

# 演算法 HW9 (G)

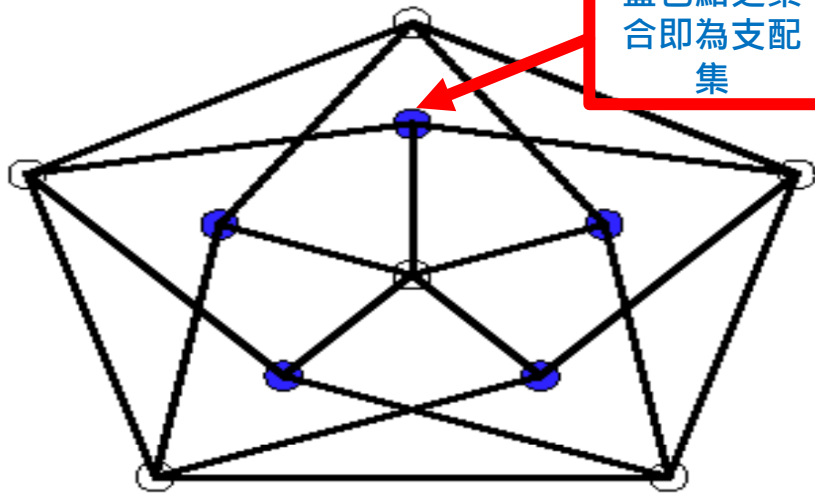
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# 題目說明

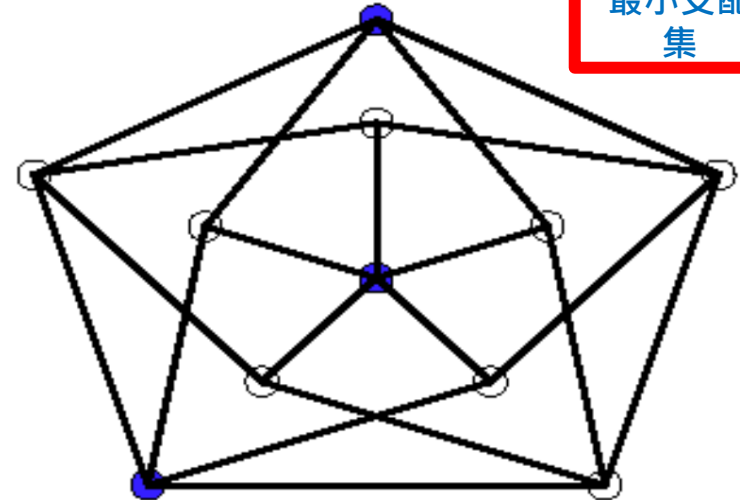
- ▶ 證明支配集問題(dominating set problem)為NP問題。
- ▶ 支配集問題：給定一個圖 $G=(V, E)$ 和一個整數 $k$ ， $G$ 是否存在一個大小 $\leq k$ 的支配集？
- ▶ 支配集：一個圖 $G=(V, E)$ 中的支配集為一集合 $D \subseteq V$ ，使得每個點 $v \in V$ 是在 $D$ 內或是與 $D$ 中至少一個點相鄰。

# 支配集

Example: A Dominating Set



Example: A Minimum Size Dominating Set



Algorithm DominatingSet( $G, k$ )

Input : Graph  $G=(V, E)$ ,  $V=\{v_1, v_2, \dots, v_n\}$ , 整數  $k$

Output : Success 存在大小小於等於  $k$  的支配集  
Failure 不存在

```
1.  $D \leftarrow \emptyset$ 
2. for  $i \leftarrow 1$  to  $k$  do //guessing
3.    $D \leftarrow D \cup \text{choice}(V)$ 
4. for  $i \leftarrow 1$  to  $n$  do //checking
5.   if ( $V[i] \notin D$ ) and ( $\forall u \in D, \forall u \text{ 相鄰 } V[i]$ ) do
6.     return Failure
7. return Success
```

- ▶ 藉由  $\text{choice}(V)$  猜測出支配集中的點
- ▶ 檢查是否所有的點皆滿足該點屬於  $D$  或者該點之相鄰點屬於  $D$
- ▶ 時間複雜度：
  - (1) 猜測支配集  $O(k)$
  - (2) 檢查支配集  $O(n^2)$

**時間複雜度為多項式複雜度，故支配集問題為NP問題**



The background is a dark blue field filled with various abstract elements. There are large, irregular shapes in a medium blue color. Some of these shapes contain patterns: one has a dense grid of small white dots, another has a grid of small white plus signs, and a third has a grid of small white dashes. There are also several small, white, wavy lines scattered throughout. In the bottom right corner, there are several thin, white, diagonal lines. The word "END" is centered in a large, white, sans-serif font.

END