Problem Set 8, Part I

Problem 1: Hash tables

1-1) linear

0	if
1	to
2	my
3	the
4	an
5	by
6	do
7	we

Overflow: go

1-2) quadratic

0	
1	
2	my
3	the
4	
5	
6	an
7	

Overflow: by

1-3) double hashing

0	
1	
2	my
3	the
4	do
5	an
6	by
7	we

Overflow: if

1-4) probe sequence: 3%8=3
(3+2)%8=5
(3+4)%8=7
(3+6)%8=1

1-5) table after the insertion:

0	function
1	see
2	
3	our
4	
5	table
6	
7	

Problem 2: Comparing data structures

The best data structure to use in this case would be a hash table. You could use a hash function on the department abbreviation and use separate chaining and that way each department would be grouped together. With that said, you wouldn't have to take the servers offline to grow the hash table as you could implement separate chaining and chain each course in a department together. With hash tables, searching for an item allows you to do better than O(log n) as well. Therefore it has a better time efficiency. To search in the best case a hashtable has O(1), in the worst case search has O(n) for separate chaining. However, the complexity generally is better than O(log n) and approaches O(1).

Problem 3: Complete trees and arrays

3-1) The left child of A is at position 151 in the array. You get this from the equations 2*i+1 which comes from how there are 2 children and the left child is 1 after as the tree is filled from left to right, therefore the left child is located at , 2*75+1 which is 151

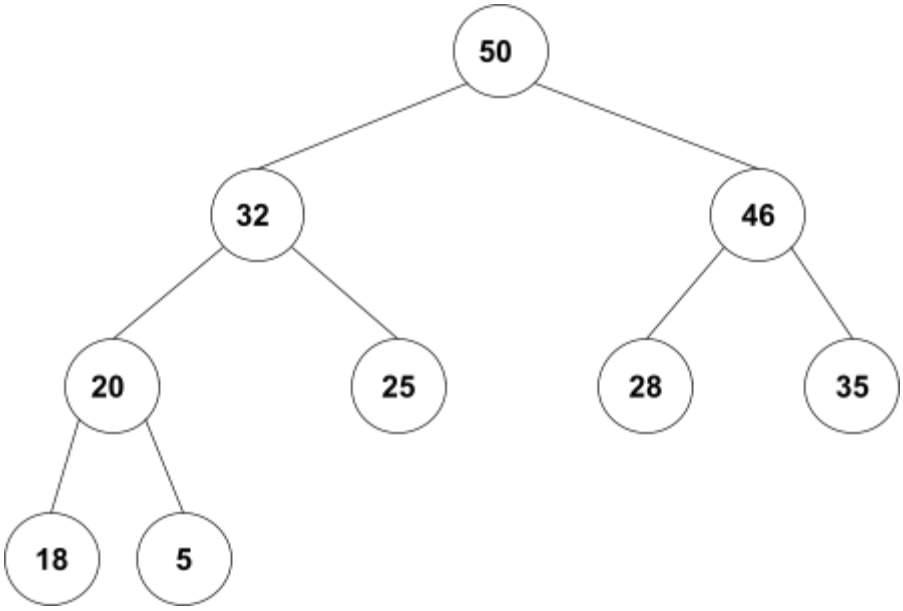
The right child of A is at position 152 in the array. You get this from the equation 2*i+2 therefore the right child is located at 2*i +2 which comes from how there are two children and the right child is 2 after as the tree is filled from left to right, therefore the right child is located at 2*75+2 which is 152

The parent of A is located at position 37 this comes from (i-1)/2 which is 75-1=74/2 which is position 37 in the array.

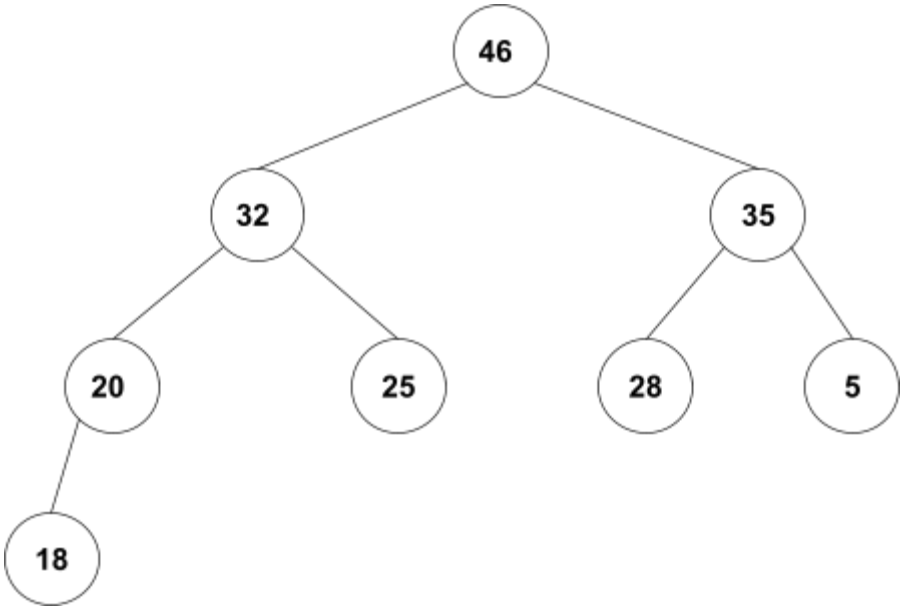
3-2) if there are 325 nodes in the tree, there are 325 items. This would give that the height of the tree is 8. The height is less than or equal to log2 of 325 = 8.34429… . In integer, this number would be 8, therefore the height is 8.

3-3) The rightmost leaf node is the left child of its parent. The rightmost node is located at position 325 as it would be the last leaf node. Its parent is located at (325-1)/2 or position 162. To find the parents left leaf node, it is located at 2*162 +1 which is 325, therefore the rightmost leaf node is the left child of its parent.

Problem 4: Heaps
4-1)
after one removal



after a second removal
(copy your revised diagram from part 1 here, and edit it to show the result of the second removal)



4-2)