

Assignment 6: Binary heaps

1. For the given data as integers perform following operations in min-heap:
 - a. Create heap
 - b. Display heap elements in sequence after k deletions of root element

Input: (T, n, k, {x_i})

```
2
11
4
12 1 21 2 24 23 15 26 4 33 10
7
2
5 2 8 1 4 6 10
```

Output:

```
1 2 15 4 10 23 21 26 12 33 24
12 24 15 26 33 23 21
1 2 6 5 4 8 10
4 5 6 8 10
```

2. Implement max-heap and perform insertion and deletion Operations.
 1. Insert the element
 2. Delete the element
 3. Display all elements
 4. Quit

Input: (n, x_i)

```
1 30
1 50
1 70
2 10
2 50
1 100
3
4
```

Output:

```
inserted
inserted
inserted
10 not found
deleted
100 30 70
```

3. Implement heapsort.

Input: (T, n_i, {x_i})

```
2
6
12 11 20 5 16 7
8
15 24 16 22 5 20 40 8
```

Output:

```
5 7 11 12 16 20
5 8 15 16 20 22 24 40
```

4. Implement binary heap using a binary tree (not arrays). Binary heap operations are:

1. Insert
2. Delete min
3. Check full
4. Check empty
5. Quit

Input: (T, n, k, {x_i})

```
10
1 24
1 6
1 28
1 5
1 63
1 19
1 94
2
2
2
2
2
2
2
4
5
```

Output:

```
24
6 24
6 24 28
5 6 24 28
5 6 28 24 63
5 6 19 24 63 28
5 6 19 24 63 28 94
6 24 19 94 63 28
19 24 28 94 63
24 63 28 94
28 63 94
63 94
94
Empty
underflow
true
```

5. For a given array of elements, determine the minimum number of interchanges needed to convert it into a max-heap.

Input: (T, n, {x_i})

```
2
13
89 19 50 17 12 15 2 5 7 11 6 9 100
8
15 24 16 22 5 20 40 8
```

Output:

```
3
5
```

6. Given a sequence find if it constitutes a max-heap.

Input: (T, n_i, {x_i})

3

7

10 8 6 4 5 2 1

7

10 5 6 4 8 2 1

7

5 2 8 1 4 6 10

Output:

yes

no

no

7. Write a program to construct priority queue using heap. Print the final contents of the priority queue.

Input: (n, {x_i})

8

15 24 32 2 5 28 48 16

Output:

48 16 32 15 5 24 28 2

8. Construct a heap structure implemented not with an array but as a normal complete binary tree with with elements given in the following order. (Figure for the first two test cases is given below). Find if it constitutes a max-heap.

Input: (T, n_i, {x_i})

3

6

10 8 6 4 5 2

7

10 5 6 4 8 2 1

7

5 2 8 1 4 6 10

Output:

yes

no

no

