# CS4335 Algorithm Design & Analysis
## Tutorial Week 1

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# Information

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# Overview for each Tutorial

- ▶ Recall the important knowledge of last lecture.
- ▶ Teach some excises.
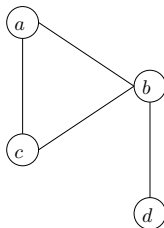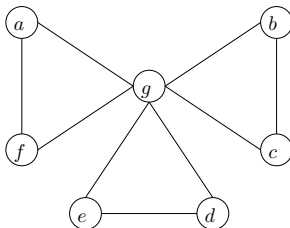- ▶ Ask questions.

# Euler circuit

### Definition
A circuit in graph $G(V, E)$ that uses each edge exactly once.

▶ You can use a vertex more than once.

▶ A graph may have many different Euler circuits.

### Euler's theorem
An un-directed connected graph has an Euler circuit **if and only if** all the vertices in the graph have even degrees.

# Euler circuit

The algorithm to find the Euler circuit.

1. Starting with any vertex u in G, take an unused edge (u,v) (if there is any) incident to u
2. Do Step 1 for v and continue the process until v has no unused edge. (a circuit C is obtained)
3. If every node in C has no unused edge, stop.
4. Otherwise, select a vertex, say, u in C, with some unused edge incident to u and do Steps 1 and 2 until another circuit is obtained.
5. Merge the two circuits obtained to form one circuit
6. Goto Step 3.

# Euler circuit

Example for algorithm
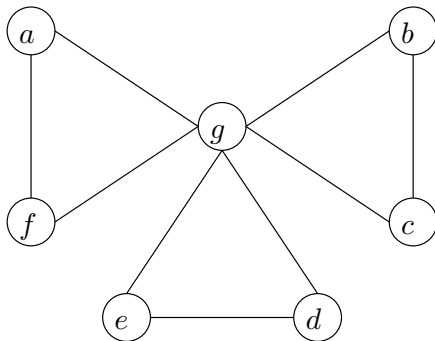
# Hamilton circuit

### Definition

A circuit in graph $G(V, E)$ that visits each vertex exactly once.

- Given an arbitrary undirected connected graph, determine whether there is a Hamilton circuit or not is a NP-hard problem.