CSE 373, Autumn 2008, Assignment 2

October 1, 2008

Do this assignment individually. Turn in hardcopy in class on either Friday, October 10, or at the latest, the beginning of class on Monday, October 13.

You may either type up your answers on a computer or handwrite the answers. If you handwrite them, be sure that your writing is completely clear, legible, and and large enough to be read easily. If the graders have difficulty reading your answers, they will not be able to award you full points, even if the answer is "correct".

1. Find the sums of the following sequences, using appropriate formulas. Show your work.
   (a) $\langle -10, -3, 4, \ldots, 795 \rangle$
   (b) $\langle 256, 128, 64, \ldots, 1 \rangle$
   (c) $\langle 1, 3, 9, \ldots, 6561 \rangle$
   (d) $\langle 144, 36, 9, \ldots \rangle$
2. Simplify the following expressions
   (a) $10^x \cdot 10^y \cdot 10^z$
   (b) $2^{\log_2 x} \cdot 2^{\log_2 y}$
   (c) $\log_2(2x^2 \cdot y^3)$
3. Give an inductive proof that for all $n > 0$,
$$\sum_{i=1}^{n}(i+1) = \frac{n(n+3)}{2}$$
4. Let $S = \{0, 1\}$.
   (a) List all the subsets of S.
   (b) Give the cartesian product SXS.
   (c) Give the cartesian product $SXSXS$.

5. Let $S = \{a, b, c\}$. For each of the following relations on S, determine its properties, and then fill in the table with Y or N for each box (meaning Yes or No).

$$
\begin{aligned}
R1 &= \{\} \\
R2 &= \{(a,a)\} \\
R3 &= \{(a,b),(b,a),(c,c)\} \\
R4 &= \{(a,a),(b,b),(c,c)\} \\
R5 &= \{(a,a),(a,b),(a,c),(b,b),(b,c),(c,c)\} \\
R6 &= \{(a,a),(a,b),(b,a),(b,b),(c,c)\}
\end{aligned}
$$

	$R1$	$R2$	$R3$	$R4$	$R5$	$R6$
Reflexive						
Symmetric						
Transitive						
Antisymmetric						
Equivalence Relation						
Partial Order						

6. For the table below, we compare pairs of functions $f(n)$ (shown on the left) and $g(n)$ (shown at the top). For each cell, fill in the strongest true relationship between f and g:

   O if $f(n)$ is $O(g(n))$
   Ω if $f(n)$ is $\Omega(g(n))$
   Θ if $f(n)$ is $\Theta(g(n))$
   $-$ if none of the above.

   If there is a * in the box, then also give a short explanation of why that relationship holds.

	100	$2n+5$	$\log_2 n$	$5n^2$	$n \log_2 n$
$3n+1$					
$0.001 * 2^{n-10}$				*	
$\log_{10} n^n$					*

7. (a). Write an algorithm in pseudocode that uses two stack objects S_a and S_b to implement a queue ADT. You should handle the methods isEmpty, enqueue and dequeue. Assume the stack supports isEmpty, push, and pop.

   (b). What is the time complexity (worst case) for each of the queue's methods and why?

   (c). Suppose n items are enqueued and dequeued in some arbitrary order. What is the time complexity for this entire sequence of operations? Why?

8. In Weiss, do problem 2.14 (which starts on page 52).