NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

SC1007 Data Structures and Algorithms

Lab 6: Searching

Q1 Given an array of n elements. Find two elements in the array such that their sum is equal to K. The two elements can be the same element. Once a pair of elements is found, the program can be terminated. The function prototype is given below:

```
def dual_search(A, size, K, dual_index):
#A (list): The input array of integers.
#size (int): The size of the array.
#K (int): The target sum.
#dual_index (list): A list to store the indices of the two elements.
```

An example input is:

A = [3, 1, 7, 4, 5, 9]

K = 8

The output is:

Pair found at indices: [0, 4]

Elements: 3 + 5 = 8

Q2 Given a sorted array of *n* elements (you can use merge sort to sort the array). Find two elements in the array such that their sum is equal to K. The two elements can be the same element. Once a pair of elements are found, the program can be terminated. The results may be different from the results of Question 1. The function prototype is given below:

```
def dual_sorted_search(A, size, K, dual_index):
#A (list): The input array of integers.
#size (int): The size of the array.
#K (int): The target sum.
#dual_index (list): A list to store the indices of the two elements.
```

An example input is:

A = [9, 1, 4, 3, 7, 5]

K = 8

The output is:

Pair found at indices: [0, 4]

Elements: 1 + 7 = 8

Q3 Compare the performance between Q1 and Q2. Try to use a large input file to evaluate their running time. A 500k data and 1 million data file are attached. The first line is a search key and the second line is a data size. The rest are the data.

Q4 Given two arrays num1 and num2. Both are sorted in an ascending order. The length is m and n, respectively. Please find the median of the two arrays with time complexity being $O(\log(m+n))$. You can apply binary search to partition the arrays. The function prototype is given below:

```
def find_median_sorted_arrays(num1, num2):
#num1 (list): First sorted array.
# num2 (list): Second sorted array.
# Returns:
# float: The median of the combined sorted array.
```

An example input is:

num1 = [1, 3, 8]

num2 = [7, 9, 10, 11]

The output is:

Median of the two sorted arrays is: 8