Data Structures: 505 22240 / ESOE 2012

Homework Assignment 1: Asymptotic Analysis, Stacks, and Queues
Due: the week after next in class, 11:10am

Total score: 100

1. The number of operations executed by algorithms A and B is $8n\log n$ and $2n^2$, respectively. Determine n_0 such that A is better than B for $n \geqq n_0$. (10%)

2. Order the following functions by asymptotic growth rate. (20%)

$4n\log n+2n$	2^{10}	$2^{\log n}$
$3n+100\log n$	$4n$	2^n
n^2+10n	n^3	$n\log n$

3. Show that $(n+1)^5$ is $O(n^5)$. (10%)

4. Given an n-element array X, Algorithm D calls Algorithm E on each element X[i]. Algorithm E runs in O(i) time when it is called on element X[i]. What is the worse-case running time of Algorithm D? (10%)

5. Show that $\log_b f(n)$ is $\Theta(\log f(n))$ if $b > 1$ is a constant. (15%)

6. Describe the **output** of the following series of stack operations: push(5), push(3), pop(), push(2), push(8), pop(), pop(), push(9), push(1), pop(), push(7), push(6), pop(), pop(), push(4), pop(), pop(). Show me the content in the stack after each operation and the final result. (10%)

7. Describe the **output** for the following sequence of queue operations: enqueue(5), enqueue(3), dequeue(), enqueue(2), enqueue(8), dequeue(), dequeue(), enqueue(9), enqueue(1), dequeue(), enqueue(7), enqueue(6), dequeue(), dequeue(), enqueue(4), dequeue(), dequeue(). Show me the content in the queue after each operation and the final result. (10%)

8. Describe how to implement the stack ADT using two queues, Q1 and Q2. What is the running time of the push() and pop() methods in this case? (15%)