



ITCS112 DISCRETE STRUCTURES

Fall Semester
Academic Year 2023



My Courses Checklist...

- I read the course information
- I check the course syllabus
- I get PowerPoint lecture slides
- I know where to get practice problems & exercise sheets
- I see the link to a weekly quiz

Always check messages from the ICT faculty
Know your instructor's email (or where to find it)



- Submit an absent form
- Sick leave, within 7 days, with a medical certificate
- Business leave, 3 days in advance, proof document
- It is your responsibility to follow-up with all the coursework when you miss a class
- Contact your instructors if you need help

Course Information

ITCS112 - Discrete Structures

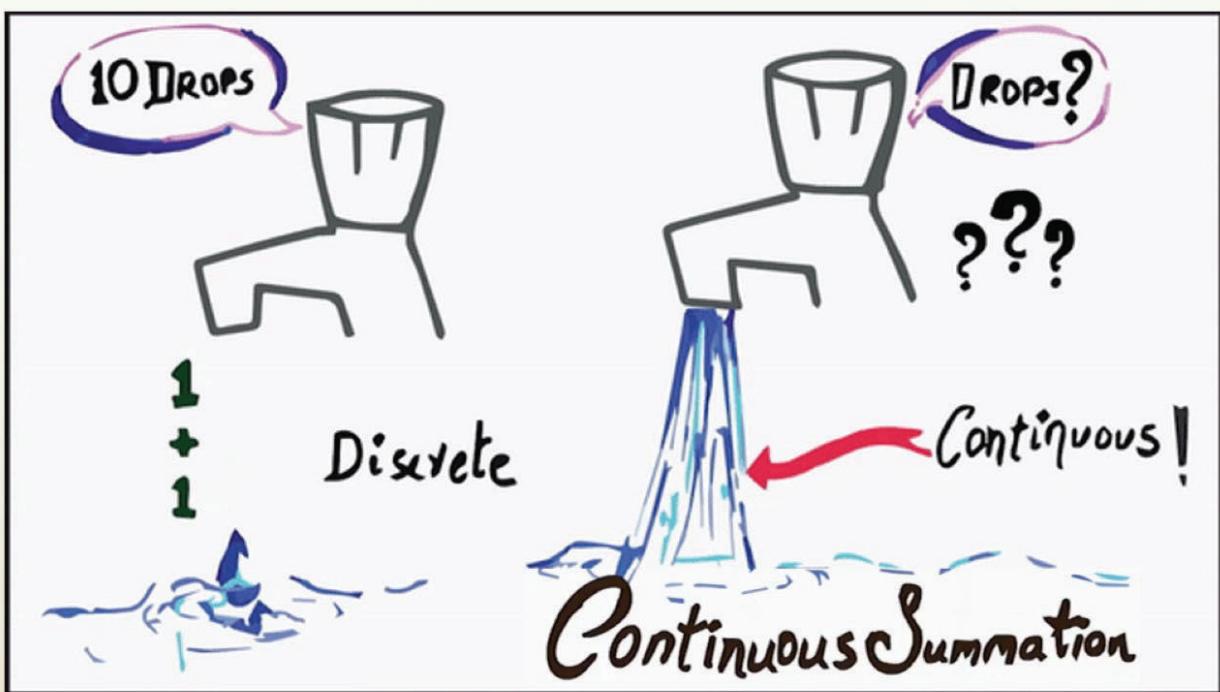
WHAT is this course about?

WHY do you need this course?

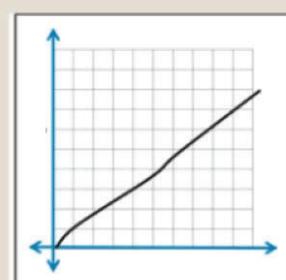
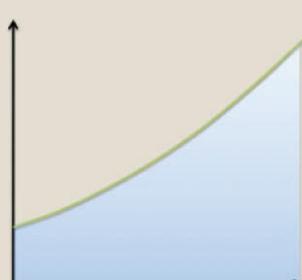
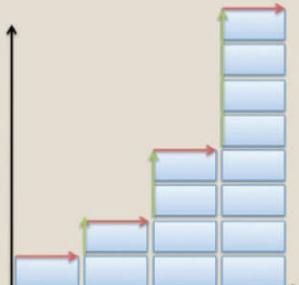
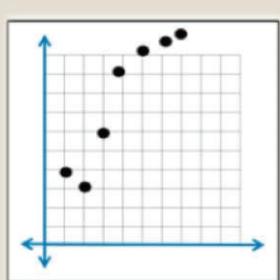
HOW to do well in this course?

