

CPRE 310 Discrete Mathematics

Introduction - First Lecture

January 13, 2009

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1

Summary

- Discussion of why study discrete mathematics – slides 3-11
- About the course: Goal, expected work, grading, policies, office hours - slides 12-16

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2

Why Study Discrete Mathematics

- Elegant and powerful thinking = C. A. R. T.
 - Clarity >> Effective communication
 - Abstraction >> Core of the problem
 - Reasoning >> Right vs. wrong
 - Techniques >> design, analysis, & verification

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3

Clarity

- Does the set of integers have *more number of elements* than the set of even integers?
 - NO !
- To understand the answer, we need a precise definition of *number of elements* that makes sense even when the sets are infinite.

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4

Clarity

- CC-Finder is a powerful tool to find software clones
- What are *software clones*?
 - Two *identical* pieces of software
- *Identical*?
 - Need a precise definition of the difference between two versions of software.

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5

Mathematical Communication

- Must be unambiguous
- Must express things so that everyone understands exactly what we are saying
- **Consequence:** Careful definitions are necessary

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6

Abstraction

How do you know today isn't Thanksgiving?

If today is Thanksgiving, then it is Thursday.
It is not Thursday.

Therefore, today is not Thanksgiving.

What is the form of this argument?

If p then q.
Not q.
Therefore, not p.

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7

Proof Technique

Common form:

If p then q.
Not q.
Therefore, not p.

modus tollens

Modus tollens is **valid** in the sense that if you have an argument of this form in which the first two statements (the **premises**) are true, then you can be 100% sure that the final statement (the **conclusion**) will be true.

We'll come back to this later in class.

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8

Abstraction

Ralph is a forest ranger. From each of the four windows of his lookout station, Ralph can see three campsites. The north window shows campsites A, B, C; the east window shows campsites C, E, H; the south window shows campsites F, G, H; the west window shows campsites A, D, F. One day Ralph counted five campers through each of the four windows. There were 14 campers altogether and at least one camper at each campsite. What are the all possible arrangements of the campers in the campsites, i.e. how many campers at each campsite?

What is a good abstraction to solve the above problem?

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9

Reasoning

Mr. and Mrs. Jones invite four couples for a party. At the party, husband and wife do not shake hands but others do. Mr. Jones counts the number of hands each person (other than himself) shook and finds that no two persons have shaken hands with the same number of people.

Claim: Mrs. Jones shook hands with 4 people.

Correct?

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10

Counting Techniques

The given nested loops execute the function f().

What is the total number of iterations for each of the following two loops? - answer should be a formula using N.

For I = 1 to N
 For J = 1 to N
 For K = 1 to N
 f();

For I = 1 to N
 For J = 1 to I
 For K = 1 to J
 f();

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11

Goal of this Course

- **Clarity** - learn to define clear problems and ask specific questions
- **Abstraction** - learn how to abstract real-world problems
- **Reasoning** - learn how to support claims with effective arguments
- **Techniques** - learn mathematical techniques and their applications

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12



What you will need to do

- Do the odd numbered problems from the book. Do not look at the solutions before trying. There will be weekly quizzes based on these problems.
- Always attend the class. Inform the instructor if you are going to be absent. Ask questions if you do not understand something.
- Take notes. After every lecture – read the corresponding part from the book and do the problems on that part.
- Prepare for exams by studying regularly. Cramming before the exam will not work.
- If you understand well then you will need to memorize very little. Consult the instructor soon if you experience difficulties in understanding the material being covered.

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13



Grading

- **Weekly quizzes:** at the end of the class, 2 to 4 problems, chosen from the odd numbered problems on the material covered the week before, usually on Tuesdays – 25% of the grade
- **Three Exams:** 1st 20%, 2nd 25%, 3rd 25%
- **Discretionary:** Instructor will decide at the end based on factors such as attendance, participation in the class, exemplary work etc. – 5% of the grade
- Exam dates and the topics will be announced at least a week before the exam

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14



Policies

- **Makeup:** No makeup quizzes or exams without prior permission
- **Attendance:** Always expected to attend. Sometimes I will take attendance
- **Email:** Do not send emails to me to find out what was covered in the class
- **Appointments:** You are encouraged to do it if you need help from me. Make appointments by talking to the instructor before or after the class and *not* by email
- **Lectures:** Interactive with questions and answers on both sides. PowerPoint slides to drive the discussions with details on the board. It will be difficult to understand the slides without listening to the discussions in the class. PowerPoint slides will usually be posted after the lecture.
- **Special Situations:** Contact me if have a special situation and need my help. We follow the university guidelines.

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15



Office Hours

- Tuesday 9:30 to 10:30 and Thursday 10:30 to 11:30 or by appointment
- Room 3132 Coover Hall
- Make appointments if you cannot come during the office hours. To make an appointment, talk to me after or before the class period.

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16



Textbook

- Discrete Mathematics and Its Applications, sixth edition, Kenneth Rosen.

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17



Special Thanks

- Professor Susanna EPP – I am using her slides and book to prepare my lectures.
- Her Webpage:
<http://condor.depaul.edu/~sepp/>

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18