

CSE 202 Midterm 2

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I. QUESTION (QUEUE) (20 POINTS)

Write the methods

```
Element dequeue2nd()
Node dequeue2nd()
```

which removes the second element (node) from the queue which uses array (list) implementation. Your method should run in $\mathcal{O}(1)$ time. You are not allowed to use `dequeue()`.

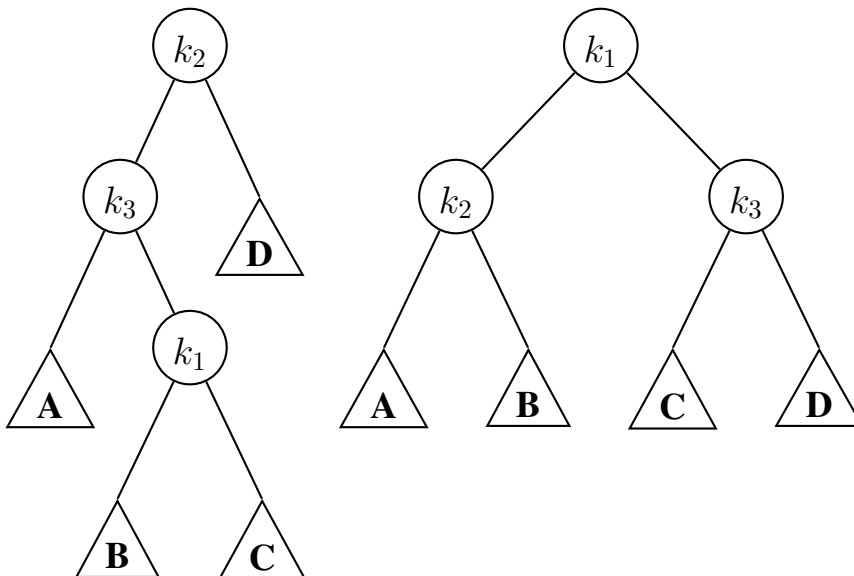
II. QUESTION (QUEUE) (15 POINTS)

Modify the queue data structure such that the new implementation uses doubly linked list representation instead of singly linked list representation. Implement `enqueue` and `dequeue` operations.

III. QUESTION (TREES) (15 POINTS)

Write the method for the following rotation in AVL trees. You do not need to update the heights of subtrees.

```
AvlNode rotate(AvlNode k2)
```



IV. QUESTION (TREES) (15 POINTS)

Write the method

```
int sumLargerThanX(int X)
```

which returns the sum of contents of nodes in the binary search tree which have values larger than X .

V. QUESTION (HASHING) (20 POINTS)

Write the method

```
int between(int X, int Y)
```

which returns the number of items in the hash table whose values are between X and Y . Your method should run in $\mathcal{O}(N)$ time. You should write the method for both array and linked list implementations.

VI. QUESTION (HASHING) (15 POINTS)

Write the method

```
void undelete(int value)
```

which undeletes the recently deleted value from the hash table. Assume that linear probing is used as the collision strategy.