Heap queue (or heapq) in Python

Difficulty Level : Easy • Last Updated : 11 Sep, 2020

Heap data structure is mainly used to represent a priority queue. In Python, it is available using "**heapq**" module. The property of this data structure in Python is that each time the **smallest of heap element is popped(min heap)**. Whenever elements are pushed or popped, **heap structure in maintained**. The heap[0] element also returns the smallest element each time.

Let's see various Operations on heap :

- **heapify(iterable)** :- This function is used to **convert the iterable into a heap** data structure. i.e. in heap order.
- **heappush(heap, ele)** :- This function is used to **insert the element** mentioned in its arguments into heap. The **order is adjusted**, so as **heap structure is maintained**.
- **heappop(heap)** :- This function is used to **remove and return the smallest element** from heap. The **order is adjusted**, so as **heap structure is maintained**.

```
# Python code to demonstrate working of
# heapify(), heappush() and heappop()
# initializing list
li = [5, 7, 9, 1, 3]

# using heapify to convert list into heap
heapq.heapify(li)

# printing created heap
print ("The created heap is : ",end="")
print (list(li))

# using heappush() to push elements into heap
# pushes 4
heapq.heappush(li,4)

# printing modified heap
print ("The modified heap after push is : ",end="")
print (list(li))

# using heappop() to pop smallest element
print ("The popped and smallest element is : ",end="")
print (heapq.heappop(li))
```

Output :

```
The created heap is : [1, 3, 9, 7, 5]
The modified heap after push is : [1, 3, 4, 7, 5, 9]
The popped and smallest element is : 1
```

- **heappushpop(heap, ele)** :- This function **combines the functioning of both push and pop operations** in one statement, increasing efficiency. Heap order is maintained after this operation.
- **heapreplace(heap, ele)** :- This function also inserts and pops element in one statement, but it is different from above function. In this, **element is first popped, then the element is pushed.i.e, the value larger than the pushed value can be returned.** `heapreplace()` returns the smallest value originally in heap regardless of the pushed element as opposed to `heappushpop()`.

```
# Python code to demonstrate working of
# heappushpop() and heapreplce()

# importing "heapq" to implement heap queue
import heapq

# initializing list 1
li1 = [5, 7, 9, 4, 3]

# initializing list 2
li2 = [5, 7, 9, 4, 3]
```

```
# using heappushpop() to push and pop items simultaneously
# pops 2
print ("The popped item using heappushpop() is : ",end="")
print (heapq.heappushpop(li1, 2))

# using heapreplace() to push and pop items simultaneously
# pops 3
print ("The popped item using heapreplace() is : ",end="")
print (heapq.heapreplace(li2, 2))
```

Output :

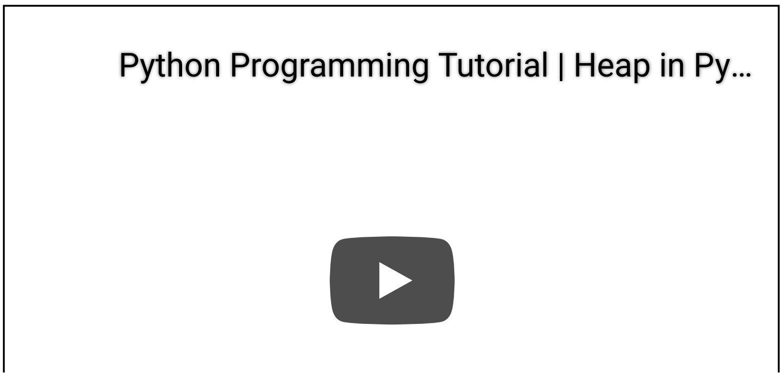
```
The popped item using heappushpop() is : 2
The popped item using heapreplace() is : 3
```

- **nlargest(k, iterable, key = fun)** :- This function is used to **return the k largest elements from the iterable specified and satisfying the key if mentioned.**
- **nsmallest(k, iterable, key = fun)** :- This function is used to **return the k smallest elements from the iterable specified and satisfying the key if mentioned.**

```
# Python code to demonstrate working of
# nlargest() and nsmallest()

# importing "heapq" to implement heap queue
import heapq

# initializing list
li1 = [6, 7, 9, 4, 3, 5, 8, 10, 1]

# using heapify() to convert list into heap
heapq.heapify(li1)

# using nlargest to print 3 largest numbers
# prints 10, 9 and 8
print("The 3 largest numbers in list are : ",end="")
print(heapq.nlargest(3, li1))

# using nsmallest to print 3 smallest numbers
# prints 1, 3 and 4
print("The 3 smallest numbers in list are : ",end="")
print(heapq.nsmallest(3, li1))
```

Output :

```
The 3 largest numbers in list are : [10, 9, 8]
The 3 smallest numbers in list are : [1, 3, 4]
```



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