**4.4** Remember binary search from chapter 1? It’s a divide-and-conquer

algorithm, too. Can you come up with the base case and recursive

case for binary search?

base case: When there is one element in the array

recursive case: We compare the requested element with the element in the middle of the array .If the requested element is smaller than the element in the middle, we exclude the larger half and re-search the smaller half .If the requested element is larger than the element in the middle, we exclude the smaller half and re-search the larger half.

We continue dividing the array in this way until we reach the base state

How long would each of these operations take in Big O notation?

**4.5** Printing the value of each element in an array

O (n)

**4.6** Doubling the value of each element in an array.

O (n)

**4.7** Doubling the value of just the first element in an array.

O (1)

**4.8** Creating a multiplication table with all the elements in the array. So

if your array is [2, 3, 7, 8, 10], you first multiply every element by 2,

then multiply every element by 3, then by 7, and so on.

O (n2)

Which of these hash functions are consistent?

5.1 f(x) = 1

constant

5.2 f(x) = rand()

Not constant

5.3 f(x) = next\_empty\_slot()

Not constant

5.4 f(x) = len(x)

Constant

For each of these examples, which hash functions would provide a good

distribution? Assume a hash table size of 10 slots

**5.5** A phonebook where the keys are names and values are phone

numbers. The names are as follows: Esther, Ben, Bob, and Dan.

Hash functions C (يوجد به نسبة تداخل و لكن مش كبيرة )and D

**5.6** A mapping from battery size to power. The sizes are A, AA, AAA,

and AAAA.

Hash functions B and D

**5.7** A mapping from book titles to authors. The titles are *Maus*, *Fun*

*Home*, and *Watchmen*.

Hash functions B, C and D

Run the breadth-first search algorithm on each of these graphs to find

the solution

A diagram of a hexagon with circles and letters

Description automatically generated

**6.1** Find the length of the shortest path

from start to finish

2

A diagram of a car

Description automatically generated

**6.2** Find the length of the shortest path

from “cab” to “bat”.

2

A list of things on a white surface

Description automatically generated**6.3** For these three lists, mark whether each one is valid or invalid.

A is invalid

B is valid

C is invalid

**6.4** Here’s a larger graph. Make a valid list for this graph.



A diagram of a person's life cycle

Description automatically generated

**6.5** Which of the following graphs are also trees?

A drawing of a letter a

Description automatically generatedA and C