
CS 220: Discrete Structures and their Applications

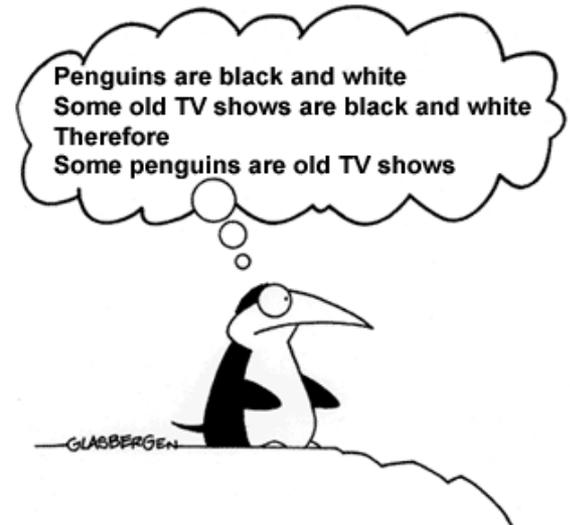
Course Introduction



About this course

- This is a math course.
 - Why is math important to us? What does it have to do with computer science?
 - We need to be able to reason about our programs
 1. Is our program correct?
 2. How much time and space does it take

- We will also write programs.
 - Programming language: Python!



Python

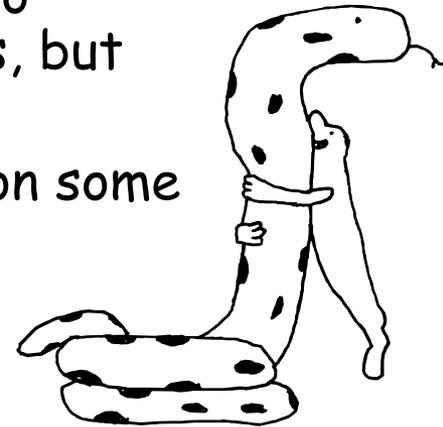
We will use Python to demonstrate mathematical concepts.

Why Python?

- ❖ Simple, easy to learn syntax
- ❖ Highly readable, compact code: almost like pseudo-code
- ❖ One of the most highly used programming languages

What makes Python different from Java?

- ❖ Java is **statically** typed, i.e. variables are bound to types at compile time. This avoids run time errors, but makes java programs more rigid.
- ❖ Python is **dynamically** typed, i.e. a variable takes on some type at run time, and its type can change. This makes python programs more flexible, but can cause strange run time errors.



About this course

Course webpage:

<http://www.cs.colostate.edu/~cs220/>

Slides/recitations/assignments are posted on the course webpage's schedule page.

Canvas will be used for grades and assignments

Piazza will be our primary communication tool

Textbook

Who reads the textbook anyhow?

- Most textbooks are expensive
- Are not in alignment with how most students interact with content → low usage

Textbook

Zybooks online discrete math book:

The screenshot shows a web browser window displaying the ZyBooks online discrete math book. The page title is "The conjunction operation". The left sidebar contains a table of contents with sections 1) Logic, 1.1 Propositions and logical operations, 1.2 Compound propositions, 1.3 Conditional statements, 1.4 Logical equivalence, 1.5 Laws of propositional logic, 1.6 Predicates and quantifiers, 1.7 Quantified statements, 1.8 De Morgan's law for quantified statements, 1.9 Nested quantifiers, 1.10 More nested quantified statements, 1.11 Logical reasoning, 1.12 Rules of inference with propositions, 1.13 Rules of inference with quantifiers, Print Chapter, 2) Proofs, 3) Sets, 4) Functions, and 5) Induction and Recursion. The main content area explains the conjunction operation, defining propositional variables p and q, and providing examples: p: January has 31 days, q: February has 33 days. It states that a compound proposition is created by connecting individual propositions with logical operations, and the conjunction operation is denoted by \wedge . The proposition $p \wedge q$ is read "p and q" and is called the conjunction of p and q. $p \wedge q$ is true if both p is true and q is true. $p \wedge q$ is false if p is false, q is false, or both are false. Using the definitions for p and q given above, the proposition $p \wedge q$ is expressed in English as: $p \wedge q$: January has 31 days and February has 33 days. Proposition p's truth value is true – January does have 31 days. Proposition q's truth value is false – February does not have 33 days. The compound proposition $p \wedge q$ is therefore false, because it is not the case that both propositions are true. A truth table shows the truth value of a compound proposition for every possible combination of truth values for the variables contained in the compound proposition. Every row in the truth table shows a particular truth value for each variable, along with the compound proposition's corresponding truth value. Below is the truth table for $p \wedge q$, where **T** represents true and **F** represents false.

