CSE 21
Lecture 1: Introduction

Instructor: Sourav Chakraborty
TAs and Tutors

- Instructor:
  Sourav Chakraborty (chakraborty.sourav@gmail.com)

- TAs:
  1. Balasundaram Radheshyam (rbalasun@ucsd.edu)
  2. Lawrence Shibu Stanroop (sslawren@ucsd.edu)

- Tutors:
  Will be announced next class
Classes

- **Lecture:** Mon, Wed, Fri 10AM-10:50AM (WLH 2005)

- **Discussions:** Wed 3PM-3:50PM (CENTR 115)

- **Office Hours:**
  - Instructor office hour: by appointment
  - Other office hours to be announced in next class.
Evaluation Process

- Assignments (no marks)

- Quizes
  - Around 6 quizzes.
  - 5% each.
  - Everything will be done on WeBWork.
  - 1st Quiz will be posted on the 10th Jan.

- MidTerm 30%.

- Endterm Term 40%.
Books and references

Textbook for the course is

- Mathematics for Algorithms and Systems Analysis, by E.A.Bender and S.G.Williamson

Also one may refer to the following books:

- A short course in Discrete Mathematics, by E.A.Bender and S.G.Williamson
- Lists, Decisions and Graphs, by E.A.Bender and S.G.Williamson
  http://cseweb.ucsd.edu/~gill/BWLectSite/
- Essentials of Discrete Mathematics, by David Hunter.
Course Outline

Mathematics for Algorithms and Systems Analysis:

- Induction
- Basic Counting
- Functions and Probability
- Decision Tree
- Graph Theory
Objects we encounter

What all things we encounter in Algorithms and System Analysis?
Numbers

- Integers
Numbers

- Integers
- Whole numbers
Numbers

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- Whole numbers
- Rational numbers
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- Irrational numbers
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Numbers with base $b$

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- When one represent a number in base 2 it is called binary representation or Boolean Representation.
Boolean Algebra

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- One can think of these as *True* and *False*
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- Operations:
  - AND (\(\land\)), OR (\(\lor\)), NOT (\(\neg\)) and XOR (\(\oplus\)).
Representing Data

- Sets

For example:

- Set of names of all students
- Set of letters in the English alphabet
- Set of digits: \{0, 1, \ldots, 9\}

Unordered Sets

Ordered Sets

(Also called LIST/STRINGS/VECTORS)
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$A^n$ is the set of all ordered subsets (with repetitions) $A$ of size $n$
Cartesian Product

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- $A^n$ is the set of all ordered subsets (with repetitions) $A$ of size $n$
- $\{0, 1\}^n$ the set of all “strings” of 0 and 1 of length $n$. 
Representing Data: functions

Given a set $D$ (domain) and a set $R$ (range) a function is a map from $D$ to $R$ such that every element in $D$ has a unique image in $R$. 

For example: $f: \{0, 1\} \to \{0, 1\}$ such that $f(x) = 1$ iff $x$ has an even number of 1.
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For example:

$f : \{0, 1\}^n \rightarrow \{0, 1\}$ such that

$f(x) = 1$ iff $x$ has even number of 1.
Q: How many elements are there in the set \(\{0, 1\}^n\)?
A little bit of counting

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**Ans:** \( 2^n \).
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Ans: \( 2^{2^n} \).