

# Lab4

September 26, 2023

## 1 Analysis of d-ary heaps

A d-ary heap is like a binary heap, but (with one possible exception) non-leaf nodes have d children instead of 2 children. Answer the questions related to d-ary heaps below and submit the code and documentation.

1. How would you represent a d-ary heap in an array? (10%)
2. What is the height of a d-ary heap of n elements in terms of n and d? (10%);
3. Given an efficient implementation of **EXTRACT-MAX** in a d-ary max-heap. Analyze its running time in terms of d and n. (20%);
4. Given an efficient implementation of **INSERT** in a d-ary max-heap. Analyze its running time in terms of d and n. (20%);
5. Give an efficient implementation of **INCREASE-KEY**(A, i, k), which flags an error if  $k < A[i]$ , but otherwise sets  $A[i] = k$  then updates the d-ary max-heap structure appropriately. Analyze its running time in terms of d and n. (20%);
6. Constructing a 3-ary heap with an insertion sequence ranging from 1 to 30, we shall perform consecutive operations of EXTRACT-MAX and INCREASE-KEY (A, 10, 28), subsequently reporting the results on three occasions. (20%)

## 2 Points for Attention

- (1) For the implementation of these algorithms, you are free to select a programming language of your choice.
- (2) Kindly upload the source code files along with their associated documentation in a compressed ZIP format to the elearning system for assessment.
- (3) Your document should be submitted in electronic format whenever possible. The document format should be either Word, PDF, or Markdown.
- (4) The deadline of this lab is **23:59:59 on September 29**.
- (5) The naming format for the file should be "lab4-StudentID-Name," and make sure to compress all the files into a single compressed folder.
- (6) If you have any questions please feel free to contact teaching assistants.