Hint for Assignment 8 of CS6012

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1 Approximation Algorithm

Hint: Denote $OPTT$ as the optimal Vertex Cover for the DFS tree. You need to prove 2 things: a) $OPTT \leq OPT$ and b) $S \leq 2OPTT$, where OPT is the optimal solution for the problem while S is the Vertex Cover obtained by the algorithm given in the statement.

2 Approximation Algorithm

Note: In (a), the problem statement misses a condition: the graph needs to be a *complete* graph, which means there exists edges in any pair of nodes.
Hint: (a). The algorithm is simple: the MST(minimum spanning tree) of G' is a factor-2 approximate solution where G' is sub-graph obtained by removing $V - T$ from G.
In order to prove the approximate guarantee, you may try to construct the inequality from the following route: $2OPT$, Halmilton cycle of G, Halmilton cycle of G', MST of G'.

(b). Construct a graph $G' = (V', E')$ from G: $V' = V$, edge between u and v is the *shortest path* in G. Next, prove 2 things: 1) G' is complete and satisfies the triangle inequality, 2) If we have obtained an factor-2 approximate solution of G', we can map it to G to get a factor-2 approximate solution in G. Give the mapping method and prove it keeping the approximation factor.

3 Approximation Algorithm

Hint: The Algorithm is simple, you can just try the *greedy* strategy. The prove is also simple :)

4 Approximation Algorithm

Hint: LP - rounding works.

5 Approximation Algorithm

Hint: You can compare to the technique used on page 645, *Algorithm Design*. Difference: 1) Dynamic Programming Algorithm should be that on page 171, *Algorithm Design*, b) In analysis process, both w_i and W should be rounded.