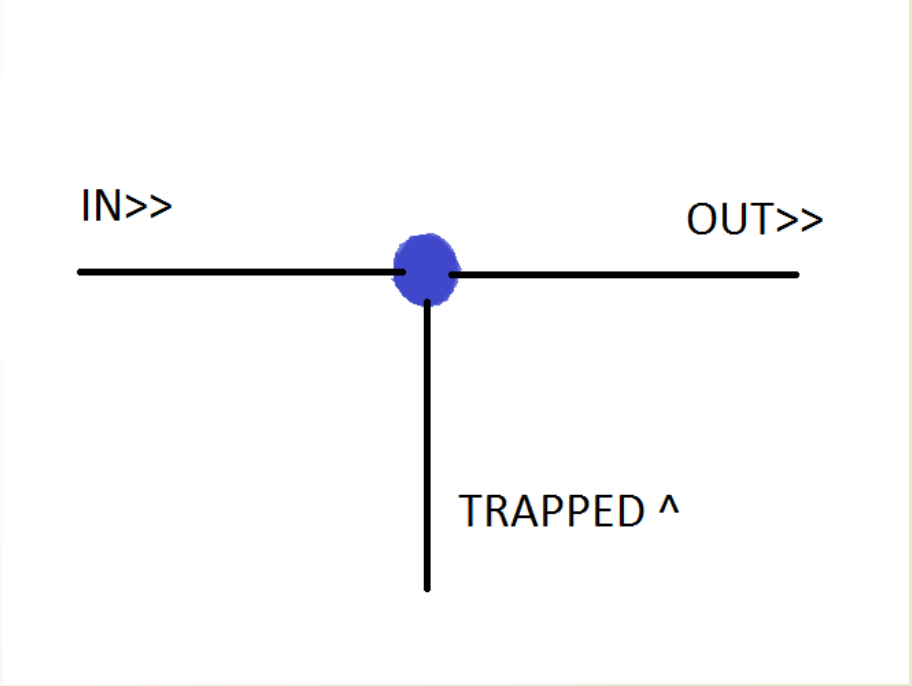


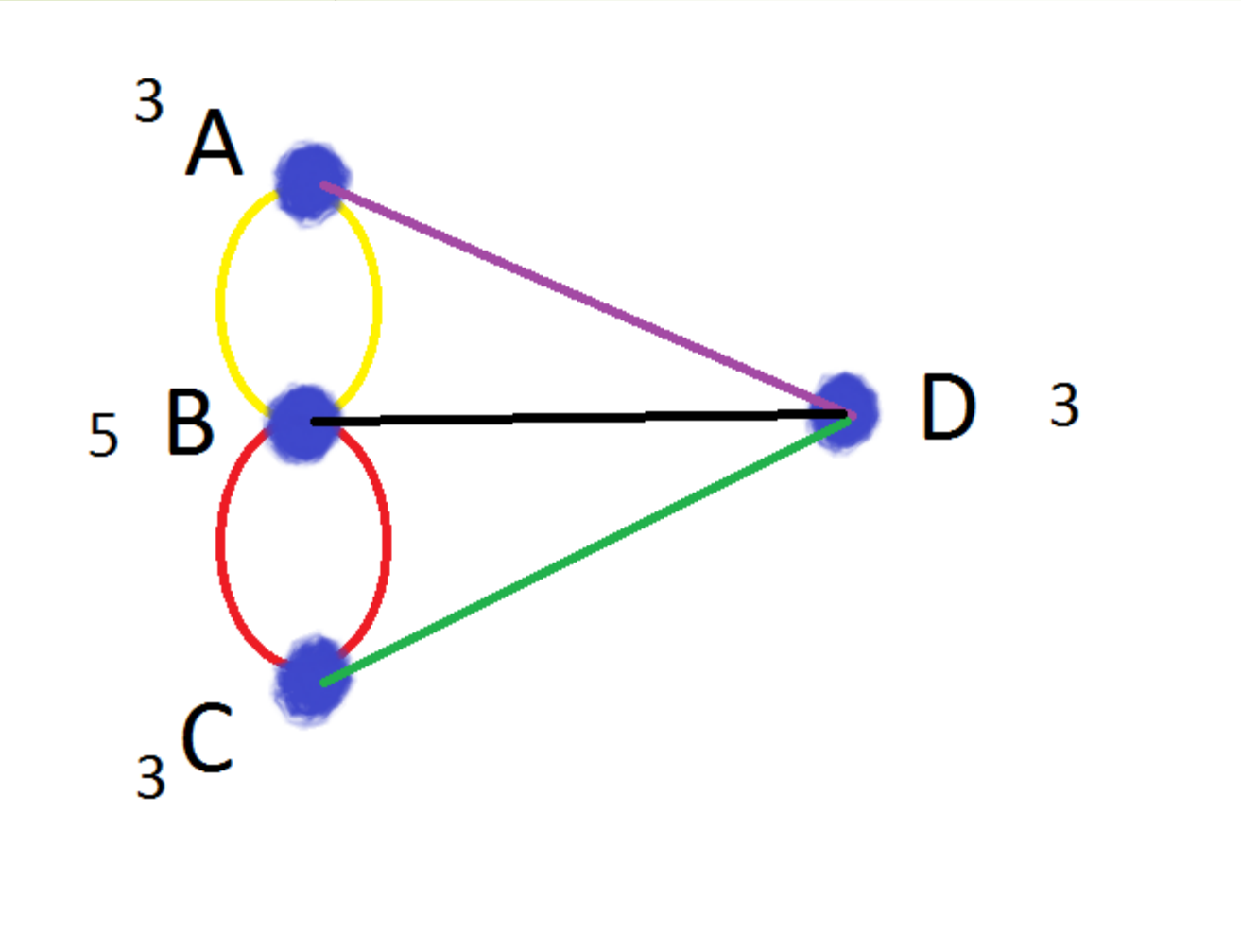
Special Euler's properties

- To get the Euler path a graph should have two or less number of odd vertices.
- Starting and ending point on the graph is a odd vertex.

