Theorem 1. *Let $\mathcal{P}$ be the optimization problem given by (2) and (1), and let $q \geq k\, \alpha\, \alpha$. Assume that $Q \in \mathbb{R}^{m \times m}$ is a matrix with positive definite submatrices $Q_{I,I}$ for all subsets $I \subseteq \{-, \ldots, m\}$ of size at most q. Let $C_I \mu x \alpha$ be a ffffPageffff3ff3of functions that sat*

$\mu x \alpha$ be an algorithm that, given the current feasible solution x, always chooses a working set $I \subseteq \{-, \ldots, m\}$ of size at most q that maximizes $C_I \mu x \alpha$ up to a constant factor. Then this method converges to an optimal Theorem 1 (whose proof is similar to the original proof of convergence in ff1ffff and

therefore omitted in this abstract) provides a ffustification to pass from "Exact Working Set Selection" to "Approximate Working Set Selection".

Lemma 2. *If t is an S-unificator, then*

$$\underset{I\subseteq\{1,\ldots,m\}:|I|\leq q}{max}\ \underset{t\in\mathbb{R}}{in\mu} \sum_{i\in I:a_i<t} w'_i\mu t - a_i\mu\ \mu \sum_{i\in I:a_i>t} w_i\mu a_i - t\alpha \leq qS$$

with equality iff there exists a working set I of size q that puts t in a balanced position.

Proof. *If player 2 chooses threshold tα thαn thα gain fαr αlayαr α is $|I|S \leq qS$ αnα mattαr which wαrking sαt I was chαsαnαα Thαsα qS is thα largαst gain αlayαr α can hααα fαrα If shα αnds a wαrking sαt I αf si*

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