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We will be working with things that are **DISCRETE**



Discrete mathematics is the study of mathematical structures that are **fundamentally discrete** (can be enumerated by integers) rather than continuous



Has clear spaces between values

Distinct, separate values, unconnected

Discrete - countable

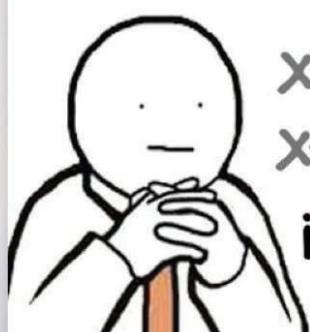
Falls on a continuous sequence

Any value within some interval or range

Continuous - measurable



I'm still waiting for the day that I will actually use



$$xy + (4 \cdot 20) > \\ x - 5y [2+9-7]$$

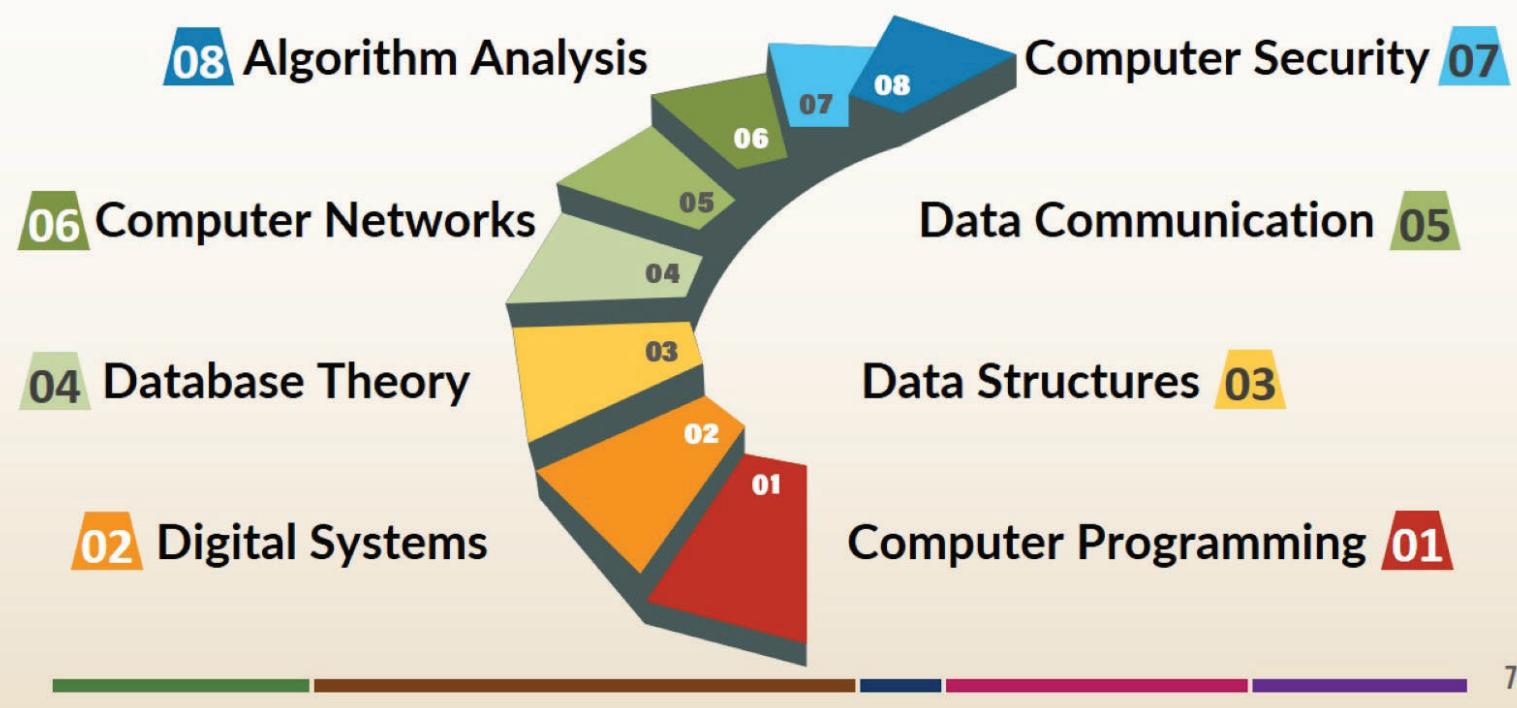
in real life

Can you name things in **CS & ICT** that are clearly **DISCRETE**?

