

School of Computer & Information Sciences
ALGORITHMS MINOR 1 M.Tech (AI)

23 August 2013 Total Marks: 20 Duration: 1 1/2 hours

All the questions carry equal marks.

Please be precise in your answers

1. (a) Propose an algorithm to find all the nodes less than some value X in a binary heap. Your algorithm should run in $O(k)$ where k is the number of nodes that is output by the algorithm. Analyze its running time.
(b) Analyze the following program segment in terms of $\theta(n)$

```
for (i = n; i>0: i/=2) {  
  for(j=0; j < i; j++) {  
    count = count + 1  
  }  
} return count
```

2. Suppose you are required to sort a file of one million integers ranging from 0 to 999 999. Suppose you initialize 1000 bins numbered 0 to 999 and begin the sorting by assigning each integer to the bin corresponding to its first 3 digits. Then use insertion sort on each bin. Instead, you used insertion sorting on the whole file, which algorithm will be faster? Discuss clearly for a) the worst case b) the best case.

3. (a) Write the dynamic programming algorithm to solve the **0/n** Knapsack problem.
(b) Make sure to write all the functions (if any) used in the algorithm
(c) Solve the following instance of 0/N- Knapsack problem whose maximum capacity is 14 units:

p	5	8	14	16	15
w	2	3	5	7	9

4. (a) Show the result of inserting 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13, 2, one at a time, into an initially empty binary heap.
(b) Show the result of using the linear-time algorithm to build a binary heap using the same input.
(c) Perform 3 Delete-Min operations on this heap and show the result.
