Indian Institute of Information Technology Sri City, Chittoor
(An Institute of National Importance under An Act of Parliament)

Name: **DSA Lab Assignment - 9** Duration: **3 Hrs**
Date: **10 June, 2021** Maximum Marks: **10**

INSTRUCTIONS:

1. Please carefully read all assignment problems and use the function names given to solve the problems.
2. The first **THREE PROBLEMS** are **COMPULSORY** and the **FOURTH** one is a **BONUS PROBLEM** which is **OPTIONAL**.
3. Write only a single main function. You can call the required functions from the main function. Print the list of elements wherever necessary.
4. Print the Time Complexity of each heap operation (given in the questions) and provide the description as comments in the code.
5. Name the file as follows: **S2020xxxxx_A9.**
6. DO NOT zip. Upload a single .c file directly to your submission in the common Google classroom.
7. Don't share or copy the codes. If malpractice found, you will be awarded **Zero**.

If you do not follow the above-mentioned instructions, a suitable penalty would be imposed.

COMPULSORY PROBLEMS

1. Initialize an array with size 20 `(eg: A[20])`. Generate 10 integers randomly and store it in the array `A`. You may use `rand()` function to generate random numbers. Write a function `void max_heapify(int A[], int array_index, int array_size)` that changes the array list to an array in max heap order. Print all the parent nodes and its corresponding children nodes level-wise. **[1+2+1 marks]**

2. Write a function `void insert(int num)` that adds the new number `num` to the heap. If the heap is full, the function should return without modifying the heap. Else reorder the heap to maintain the heap property. **[3 marks]**

3. Write a function `int update(int key, int alpha)` that finds the key element in the heap and update the element by adding the alpha value `(i.e, new_value = key + alpha)`. The return value should be the number updated. If the key element is not found, the function should return -1. Also check the heap whether it maintains the heap property or not. **[3 marks]**

BONUS PROBLEM

4. Write a function `void sort(int *A, int array_size)` which sorts the numbers in the array `A` in non-increasing order using the Heapsort algorithm. **[5 marks]**