How about related applications?

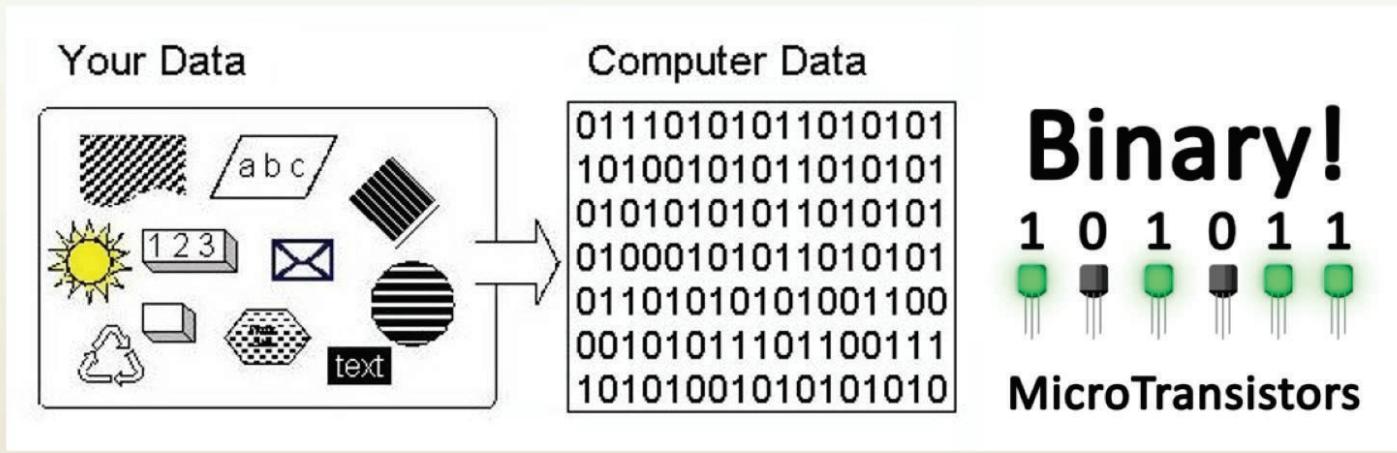
M O T I V A T I O N

Courses after Discrete Math Structures

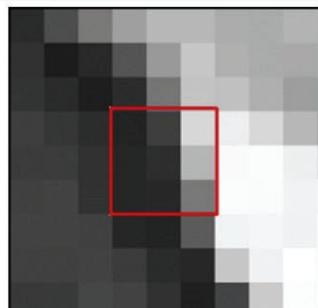


Binary, bits and bytes

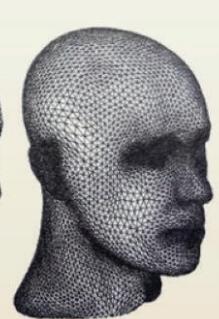
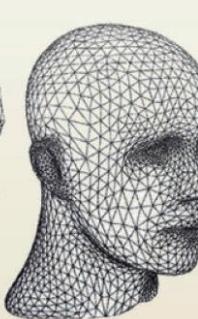
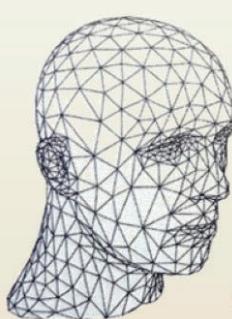
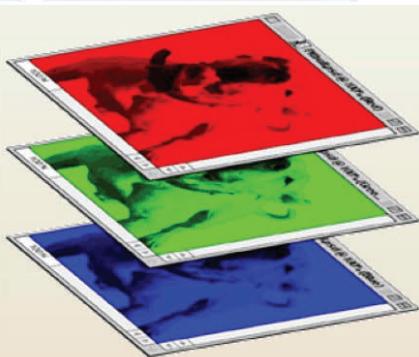
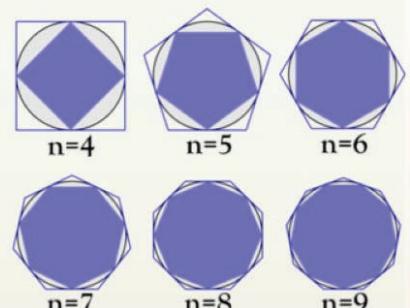
- Software and files on computers are both stored as huge strings of 1s and 0s. Binary math is discrete mathematics.



