There is another interesting question we can ask about graph: Given a connected graph G, does G have a circuit in which every vertex is visited exactly once?

Such a circuit, if it exists, is called a **Hamiltonian circuit**. Hamiltonian trails are defined similarly.

It turns out that finding a Hamiltonian circuit or trail in a graph is quite difficult in general, but can be done for many simple graphs.

## Finding Hamiltonian Circuits and Trails

Which of the following graphs have an Hamiltonian circuit? If you can't find a Hamiltonian circuit, can you find an Hamiltonian trail?



## Finding Hamiltonian Circuits and Trails

How about these? Any Hamiltonian circuits or trails?



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Although finding a Hamiltonian circuit may be hard, the following theorem says that for some graphs, knowing that a Hamiltonian circuit exists is relatively easy to assert.

## Theorem

If G is a simple connected graph with  $n \ge 3$  vertices and if the degree of each vertex is greater than n/2, then G has a Hamiltonian circuit.

## Finding Hamiltonian Circuits and Trails

Any Hamiltonian circuits or trails in these graphs?

