UNIVERSITY OF BIRMINGHAM | DUBAI دبي

LM Data Structures, Algorithms, and Databases (34140, 34141, 34139, 36989)

Exercise Sheet

Week 01

Q1.

- Part A - Suppose you have a sorted list of 128 names, and you're searching through it using binary search. What's the maximum number of steps it would take?
- Part B - Suppose you double the size of the list. What's the maximum number of steps now?

Q2. Give the run time for each of these scenarios in terms of Big O.

- Part A- You have a name, and you want to find the person's phone number in the phone book.
- Part B- You have a phone number, and you want to find the person's name in the phone book. (Hint: You'll have to search through the whole book
- Part C- You want to read the numbers of every person in the phone book.

Q3. Given a list of n numbers, create a straightforward python function **has_duplicates** to determine if there are any duplicate elements in the array. Additionally, calculate the time and space complexity for the worst-case scenario of your function.

Q4. Consider the following factorial program and let the input size be the value of n that is read. Counting one time unit for each assignment, read, and write statement, and one unit each time the condition of the while-statement is tested, compute the running time of the program

```
1. n = int(input("Enter a number: "))
2. i = 2
3. fact = 1
4. while i <= n:
5.     fact *= i
6.     i += 1
7. print(fact)
```

Q5. What rule or criterion can be established to assess the overall time complexity of the selection statement, considering the functions f(n) and g(n) and the condition within the if statement?

```
if 1 == 2:
    # something with O(f(n)) complexity
else:
    # something with O(g(n)) complexity
```

Q6.

- How can we express the number of iterations in a for-loop with the header for i in range(a, b+1) in terms of the initial value 'a' and the final value 'b'?
- How can we express the number of iterations in for i in range(a, b-1, -1) in terms of the initial value 'a' and the final value 'b'?

Q7. In the context of Python, provide a big-O upper bound on the running time of the straightforward selection statement:

```
while C:
    # Empty body
```