The second test for this course will be given in class on Friday, October 24. It covers everything that we have done from Chapter 2, Sections 1, 2, 3, 4, and 6; it also covers Section 3.1. Note that we skipped some of the material in the listed sections in Chapter 2. You can expect a test that is similar in format to the first test: The test will include some "short essay" questions that ask you to define something, or discuss something, or explain something, and so on. Other than that, you can expect most of the questions to be similar to problems that have been given on the homework. This might include some proofs. There will not be any questions about `HashSet` *or* `BitSet` *on the test, but there might be questions about using the bitwise operators* `&`, `|`, `~`, *and* `<<`.

Here are some terms and ideas that you should be familiar with for the test:

sets

set notations: $\{a, b, c\}$ and $\{x \mid P(x)\}$

the empty set, $\emptyset$

equality of sets: $A = B$ iff they contain the same elements

element of a set: $a \in A$,

subset: $A \subseteq B$

$A = B$ if and only if both $A \subseteq B$ and $B \subseteq A$

proper subset

union, intersection, and set difference: $A \cup B$, $A \cap B$, $A \smallsetminus B$

definition of set operations in terms of logical operators

disjoint sets ($A \cap B = \emptyset$)

power set of a set: $\mathcal{P}(A)$

universal set

complement of a set (in a universal set): $\overline{A}$

DeMorgan's Laws for sets

Russell's Paradox

there is no "set of all sets"

bitwise operations in Java: `&`, `|`, `~`

using an n-bit integer to represent subsets of $\{0, 1, 2, \ldots, n-1\}$

`&`, `|`, and `~` as set operations

the shift operators `<<` and `>>>`

using "`1 << n`" to represent the singleton set $\{n\}$

ordered pair: (a, b)

equality of ordered pairs

cross product of sets: $A \times B$

one-to-one correspondence

cardinality of a finite set: $|A|$

cardinality rules for finite sets: $|A \times B| = |A| \cdot |B|$, $|\mathcal{P}(A)| = 2^{|A|}$, $|A \cup B| = |A| + |B| - |A \cap B|$

finite set

infinite set

countably infinite set

countable set (finite or countably infinite)

uncountable set

Cantor's dialgonalization proof that the set of real numbers is uncountable

examples of countably infinite and uncountably infinite sets

the union of two countably infinite sets is countably infinite

the cross product of two countably infinite sets is countably infinite

the power set of a countably infinite set is uncountable

if X is uncountable and A is a countable subset, then $X \smallsetminus A$ is uncountable

for any set A, there is no one-to-one correspondence between A and $\mathcal{P}(A)$

proof of the above fact

function $f \colon A \to B$

a function as a set of ordered pairs

composition of functions, $f \circ g$

alphabet

string over an alphabet Σ

length of a string, $|x|$

empty string

concatenation of strings

reverse of a string

x^n, for a string x and a natural number n

the set of strings over Σ, denoted Σ^*

language over an alphabet Σ

a language over Σ is an element of $\mathcal{P}\big(\Sigma^*\big)$

the set of strings over Σ is countable; the set of languages over Σ is uncountable

operations on languages

union, intersection, set difference, and complement applied to languages

concatenation of two languages: LM

L^n, for a language L and a natural number n

Kleene star of a language: L^*