Discrete math in image processing & computer graphics



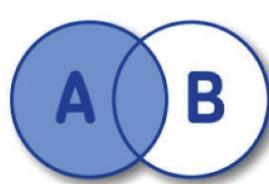
43	102	169
35	58	191
38	44	155



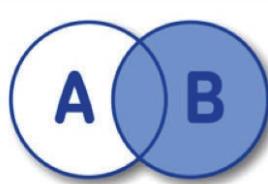
<https://www.science direkta.com/topics/engineering/monochrome-image>; https://gsp.humboldt.edu/OLM/Courses/GSP_216_Online/lesson3-1/raster-models.htm; <https://htmlict.com/topics/engineering/monochrome-image>; <https://www.sketchpad.net/channels1.htm>

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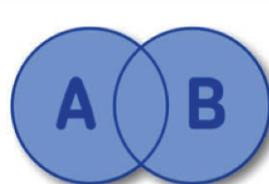
Discrete math in relational databases



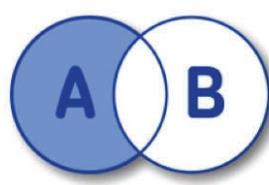
SELECT * FROM
A **LEFT JOIN** B
ON A.KEY = B.KEY



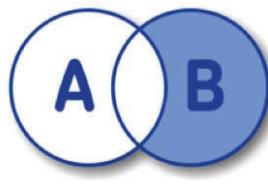
SELECT * FROM
A **RIGHT JOIN** B
ON A.KEY = B.KEY



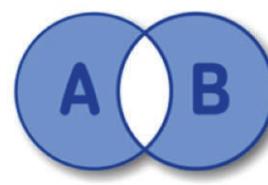
SELECT * FROM A
FULL OUTER JOIN B
ON A.KEY = B.KEY



SELECT * FROM A
LEFT JOIN B
ON A.KEY = B.KEY
WHERE B.KEY IS NULL



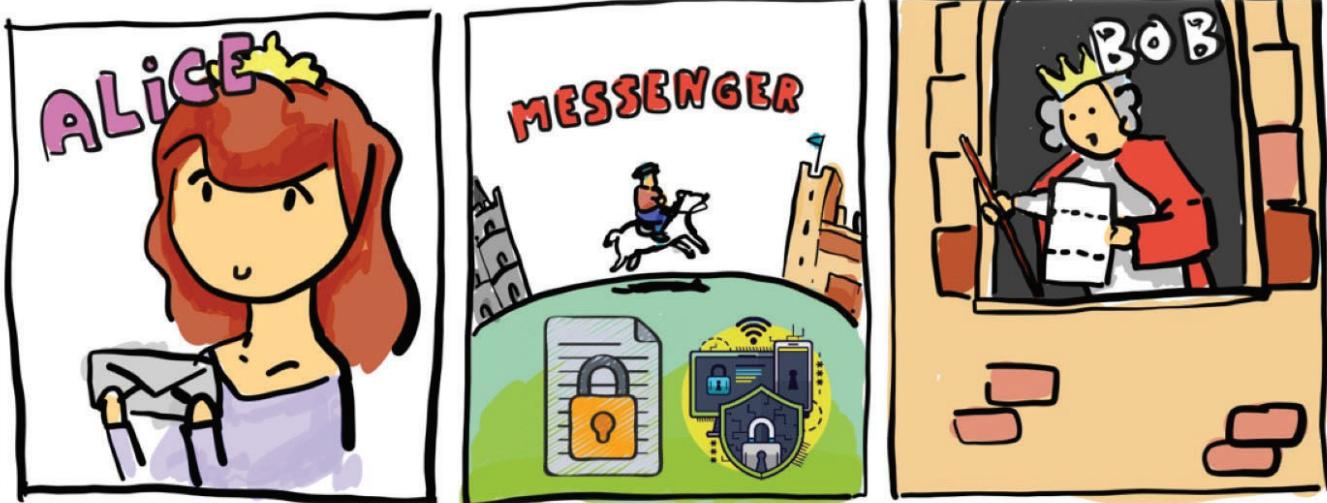
SELECT * FROM A
RIGHT JOIN B
ON A.KEY = B.KEY
WHERE A.KEY IS NULL



SELECT * FROM A **FULL
OUTER JOIN** B ON A.KEY =
B.KEY WHERE A.KEY IS
NULL OR B.KEY IS NULL

Discrete math in cryptography and cyber security

- How would you ensure that a messenger cannot read your letter?