Problem faced

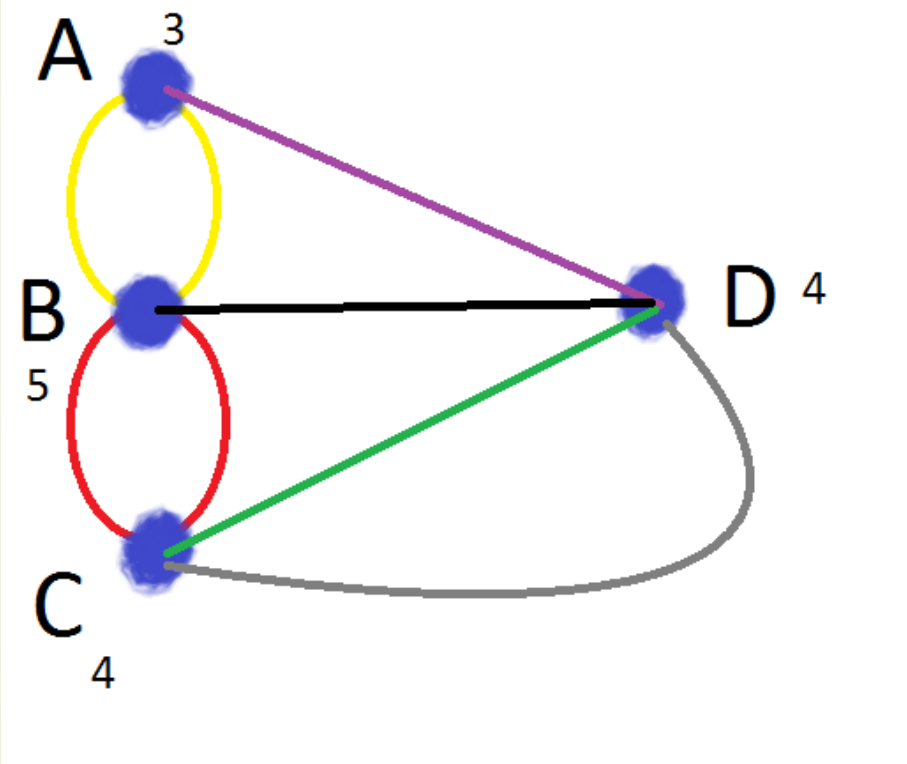
- A vertex needs minimum of two edges to get in and out.
- If a vertex has odd edges then the person gets trapped.
- Hence every odd vertex should be a starting or ending point in the graph.





