HAMILTONIAN CIRCUITPROBLEM

A **Hamiltonian circuit (**also called a **Hamiltonian cycle**, **Hamilton cycle**, or **Hamilton circuit)** is a graph **cycle** (i.e., closed loop) through a graph that visits each node exactly once. A graph possessing a **Hamiltonian cycle** is said to be a **Hamiltonian** graph.

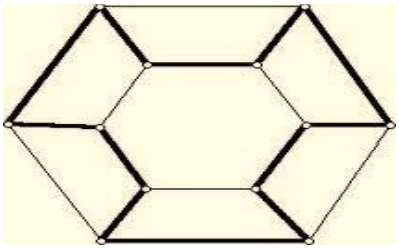
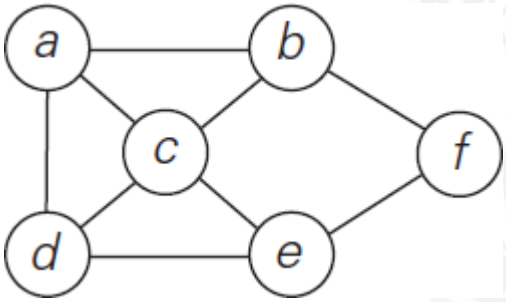


FIGURE Graph contains Hamiltonian circuit

Let us consider the problem of finding a Hamiltonian circuit in the graph in Figure 5.13.



Example: Find Hamiltonian circuit starts at vertex *a.*

FIGURE Graph.

Solution:

- Assume that if a Hamiltonian circuit exists, it starts at vertex *a.* accordingly, we make vertex *a* the root of the state-space tree as in Figure5.14.
- In a Graph G, Hamiltonian cycle begins at some vertex $V_1 \in$ G, and the vertices are visited only once in the order $V_1, V_2, \ldots, V_n$. (V_i are distinct except for V_1 and V_{n+1} which are equal).
- The first component of our future solution, if it exists, is a first intermediate vertex of a Hamiltonian circuit to be constructed. Using the alphabet order to break the three-way tie among the vertices adjacent to *a,* we
- Selectvertex*b*.From*b*,thealgorithmproceedsto*c*,thento*d*,thento*e*,andfinallyto*f*, which proves to be a dead end.
- So the algorithm backtracks from *f* to *e,* then to *d,* and then to *c,* which provides the first alternative for the algorithm topursue.
- Going from *c* to *e* eventually proves useless, and the algorithm has to backtrack

from *e* to *c* and then to *b*. From there, it goes to the vertices *f* ,*e, c*, and *d*, from which it can legitimately return to *a*, yielding the Hamiltonian circuit *a, b, f , e, c, d, a*. If we wanted to find another Hamiltonian circuit, we could continue this process by backtracking from the leaf of the solutionfound.

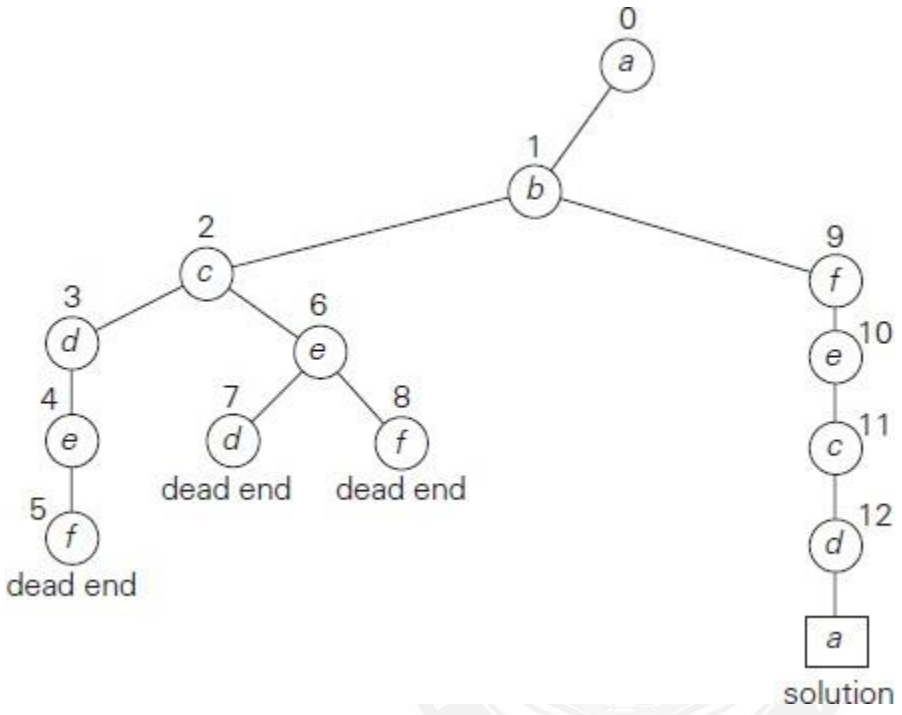


FIGURE -State-space tree for finding a Hamiltonian circuit.