

## Notice

- We cannot accept late submissions for **any excuse**.
- Please visit the [AR website on academic integrity](#).
- For each question, write the following information as a comment preceding the method:
  - 1) all the Internet resources you've used for solving the problem (even though you didn't explicitly copy from them);
  - 2) all the students with whom you have discussed this question; and
  - 3) running time of your method, with the smallest possible function.<sup>1</sup>
- Make your algorithms as efficient as possible, in terms of both time and space, with priority on time. Your scores depend on their efficiency.
- No points shall be awarded if your submission does not compile.<sup>2</sup>
- Submission procedure (each deviation will result in a deduction of 10 points):
  - 1) Name the .java file as `<class_name>_<your_id>_<your_name>.java`, e.g., `DaryHeap_12345678d_TangTszkei.java` if your name is Tang Tszkei and your ID is 12345678d. (You may find Alt-Shift-R helpful if you're using Eclipse.)
  - 2) Put all your files into a folder with name `A2_<your_id>_<your_name>`.
  - 3) Create a .zip or .jar file to contain this folder, similar as the distributed file.  
**Warning: only zip and jar are accepted.**

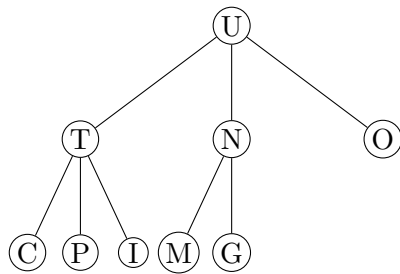
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<sup>1</sup>A frequent question is "Whether I can use methods from Java library?" Most library methods are complicated and difficult to analyze. If you use them, you have to count their steps, which is almost impossible from my experience.

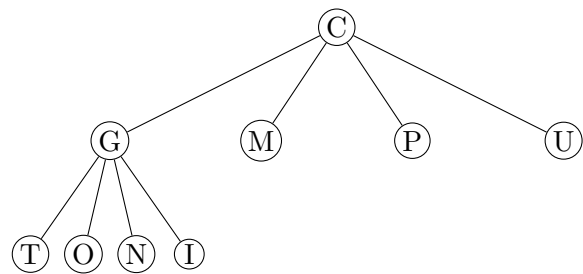
<sup>2</sup>If you've problems, [this](#) and [this](#) web pages may help, and you're welcome to seek help on the discussion forum (DON'T SHARE YOUR CODE).

The  $d$ -ary max heap is a generalization of the binary heap in which the nodes have  $d$  children instead of 2. The  $d$ -ary min heap is defined analogously. For example, inserting the nine letters of COMPUTING into a 3-ary max heap and a 4-ary min heap, the results are as follows.

Take  $d$  to be the last digit of your student ID that is between 3 and 7, both inclusive. If it's the last digit, do a maximum heap, and a minimum heap otherwise. For example, a student with ID xxxxx716d will implement a 6-ary max heap, and a student with ID xxxxx592d will do a 5-ary min heap. Do a 5-ary min heap if your student ID does not have any number between 3 and 7.



(a) A 3-ary max heap.



(b) A 4-ary min heap.

1. (50 points) Grader: Pan Chao (chao.pan@connect.polyu.hk)

Implement the class `DaryHeap`.

```
class DaryHeap<T> {
    DaryHeap (int capacity) {}
    void insert(int x) {}
    T removeRoot() {}
    void up(int c) {}
    void down(int ind) {}
}
```

2. (50 points) Grader: Zhao Xiangyu (xiang-yu.zhao@connect.polyu.hk)

Write an algorithm to merge another  $d$ -ary heap into the current  $d$ -ary heap.

```
void merge(DaryHeap<T> heap) {}
```