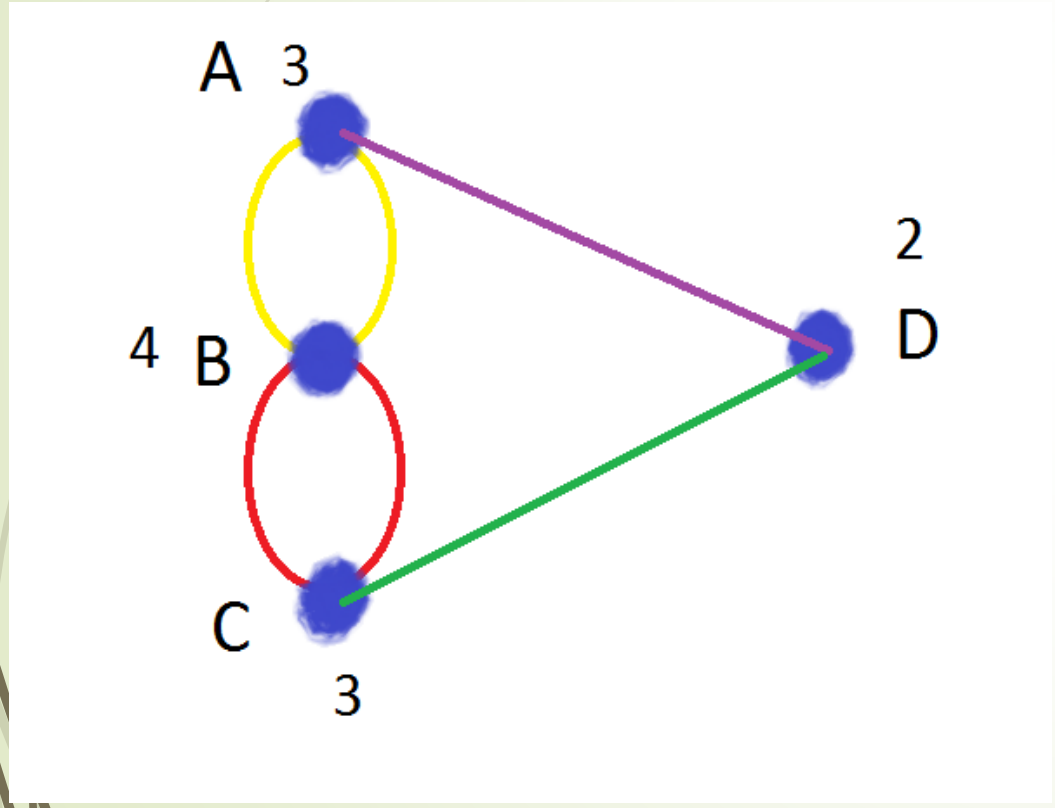
- In our problem graph we have four odd vertices hence there cant be any Euler path possible.

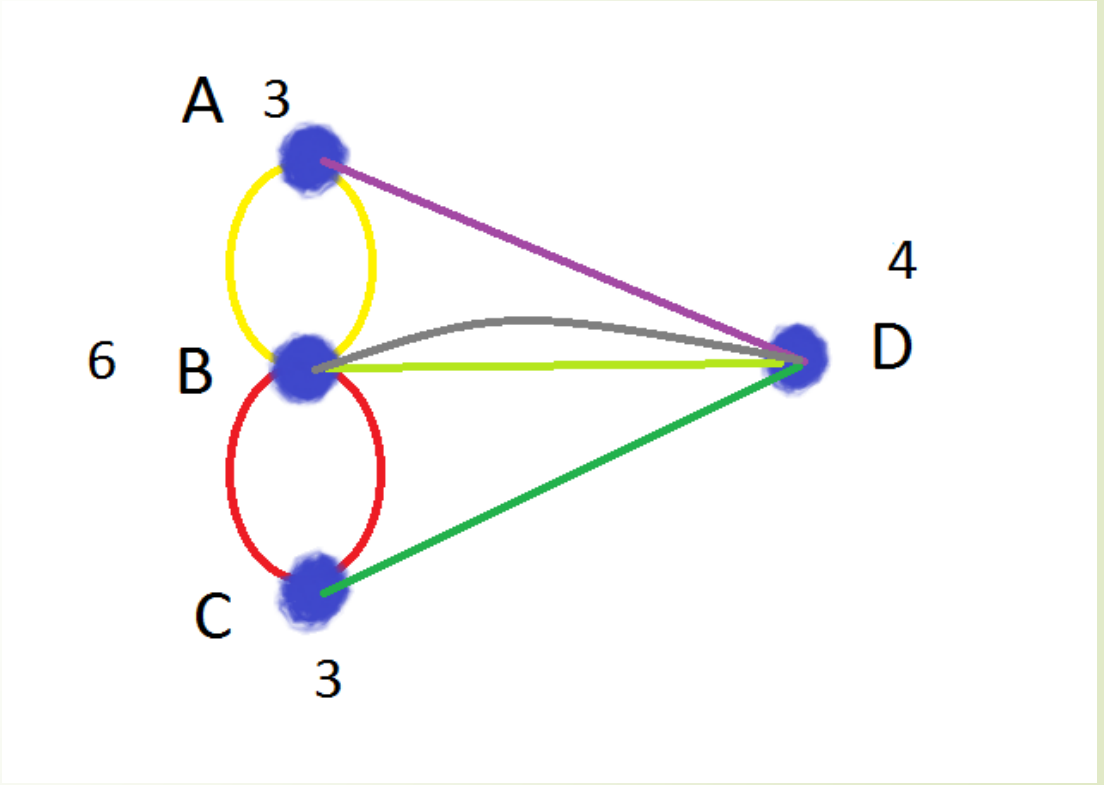
solution



- A bridge is added between C and D
- This makes the number of odd vertices 2 and number of even vertices 2 which satisfies our properties

Other Possible Solutions





Applications

- Transportation
- Biology
- Chip designing
- Chemistry ….

Reference

- http://mathforum.org/isaac/problems/bridges1.html
- http://www.maa.org/press/periodicals/convergence/leonard-eulers-solution-to-the-konigsberg-bridge-problem-konigsberg

Any Queries ??