Algorithm Design Techniques

- **Induction**
- Divide and Conquer
- Dynamic Programming
- Greedy
- Reduction

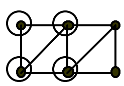
Induced Subgraphs

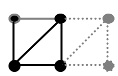
- Let G=(V,E) be a graph and let W be a subset of V.
- The subgraph of G induced by W is the graph has

  Vertex set: W

  Edge set: {(x,y) ε E such that x and y are in W}

Example

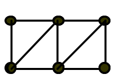
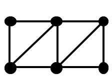
G = 



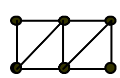
Maximal Induced Subgraph

- Input: A graph G=(V,E) and an integer k.
- Output: A largest subgraph G'=(V',E') such that every vertex of G' has degree at least k.

Maximal Induced Subgraph Example

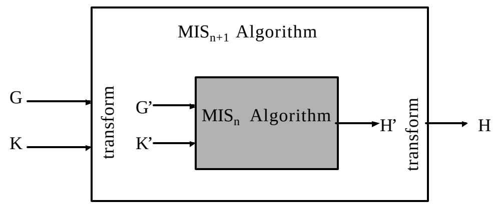
- Input: G =  K=2
- Output: 

Maximal Induced Subgraph Example

- Input: G =  K=3
- Output: ϕ

MIS_n Algorithm

Finds MIS on graphs with n or fewer node



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MIS_n Algorithm

- Suppose x is a vertex of G with degree < k
- If H is a solution in G
  then H exists in G-{x}

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Evaluating Polynomials

- Input: Set of integers $\{a_0, a_1, \ldots, a_{n-1}\}$ and an integer x.
- Output: $P_n(x) = \Sigma_{i=o\ldots n-1} a_i x^n$

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Evaluating Polynomials

- Input: List of integers $a_0, a_1, \ldots, a_{n-1}$ and an integer x.
- Output: $P_n(x) = \Sigma_{i=o\ldots n-1} a_i x^n$

Example:

Input: 3,-1,0,2 and 2
Output: 22
Explanation: $P(x)=3x^3-x^2+2$; $P(2)=22$

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Naïve Approach

- Number of multiplications:
- Number of additions:

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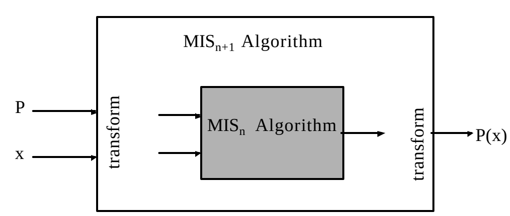
PE_n Algorithm

Evaluation of polynomials of degree at most n



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PE_n Algorithm

- $P(x) = \Sigma_{i=0\ldots n}\, a_i x^i$

  $= a_0 + x\,(\Sigma_{i=1\ldots n} a_i x^{i-1})$

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Inductive Approach

- Number of multiplications:
- Number of additions:

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