<https://www.cryptologie.net/article/479/a-book-in-preparation/>

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Discrete math in path finding, routing, and scheduling



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Why Study DISCRETE MATHEMATICS



Math of computing, Math language of CS



Data structures, algorithms, cryptography,
security, database, automata, formal languages



Symbolic and logical reasoning
Algorithmic & creative thinking



Very much “real world” mathematics
science, engineering, economics, biology, etc.



Problem → formulate it using mathematical
structure and solve it mathematically → solution

Where do we start? Ready?

START

Topics for the MIDTERM

A.J. PLA

piyanuch.sil@mahidol.edu



Weeks 1-2 Logic and Proof



Propositions & Logical Operators
Rules of Inference and Validity
Mathematical Induction

Weeks 3-5 Sets and Counting



Sets, Operations on Sets
PIE, Sum and Product Rules
Counting and Combinatorics

Weeks 6-8 Properties of Integers



Divisibility and Modulo
Binary and Base Arithmetic
Applications in Cryptography

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Topics for the FINAL

A.J. TEE

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Weeks 9-10 Relations



Product Sets, Partitions
Relations and Digraphs
Boolean Matrix of Rel.

Weeks 11-12 Prop. of Relations



Properties of Relations
Equivalence Relations
Transitive Closure

Weeks 13-14 Functions



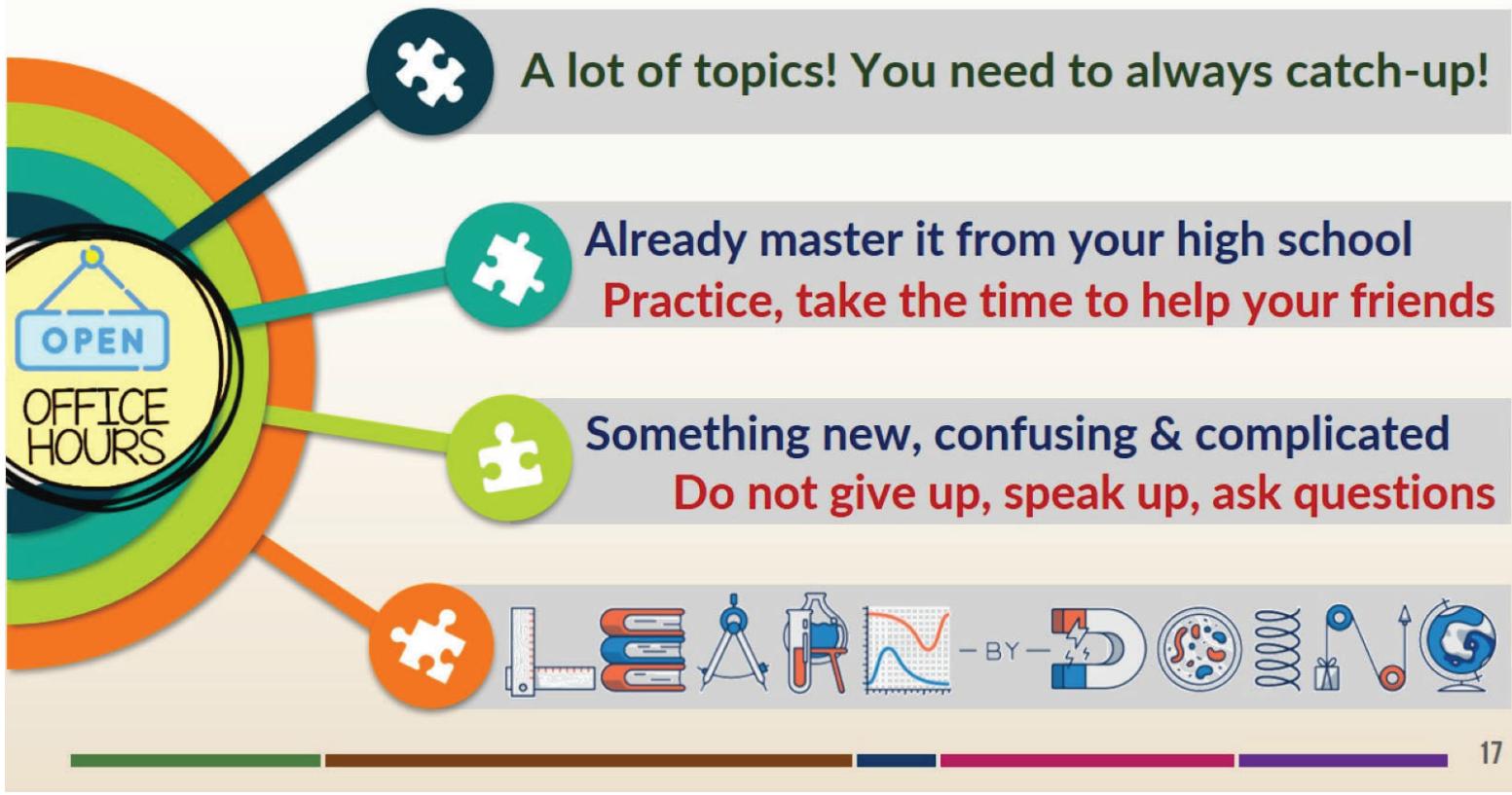
Functions in CS
Growth of Functions
Permutation Functions

