Approximation Algorithms
Summer term 2009

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Exercise Set 4

Exercise 1:
Show that any 4-colourable graph with n vertices can be coloured with $\mathcal{O}(n^{\frac{2}{3}})$ colours in polynomial time.

(4 points)

Exercise 2:
Describe an algorithm which decides if a graph $G = (V, E)$ is 4-colourable with a running time of $\mathcal{O}(|E| \cdot 2^{|V|})$.

(4 points)

Exercise 3:
Show with a reduction from 3Sat that Max-2-Sat is NP-hard.

(4 points)

Exercise 4:
Show that the Crossword Puzzle problem is NP-complete: Given an integer n, a subset $B \subseteq \{1, \ldots, n\}^2$ of black squares, and a finite dictionary $D \subseteq \Sigma^*$, decide if there is a mapping $F : \{1, \ldots, n\}^2 \backslash B \longrightarrow \Sigma$ such that all maximal words $(F(i, j), \ldots, F(i, j+k))$ and $(F(i, j), \ldots, F(i + k, j))$ are in D.

(4 points)

Please return the exercises until Tuesday, **May 12th, at 2:15 pm**.