PARTICIPATION ACTIVITY 1.1.2: Truth table for the conjunction operation.

Start

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

$p \wedge q$ is true only when both p and q are true
false for all other combinations

If you haven't gotten access to it:

- ❖ Sign in or create an account at learn.zybooks.com
- ❖ Enter zyBook code **COLOSTATECS220Spring2018**
- ❖ Subscribe
- ❖ A subscription is \$48 and will last until June 13, 2018.

Textbook

Zybooks online discrete math book:

The screenshot shows a web browser window displaying the ZyBooks online discrete math book. The page title is "The conjunction operation". The left sidebar contains a table of contents with sections like "Logic", "Propositions and logical operations", "Compound propositions", etc. The main content area explains the conjunction operation, defining propositional variables and compound propositions. It includes an example with p (January has 31 days) and q (February has 33 days), and discusses the truth value of the compound proposition $p \wedge q$. A "PARTICIPATION ACTIVITY" section titled "1.1.2: Truth table for the conjunction operation" is shown, featuring a truth table and a "Start" button.

The conjunction operation

Propositional variables such as p , q , and r can be used to denote arbitrary propositions, as in:

p : January has 31 days.
 q : February has 33 days.

A **compound proposition** is created by connecting individual propositions with logical operations. A **logical operation** combines propositions using a particular composition rule. For example, the conjunction operation is denoted by \wedge . The proposition $p \wedge q$ is read "p and q" and is called the **conjunction** of p and q . $p \wedge q$ is true if both p is true and q is true. $p \wedge q$ is false if p is false, q is false, or both are false.

Using the definitions for p and q given above, the proposition $p \wedge q$ is expressed in English as:

$p \wedge q$: January has 31 days and February has 33 days.

Proposition p 's truth value is true — January does have 31 days. Proposition q 's truth value is false — February does not have 33 days. The compound proposition $p \wedge q$ is therefore false, because it is not the case that both propositions are true.

A **truth table** shows the truth value of a compound proposition for every possible combination of truth values for the variables contained in the compound proposition. Every row in the truth table shows a particular truth value for each variable, along with the compound proposition's corresponding truth value. Below is the truth table for $p \wedge q$, where **T** represents true and **F** represents false.

PARTICIPATION ACTIVITY 1.1.2: Truth table for the conjunction operation.

Start

p	q	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

$p \wedge q$ is true only when both p and q are true
false for all other combinations

Demonstrated to be effective.

A. Edgcomb, F. Vahid, R. Lysecky, A. Knoesen, R. Amirtharajah, and M.L. Dorf. Student Performance Improvement using Interactive Textbooks: A Three-University Cross-Semester Analysis, Proc. of ASEE Annual Conference, Seattle, 2015.

Components of the course

- Lectures
 - Slides are posted ahead of time
- Zybooks reading assignments
 - Help prepare/reinforce lecture
- Recitations
 - Help you with written/programming assignments
 - Reinforce material from lecture
- Written/Canvas assignments
 - Do you understand the theory?
- Programming assignments
 - Can you implement it?
- Tests
 - What have you learned?

Grading

Written/Canvas assignments

Programming assignments (~3)

Zybooks activities

Recitation (attendance + completion)

Midterm

Final

For the percentages see course website.

CS building

Make sure you can get into the Unix lab (CSB 120)!

If you have keycard access problems:

- CS students: talk to a CS accounting person (Kim or student employee)
- Non CS students: Key Desk at Facilities Management

Professional class behavior

We all have to have respect for each other, independent of race, gender, ability

Laptop usage: use the back row of the class

THERE ARE NO STUPID QUESTIONS

- Your classmates will be grateful you asked.
- Questions outside of class: use Piazza rather than emailing your instructor/TA

Cheating

What is cheating? What is not?

Where is it defined?

What is gained / lost when cheating?

What are the consequences?

When / how does it happen?

- How can cheating be avoided?