

CSU200 Discrete Structures Professor Fell
Written Homework 4

Fall 2004
Due: Monday, 12/6/2004
at the start of class

1. (12 points) The Successor of a Set

The *successor* of a set S is the set $S \cup \{S\}$.

a) Give the successor of each of these sets.

- i) $\{1\}$
- ii) $\{1, 2\}$
- iii) \emptyset
- iv) $\{\emptyset\}$
- v) $\{\emptyset, \{\emptyset\}\}$

b) If the set S has n elements, how many elements does the successor of S have?
Explain your answer.

2. (16 points) Relations

For each of the following, give a relation Q on the real numbers \mathbb{R} satisfying the given conditions or explain why no such relation exists.

	Reflexive	Symmetric	Transitive
a.	no	no	no
b.	no	no	yes
c.	no	yes	no
d.	no	yes	yes
e.	yes	no	no
f.	yes	no	yes
g.	yes	yes	no
h.	yes	yes	yes

3. (8 points) Expression Trees

Given the expression $((x + y)/2) * (3 - (w - a) * (5 + c))$,

- a) Draw the corresponding expression tree.
- b) Give the Scheme expression that corresponds to the tree.

4. (4 points) (Size of Binary Trees)

Prove by Induction:

Theorem: If T is a binary tree of height h , then T has at most $2^{h+1} - 1$ nodes.