Christian Schindelhauer

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Exercises for the Lecture

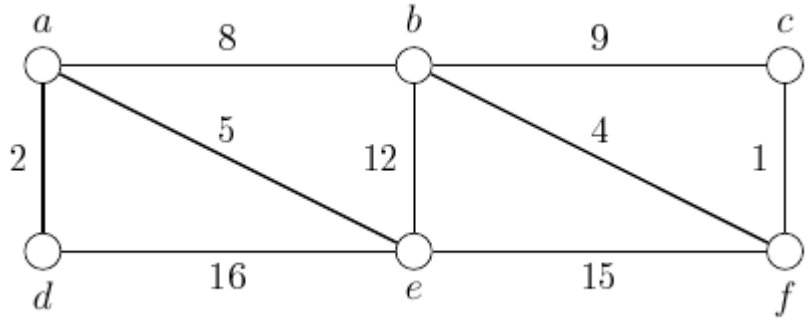
Graph Theory

Winter 2014/15

Blatt 5 (10 points)

Task 1: 10 points

1. Look at the graph. Apply the algorithm of Kruskal and mark the edges which are added to the *Minimum Spanning Tree*. Also give the order in which the edges are chosen.



Algorithm 1 Algorithm of Prim

Input: A non-empty connected weighted graph with vertices V and edges E
Output: U and T describe a minimal spanning tree

1: $T \leftarrow \phi$;
2: $U \leftarrow v_1$;
3: **while** $U \neq V$ **do**
4: Let (u, v) be the edge with lowest cost such that u $\in U$ and $v \in V - U$;
5: $T \leftarrow T \cup (u, v)$;
6: $U \leftarrow U \cup v$;
7: **end while**

2. Apply the algorithm of Prim to the given graph and discuss the different output.

3. Assume negative edge costs are allowed and define a minimum spanning graph as the subgraph connecting all nodes of each connecting component with minimum edge weight. Is every minimum spanning graph still a forest? Prove your answer!

4. Give an algorithm that produces the minimum spanning graph of a graph with negative edge costs allowed! Hint: Modify Kruskal's or Prim's algorithm.