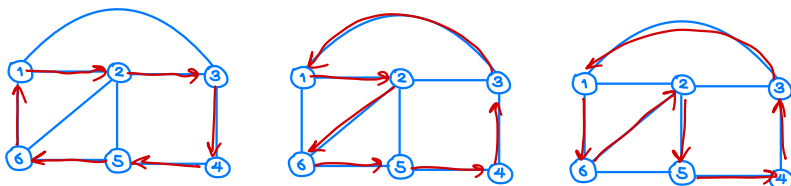
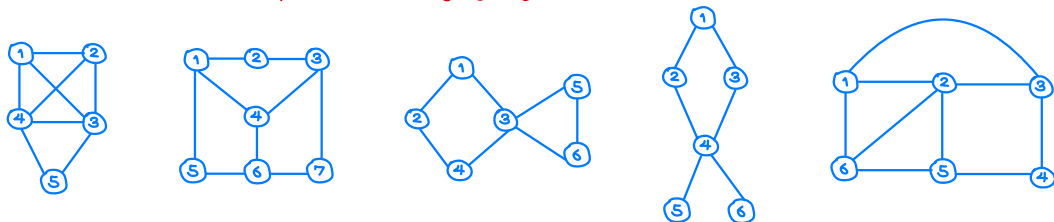


Hamiltonian cycles "starting from some starting vertex and visit all the vertices exactly once and return back to the starting vertex"

Δ NP-hard problem : no easy way to find if there's one or not.



1, 2, 3, 4, 5, 6, 1

1, 2, 3, 5, 4, 6, 1

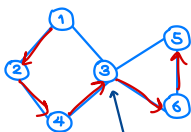
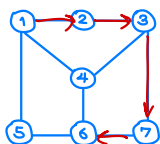
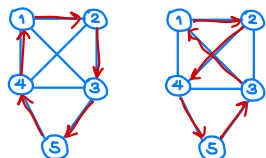
1, 6, 2, 5, 4, 3, 1

⋮

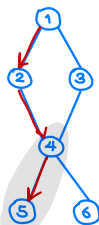
We want all of them

2, 3, 4, 5, 6, 1, 2 ?? Wrong
Duplicated!

Same

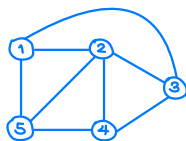


Articulation point
(connection point)

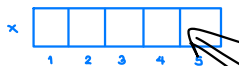


Pendent vertices

Hamiltonian cycles
Not existed in this graph

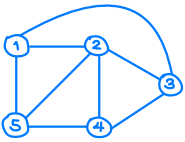


$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

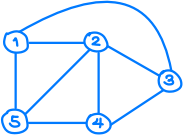
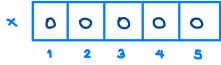


Keep in mind

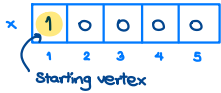
- No duplicates
- Take vertex 1, should be edge 1-2
- Last vertex, should be edge 5-1



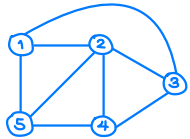
$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$



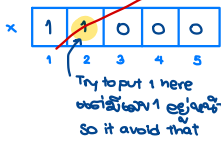
$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$



State space tree



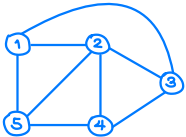
$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$



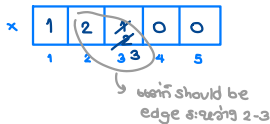
State space tree

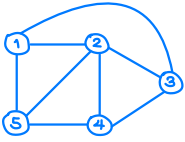


State space tree



$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$



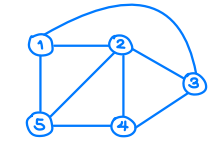
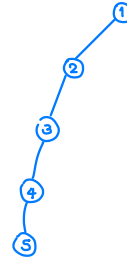


$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

State space tree



State space tree

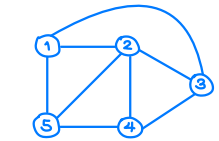
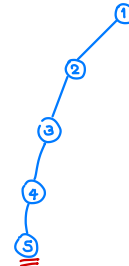


$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

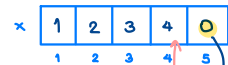


จะติด edge 5-1 หรือเปล่า?
ก็ verify ว่ามี edge 5-1 หรือไม่? ✓

State space tree

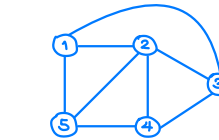
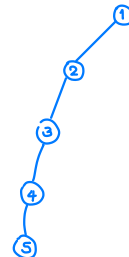


$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$

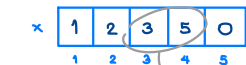


Stop?
ห้ามซ้ำ edge กับอีก state หนึ่ง

State space tree



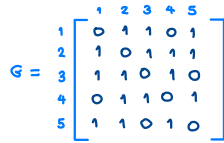
$$G = \begin{bmatrix} & 1 & 2 & 3 & 4 & 5 \\ 1 & 0 & 1 & 1 & 0 & 1 \\ 2 & 1 & 0 & 1 & 1 & 1 \\ 3 & 1 & 1 & 0 & 1 & 0 \\ 4 & 0 & 1 & 1 & 0 & 1 \\ 5 & 1 & 1 & 0 & 1 & 0 \end{bmatrix}$$



no edge



go back



∴ အိပ်ငြိမ်းစရာ ကိုယ်စားလှယ်အရာရှိ