

TIC2001 Data Structure and Algorithm Quiz 1

Name: _____ Student#: A

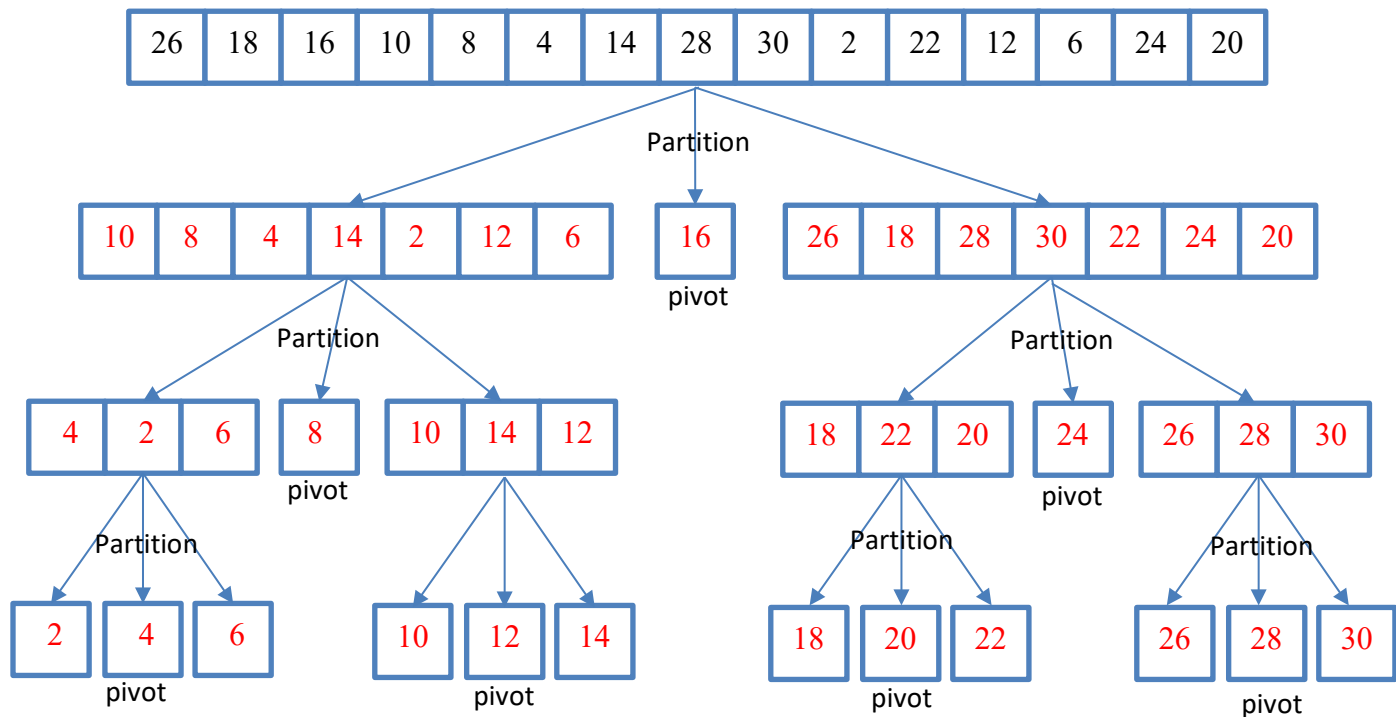
Question 1 (4 × 3 marks)

What is the time complexity of calling the functions on the right column in terms of n for $n > 0$? Give your answer in the Big O notation. The function `doSomething(m)` will have a time complexity of $O(m)$ depending on the input m .

<pre>int f(double n) { return n < 1 ? 1 : f(n*90.0/100.0); }</pre>	Time complexity of $f(n) = O(\log n)$
<pre>int f(double n) { if (n<=1) return 0; doSomething(n); return f(n/2) + f(n/2); }</pre>	Time complexity of $f(n) = O(n \log n)$
<pre>void f(double n) { for (int i = 1; i < n; i*=2) for (int j = 1; j < log(n); j++) doSomething(1); }</pre>	Time complexity of $f(n) = O(\log^2 n)$

Question 2 (8 marks)

Perform a quick sort for the following array according to **descending** order. Show the steps. Note that you should choose the median as the pivot for each recursion. Note that your sorting has to be **stable**.



Question 3 (7 + 3 marks)

Given a hash table with size $m = 13$ buckets and the hash function $h(\text{string}) = \text{the number of characters times two}$. For example:

$$h(\text{"hat"}) = 3 \times 2 = 6.$$

With i equals to the number of collisions, perform hashing with **linear** probing for the key x with the probing, namely,

$$(h(x) + i) \bmod m,$$

with **open addressing**.

Question 3a

Update the hash table on the right according to the commands on the left similar to the exercise we did in the lab sessions.

Commands:

```
insert("apple")
insert("orange")
insert("durian")
insert("mango")
insert("salt")
insert("milk")
insert("cake");
delete("orange")
insert("tart")
delete("durian")
insert("pineapple")
delete("tart")
delete("milk")
```

Index	Hash Table Contents					
0	Null	durian				
1	Null	cake				
2	Null					
3	Null					
4	Null					
5	Null	pineapple				
6	Null					
7	Null					
8	Null	salt				
9	Null	milk				
10	Null	apple				
11	Null	mango				
12	Null	orange	tart			

Note that it is not chaining. The space on the "right" of "Null" is just for your "replacement" of the contents. You just need to cross out a word if it's deleted.

Question 3b

After all the above operations, if we search for "rice", what is the index of the **last** hash table entry that the searching visited before telling us that "item not found"?

The index of the last hash table entry = 2.