

Computer Science 411
Homework 1: Sets
Due Friday, September 4th, 2015

1. (9 points) Enumerate each of the following sets (that is, write out all elements of each of the following sets). Careful – some of these are a bit tricky!
 - (a) $\{a, b, c, \{a, b, c\}, \{\{a, b, c\}\} - \{a, b\}$
 - (b) $\{a, b, c, \{a, b, c\}, \{\{a, b, c\}\} - \{\{a, b, c\}\}$
 - (c) $\{a, b, c, \{a, b, c\}, \{\{a, b, c\}\} - \{\{a, b\}\}$
 - (d) $\{x : x \subseteq \{a, b, c\} \wedge |x| = 2\}$
 - (e) $2^{2^{\{3\}}}$
 - (f) $2^{2^{2^{\{3\}}}}$
 - (g) $2^{\{a,b,c,d\}} - 2^{\{b,c,d\}}$
 - (h) $\{a\} \times \{a, b\} \times \{a, b, c\}$
 - (i) $\{\} \times \{a\} \times \{a, b\}$
2. (2 points) Give a set S such that $|S \cap 2^S| > 1$. Also, give $S \cap 2^S$
3. (2 points) Let $R = \{(a, b), (b, c), (c, a)\}$. Give the transitive closure of R .
4. (2 points) Under what conditions is the symmetric, transitive closure of a relation R over a set S *not* reflexive?
5. Fun with sets of functions:
 - (a) (1 point) How many different functions are there from set $\{a\}$ to the set $\{0, 1\}$?
 - (b) (1 point) How many different functions are there from set $\{a, b\}$ to the set $\{0, 1\}$?
 - (c) (1 point) How many different functions are there from the set A (where $|A| = n$) to the set $\{0, 1\}$?
 - (d) (1 point) How many different functions are there from the set A (where $|A| = n$) to the set B (where $|B| = n$)?
 - (e) (3 points) Let $\{0, 1\}^A$ be the set of all functions from the set A to the set $\{0, 1\}$ (So, $\{0, 1\}^{\{a,b\}}$ would be: $\{\{(a, 0), (b, 0)\}, \{(a, 0), (b, 1)\}, \{(a, 1), (b, 0)\} \dots\}$. Give a bijection between the elements of $\{0, 1\}^A$ and 2^A .