APS
Assignment 4

Q1:Nth no. of a unsorted array

Task: To find the nth smallest element in a given sequence. The operation should take an amortized cost of O(n).

Aim: To learn how to use randomization in algorithms.

Hint: Think of the partition function of randomized quick-sort.

Testing: Time your function using time.h and compare it with the Standard Library Function nth_element().

Bonus Read: Read about how std::partial_sort() works and when how and when it used.

Format: RollNo_Q1

References:
https://en.cppreference.com/w/cpp/algorithm/partial_sort
https://en.cppreference.com/w/cpp/algorithm/nth_element

Q2:Hashing(Unordered_map and Ordered map)

Task: Implement both Ordered and Unordered Map.

Aim: To learn how Hashing works and importance of Hash Functions. Also look how Universal Hashing is implemented.

Parameter to Judge: Time and space complexity. Hashing should be efficient and appropriate reasons must be given on choice of hash function

Note:Both the map should be implemented separately and should be generic.

Format: RollNo_Q2_1 for Unordered Map and RollNo_Q2_2 for Ordered Map

References:
https://en.wikipedia.org/wiki/Hash_function
https://en.wikipedia.org/wiki/Universal_hashing

Q3:Implement Java StringBuilder

- Java StringBuilder class is mutable sequence of characters. StringBuilder Class can be comparable to String however the StringBuilder class provides more versatility because of its modification features.

- You are required to implement a library which supports following functionalities:
  1. Initialize a string   O(1)
  2. Append two string   O(1)
  3. Find substring in string   O(n)

```
int main(){
  stringBuilder s1 = stringInitialize("hello");
  stringBuilder s2 = stringInitialize("world");
  int index1 = findSubstring(s2,"or");
  // index1 will have value 1. Starting index of substring

  int index2 = findSubstring(s2,"hell");
  // index2 will have value -1. No substring found

  stringBuilder s3 = stringAppend(s1,s2);
  // s3 will become "helloworld". Append string in second     argument to string
in first argument.
}
```

- What is expected?
 Implement a library which provides following interface.

Format: RollNo_Q3

Q4:Find Articulation point in a graph

For a disconnected undirected graph, an articulation point is a vertex removing which

increases number of connected components.

Following are some example graphs with articulation points encircled with red color.

Articulation points are 0 and 3

Articulation Point is 1
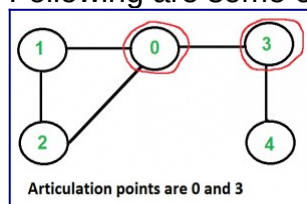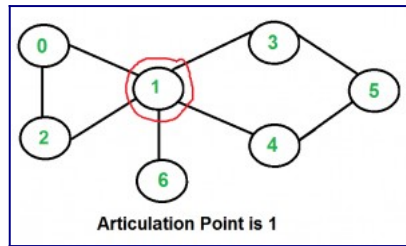
NOTE: You are not allowed to use STLs or any other inbuilt libraries.