

MTH 4320 Homework 7

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Problem 1

Solution. We run Prim's algorithm to find a minimum spanning tree (MST) of the graph with root d then the edges added to the MST are $\{d, e\}, \{e, g\}, \{e, h\}, \{b, e\}, \{a, b\}, \{a, c\}, \{c, f\}$ from first to last respectively. ■

Problem 2

Solution. We can use a modified Prim's algorithm to find the maximum spanning tree of G . We can find the greatest edge e instead of the lightest edge while keeping everything else in the algorithm the same. We can multiply the weight of every edge by -1 and we can use $-\infty$ instead of ∞ in the priority queue. Therefore, when we remove a vertex with the highest priority in the queue we will choose the edge with the highest weight in the original graph. The time complexity of the modified Prim's algorithm is $O(|V| \log |V| + |E|)$. ■

Problem 3

Solution. The time complexity of the algorithm is $O(|V| + |E|)$. ■

Problem 4

Solution. The time complexity of the algorithm is $O(|V| + |E|)$. ■