CSE 321 Homework 1

Due date: 26 / 10 /2018

1-) Answer in detail the questions that are shown below by using asymptotic notations, yes / no answers and plagiarisation from the web will not be accepted.

a) Explain why the statement, "The running time of algorithm A is at least $O(n^2)$," is meaningless.
b) Are the following true?
   i) $2^{n+1} = O(2^n)$?
   ii) $2^{2n} = O(2^n)$?
c) Are the functions below polynomially bounded?
   i) [log n]!
   ii) [log log n]!

2-) In each of the following situations, indicate whether $f \in O(g)$, or $f \in \Omega(g)$, or both (in which case $f \in \Theta(g)$).

	f(n)	g(n)
a)	$n^2 / \log n$	$n(\log n)^2$
b)	$(\log n)^{\log n}$	$n/ \log n$
c)	$\sqrt{n}$	$(\log n)\ 3$
d)	$(\log n)^{\log n}$	$2^{(\log_2 n)\ \wedge 2}$
e)	$\sum_{i=1}^{n} i^k$	n^{k+1}
f)	$100n + \log n$	$n + (\log n)^2$
g)	$n^{1/2}$	$5^{\log_2 n}$
h)	$n^{0.1}$	$(\log n)^{10}$

3-) For each of the following functions, indicate the function's growth rate when its input is increased by one (n -> n+1) and order the functions according to their growth rates.

$\text{Log}_2 n$, $\sqrt{n}$, $n!$, n^2, n, 2^n, 3^n

4-) Analyze the complexity in time (big -Oh notation) of the following operations at a given binary search tree (BST) that has height n:

a) FindMax.
b) Insert a new element.
c) Delete a leaf node.
d) Printing BST using the in order traversal

5-) Find the complexity in time (big -Oh notation) of the following program.

a)

```
void function(int n)
{
   int count = 0;
   for (int i=n/2; i<=n; i++)
      for (int j=1; j<=n; j = 2 * j)
         for (int k=1; k<=j; k = k * 2)
            count++;
}
```

Note:

- Your submissions will be handwritten
- You can deliver your homework to TA M. Burak Koca until 17:00 on due date (room 119).
- Do your homework personally, group studies will be considered as cheating.