Problems: Fibonacci Heaps

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1. Analyse the running time of the Dijkstra's algorithm when the priority queue being used in a Fibonacci Heap instead of a Binary Heap. Assume that the number of vertices in the graph is n and the number of edges m.

2. Suppose in the Fibonacci Heap, we allowed an operation ChangeKey, which takes as input the pointer to a node in a Fibonacci Heap H and a new key value k, and changes $x.key$ to k. Note that k could be larger than, equal to or less than the current key value. Analyse the amortised running time of this operation.

3. [based on CLRS book] Suppose that we generalise the cascading-cut rule to cut a node x from its parent as soon as it loses its k^{th} child, for some integer constant k. For what value of k, we have $D(n) = O(\log n)$? What are the running times of the standard operations on Fibonacci heaps with this new definition? Give an argument with the accounting method for the amortized costs of each operation.