**Year 2**

## Data Structures and Algorithms – IT2070

**BSc (Hons) in Information Technology**



**Tutorial 8 – Heaps**

# Semester 2, 2022

Question1

1. What is a binary tree?
2. Show that the relationship between height (*h*) of a Full Binary Tree and the number of nodes (*n*) is given by.

Question 2

1. The following are the algorithms for Heap sort, Max Build Heap and Max\_Heapify.

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HEAPSORT(A)

1.MAX\_BUILD\_HEAP[A]

2.for *i* = A.length down to 2

3. Exchange A[1] with A[*i*]

4. A.heap\_size = A.heap\_size-1;

5. MAX\_HEAPIFY(A,1)

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MAX\_BUILD\_HEAP (A)

1. A.heap\_size = A.length

2. for i = ⎣A.length/2⎦ downto 1

3. MAX\_HEAPIFY(*A*, i)

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MAX\_HEAPIFY (*A*,*i*)

1. *l* = LEFT\_CHILD (*i*);

2. *r* = RIGHT\_CHILD (*i*);

3. if *l* ≤ A.heap\_size and A[ *l* ] > A[ *i* ]

4. then largest = *l*;

5. else largest = *i*;

6. if *r* ≤ A.heap\_size and A[*r*] > A[*largest*]

7. then largest = *r*;

8. if *largest* ≠ *i*

9. then exchange A[*i*] with A[*largest*]

1. MAX\_HEAPIFY (A, *largest*)

Illustrate the operations of the Heap sort for the array **A** of elements given below. (For the purpose of illustration, assign the values only once to the given algorithm and use diagrammatic way to reach the answer.)

1 2 3 4 5 6 7 8

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 4 | 20 | 30 | 1 | 50 | 60 | 0 | 80 |

1. We can compute the upper bound on the running time of BUILD-HEAP as follows.

 Briefly explain two components of the above equation.