

MATH 501 – Discrete Mathematics

Lecture 0: Motivation, Topics, and Policies

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A Simple Logic Question

We would like to buy a bat and a ball.

We are given the following two facts.

- 1 A bat and ball cost \$1.10.
- 2 The bat costs one dollar more than the ball.

How much does the ball cost?

A Logic Puzzle I

You drive to the store at 20 mph and return by the same route at 30 mph. Discounting the time spent at the store, what was your average speed?

$$d = 20T$$

$$d = 30t$$

$$2d = A(t + T)$$

$$A = 24$$

A Logic Puzzle

At a family reunion were the following people: one grandfather, one grandmother, two fathers, two mothers, four children, three grandchildren, one brother, two sisters, two sons, two daughters, one father in law, one mother in law and one daughter in law. But not as many people attended as it sounds. How many were there and who were they.

There were two little girls and a boy, their parents and their father's parents. Totalling to 7 people.

The Puzzle of the Politicians¹

A certain convention numbered 100 politicians. Each politician was either crooked or honest.

We are given the following two facts.

- 1 At least one of the politicians was honest.
- 2 Given any two of the politicians, at least one of the two was crooked.

Can it be determined from these two facts how many of the politicians were honest and how many were crooked?

¹puzzle credited to Ray Smullyan, original slide by Haythem Ismail

A Logic Puzzle

- We meet two people on a liar/truth-teller island
 - A says: Exactly one of us is lying
 - B says: At least one of us is truthful
- What can you conclude about the identities of A and B?

Teaching objective

We mainly aim to teach you how to

Think.

What and Why Discrete Mathematics?

- Mathematics that deals with discrete objects.
 - **Discrete Objects** are objects which are separated from each other, e.g. integers, rational numbers, houses, people, etc.
 - In this course, we will be concerned with objects such as integers, propositions, sets, relations and functions.
- Discrete Mathematics is very much “real world” mathematics
 - Mathematical reasoning
 - Proof techniques
- Discrete Mathematics is fun.

Teaching objective

In detail:

- The fundamentals of **propositional logic**.
 - **Syntax** and **semantics** of propositional logic.
 - Various **mechanical approaches** to solve propositional logic formulas.
- The basics of **First order logic (FOL)**
- The concepts of **mathematical proofs**
 - What is a proof?
 - Proof techniques
- **All about sums**
 - Counting and recurrence
 - Generating function and difference calculus
- Some **number theory**

Course structure

We will do our best to **involve you** (as usual):

- **Weekly lectures**

- You should **attend** the lectures regularly. Material from the lectures will be **practiced** but **not repeated** in the tutorials.

Note:

These slides are **not** meant to be comprehensive lecture notes! They are only remarks and pointers. The material presented here is **not sufficient** for studying for the course. Your **main sources for studying** are

- the text and
- your own lecture notes.

Course structure

We will do our best to **involve you** (as usual):

■ Weekly tutorials

- The tutorials are **mandatory**.
- GUC regulations allows up to 25% missed tutorials. This is meant for **serious** problems and **emergencies**.

■ Occasional bonus lecture

- For those of you who are **interested** and **like to know more** we may offer an **advanced topic** extra slot.
- Attendance is **completely voluntary**
- Such events will be announced beforehand.

Assignments, quizzes, project

- There will be **two theoretical assignments**
 - There will be **no** “best of” rule on the assignments.
- There will be **3 quizzes**
- There might be **practical assignments**
 - Small **coding projects** in HASKELL/PROLOG/JAVA.
 - Whether or not we offer them will depend on the proceeding of the class

Grade distribution (tentative)

- Final exam: 40%
- Midterm exam: 25%
- Quizzes: 25%
- Theoretical assignments 10%

Important:

- No cheating.

Answers

If you have **questions** or need **help**:

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Resources

You find the **website** at:

<http://met.guc.edu.eg/>

The **textbook** is:

Graham, Knuth, Patashnik.

Concrete mathematics

<http://www.pearsoned.co.uk/bookshop/detail.asp?>

item=168565

Additional **online resources** and **textbooks** will be posted at the **website**

