Homework 1 for CMSC 858E

Due 09/13/2018

1 Problem 1

Recall the greedy vertex cover algorithms: repeatedly pick the vertex with highest degree and delete all edges incident to it.

Algorithm 1: Greedy Algorithm for Vertex Cover

```
C ← ∅;
while E ≠ ∅ do
    v ← the vertix in E with highest degree;
    C ← C ∪ {v};
    E ← E\{e ∈ E : v ∈ e};
    update degrees in the graph;
end
return C
```

Please find an unweighted example upon which this algorithm returns an answer whose approximation ratio is worse than 2.

2 Problem 2

Formally prove that bipartite vertex cover is in P. (Give an algorithm, prove its correctness, and it runs in polynomial time)

3 Problem 3

Solve problem 1.5 on page 32 in *The Design of Approximation Algorithms* (problem and page number are for the PDF version provided on course website).