

Class starts after this song

Elton John – Bennie and the Jets (1973)
requested by Jerone Samari (TA-of-CM3)

I am a senior studying physics (objectively cooler).
In my free time I like to bike and swim!



Logistic Bulletin Board

- CM4-7 readings/prepare quizzes all released
 - This should keep you from being bored in this class

Exam 1: 2/14(W) in-class

- Scope: CM1-3 (logic, proof, math tools)
 - Closed-book but with an official reference sheet
 - Official sheet will be on Canvas next week
 - You may replace the official sheet with your own (one single-sided 8.5"x11", can be typed/hand-written/hybrid)
 - If you use your own reference sheet, you have to *submit the sheet along with the exam*
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Exam 1: 2/14(W) in-class

- Practice exam 1 (mirrors the actual exam 1 in length, scope, difficulty) will be released by 2/7 for you to take a stab
 - Recitation on 2/12(M) will be a *practice exam review session*
 - No work/attendance required
 - TAs go through practice exam sols/approaches together with you
 - Sample grading results released after all recitations
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Manually-graded assignment policies

- Gradescope assignments **must be typed**
 - In other words: **handwritten and photocopied work is not accepted**
 - Exception is when you *augment* your work with figures/diagrams
 - You may do the assignments *solo* or *in pairs*
 - You must stick with the same pair throughout the feedback process for the same assignment (i.e., if round 1 is solo, can't pair for round 2)
 - **Can't collaborate with the same partner in consecutive CMs**
 - So your partner for CM2 assignment cannot be the same one in CM1
 - No such rule for EMs (EMs are not ordered at all)
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Submitted at: January 23, 1:08 PM

Select questions and pages to indicate where your responses are located. Use `esc` to deselect a

Use the arrow keys on the keyboard.

Question Outline

Select a question or a page.

Title	Points
1 1	0.0 pts
1.1 a	0.0 pts
1.2 b	0.0 pts
1.3 c	0.0 pts
2 2	0.0 pts
2.1 a	0.0 pts
2.2 b	0.0 pts
2.3 c	0.0 pts
3 3	0.0 pts
3.1 a	0.0 pts
3.2 b	0.0 pts
4 Recitation part (skip if attended recitation)	0.0 pts

CS230 Recitation/Assignments

Recitation 01/22, Assign

1 Recitation

1. (Ungraded activity) Introducing and getting to know each other.

2. (Continued from class meeting) Let $C(x)$ represent "x can be a CS student", $D(x)$ represent "x drives a car", and $P(x)$ represent "x is a person".

(a) Translate the following sentence from English to a propositional logic formula.

"Some thing can have color or ice cream, but not both."

(b) What does the sentence "Drive a car, or get pulled over, prohibits." mean?

3. (Ungraded multi-section activity) Let P be the proposition "I have got 80% of the questions in the program." Let Q be the proposition "I have attended Recitation for module 1". Derive the truth value of $P \wedge Q$, according to the information in Chinese. You will need to use the truth table.

4. (Ungraded activity) Finding assignment pointers.

5. (Do Morgan's law for these variables) We have already seen that $\neg(\neg A) = A$.

We will derive the case for these variables:

$\neg(\neg p \wedge q) = \neg(\neg p) \vee \neg q = p \vee \neg q$

$\neg(\neg p \vee q) = \neg(\neg p) \wedge \neg q = p \wedge \neg q$

Unmatched Pages & Questions

i You haven't matched all pages and questions.

Page 1 doesn't have associated questions.

Question 4 doesn't have associated pages.

You can still submit your assignment without this page associated, however we recommend matching all pages so that graders can easily find your work.

[Submit Assignment](#) [Continue Matching](#)

- Double check you label the correct pages to each question
- If you don't submit recitation work, Gradescope will warn you that you haven't labeled pages for it (which is normal)

CM1

● Ungraded

Student

Test Student

[View or edit group](#)

Total Points

- / 0 pts

Question 1

1

0 pts

1.1 a

0 pts

1.2 b

0 pts

1.3 c

0 pts

Question 2

2

0 pts

Group Members

i Add or remove group members for this submission.

Your instructor has allowed you to submit as a group of up to **2 people**. You can change the group below. Students added or removed will be notified via email.

Student

Remove

Test Student



Add Student

Close

Add

- Then add your teammate here; DO NOT SUBMIT SEPARATELY

Communication policies

- Check [course website](#) before asking a logistical question anywhere
 - For technical help (i.e., on course content), use [consulting hours](#) and/or [Ed discussions](#) (see [Help Resources](#) on course website)
 - Don't ask for technical help via email
 - For personal questions about the course (grades, accommodations, etc.) use our course inbox: compsci-230@duke.edu (reaches head staff)
 - **Send your STINFs/NoVAPs/etc. here as well!**
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CS230 Spring 2024

Module 03: Math Tools

Why math tools?

