

## Problems

1. If we know that  $A \leq_m^p B$  and  $A$  is *not* in P, then it must be true that
  - (a)  $A$  is NP-complete.
  - (b)  $B$  is not in P.
  - (c)  $B$  is in NP.
  - (d) None of the above are necessarily true.
  
2. Which of the following decision problems is most likely *not* in complexity class P.
  - (a) 0-1 Knapsack as a decision problem (i.e. does there exist a set of items that attains a profit of at least  $k$ ?)
  - (b) 2SAT
  - (c) An instance of Perfect Matching is a bipartite graph  $G = (U, V, E)$ , with  $n = |U| = |V|$ , and the problem is to decide if  $G$  has a matching of size equal to  $n$ .
  - (d) An instance of 4-Clique is a simple graph  $G$  and the problem is to decide if  $G$  has a 4-clique.
  
3. Which of the following decision problems is most likely *not* in complexity class NP?
  - (a) An instance of 4-Clique is a simple graph  $G$  and the problem is to decide if  $G$  has a 4-clique.
  - (b) An instance of Perfect Matching is a bipartite graph  $G = (U, V, E)$ , with  $n = |U| = |V|$ , and the problem is to decide if  $G$  has a matching of size equal to  $n$ .
  - (c) An instance of UNSAT is a Boolean formula  $F$ , and the problem is to decide if  $F$  is unsatisfiable.
  - (d) An instance of 4-Path is a simple graph  $G$  and the problem is to decide if  $G$  has a simple path of length equal to 4.