

Homework 1

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Student:

1 Problems

The set of problems is 1.1, 1.3, 1.7, 2.11 in the Approximation Algorithms book. You choose to solve one of them and solve the following question in class.

Counter example

Consider the following algorithm for CARDINALITY VERTEX COVER. Given a graph $G(V, E)$.

Algorithm 1 A greedy algorithm for Cardinality Vertex Cover

```
1:  $C \leftarrow \emptyset$ 
2: while  $E \neq \emptyset$  do
3:   Let  $v$  be a vertex with maximum degree.
4:    $C \leftarrow C \cup \{v\}$ .
5:    $V \leftarrow V \setminus \{v\}$ .
6:    $G \leftarrow G$  restricted on new set of vertices  $V$ .
7: end while
8: return  $C$ .
```

Find an instance such that the approximation ratio of Algorithm 1 is at least $(2 - \epsilon)$ for $\epsilon > 0$ arbitrarily small.

Hint: The tight example of the 2-approximation algorithm in class may give you some indication.