- Mod and congruence: basics of number theory
 - foundation of (classical) cryptography (EM)
 - Sequences and recurrence relations:
 - for quantifying complicated (recursive) constructs
 - heavily used in algorithm analysis
 - some in CS201, more in CS330
 - Asymptotic notations:
 - for characterizing algorithms... and more (probability, etc.)
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Terminology Musing

	Approach 1	Approach 2
$a_n \leq a_{n+1} \forall n \in \mathbb{N}$	increasing	non-decreasing
$a_n < a_{n+1} \forall n \in \mathbb{N}$	strictly increasing	increasing
$a_n \geq a_{n+1} \forall n \in \mathbb{N}$	decreasing	non-increasing
$a_n > a_{n+1} \forall n \in \mathbb{N}$	strictly decreasing	decreasing

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More terminology musing

- We here use $\{a_n\}_{n=0}^{\infty}$ to represent the sequence a_0, a_1, a_2, \dots
 - Later, we will also use curly brackets to represent **sets**
 - **Sets** ignore the *order* of elements and *repeated* elements
 - Think about Python Set or Java HashSet
 - Therefore, do NOT write a sequence as $\{a_0, a_1, a_2, \dots\}$
-



PI: Monotonicity

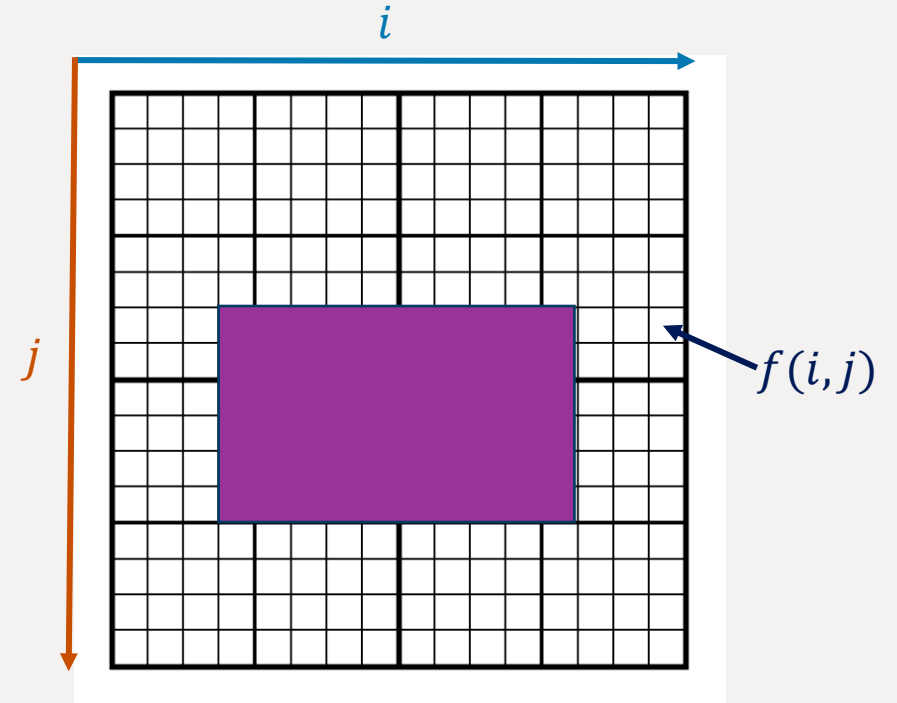
- A monotone sequence is either nondecreasing or nonincreasing (can be both, can be stronger)
 - If $\{a_i\}$ and $\{b_i\}$ are “same direction”: $\{a_i + b_i\}$ is also in that direction
 - Otherwise, $\{a_i\}$ and $\{-b_i\}$ are “same direction”, and $\{a_i - b_i\}$ is also in that direction
 - Finally notice that if $\{a_i + b_i\}$ is monotone then $\{-a_i - b_i\}$ is also monotone; same with the other options
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Summation tricks/manipulations

- $\sum_{n=a}^b f(n) = \sum_{n=0}^b f(n) - \sum_{n=0}^{a-1} f(n)$

- $\sum_{n=a}^b f(n) = \sum_{n=0}^{b-a} f(n+a)$

- $\sum_{i=a}^b \sum_{j=c}^d f(i,j) = \sum_{j=c}^d \sum_{i=a}^b f(i,j)$



Summation vs. Product tricks

$$\bullet \sum_{n=s}^t \log_b f(n) = \log_b \prod_{n=s}^t f(n)$$

$$\bullet \prod_{n=s}^t C^{f(n)} = C^{\left(\sum_{n=s}^t f(n)\right)}$$

To the asymptotic notations!

Class starts after songs



I am a math and computer science major. I enjoy traveling, reading, and knitting.

Marie-Hélène Tomé (TA-of-CM3)

***Polyphia – G.O.A.T. (2018),
SOLOMON – Listen up (2023)***

requested by Anoushka Sinha (TA-of-CM3)

I'm a junior majoring in Math and Computer Science. Outside of academics I like to sing, dance, and rock climb!



Logistic Bulletin Board

- CM1 Gradescope assignment grading results: published **later today in-class**
 - Common misunderstandings of problems
 - How to read feedback/decide whether to resubmit
 - Difference of **resubmissions** vs. **regrade requests**
 - Both due **2/7 (Wed) 11:59pm**
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PI: Congruence Meets Arithmetics

- $(a \bmod n) + (b \bmod n) = ((a + b) \bmod n)$ $a = 1, b = 1, n = 2$
- $(a \bmod n) - (b \bmod n) = ((a - b) \bmod n)$ $a = 1, b = 2, n = 2$
- $(a \bmod n) \times (b \bmod n) = ((a \times b) \bmod n)$ $a = 2, b = 2, n = 3$
- $((a \bmod n) \bmod (b \bmod n)) = ((a \bmod b) \bmod n)$ $a = 1, b = 1, n = 1$