Week 15 Summary



Conclusion
Add. Topics
Exam Review

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Course Learning Outcomes

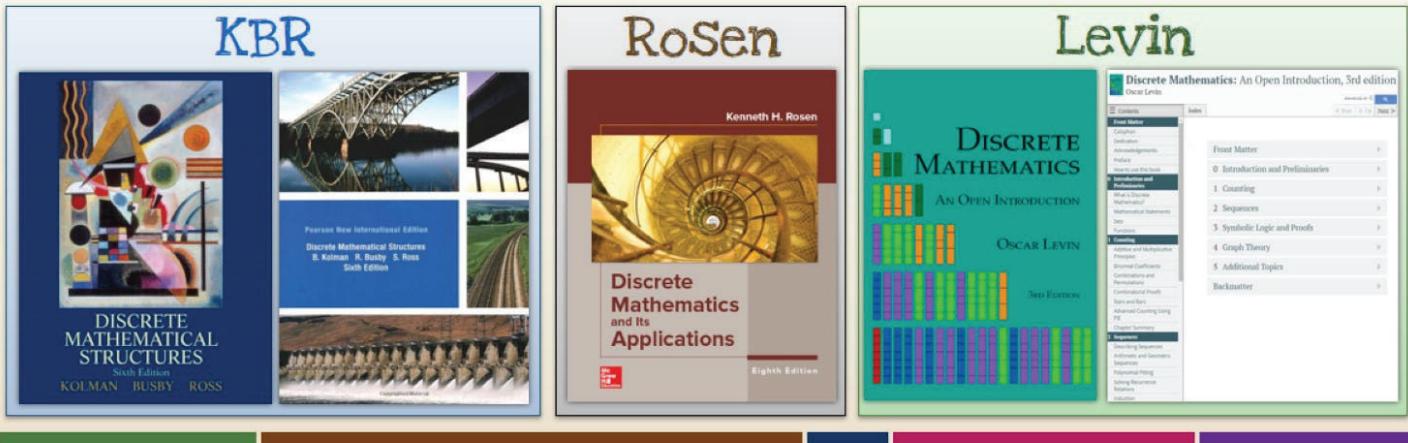
- Recall fundamental mathematical concepts in arithmetic and algebra
- Demonstrate knowledge of key theories and concepts in discrete math
- Demonstrate the abilities and skills to solve problems in discrete math



Class materials and resources

Many practice problems
for your self-study!!

- **Reading and practice exercises (problems with hints and solutions)**
- Discrete Mathematical Structures by Kolman, Busby, and Ross
- Discrete Mathematics and Its Applications by Rosen
- Discrete Math by Levin – <http://discrete.openmathbooks.org/dmoi3/>



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IN-CLASS

Live-Lecture, Videos
Step-by-step worked
examples & exercises



AT-HOME

Review the concepts
Practice problem sets
Collaborate with friends



OFFICE HOUR (EXTRA CLASS)(OH)

- ⇒ Detailed solutions for HW and quizzes
- ⇒ Get help catching up
- ⇒ Q & A from lectures
- ⇒ Other concerns



QUIZ

Weekly
Checkpoint



EXAM

Midterm
and Final



ASSESSMENT SCORE and evaluation

30%

70%

20

PRACTICE

Give it a try! Take good notes!
We will go over these
together in-class.



PRACTICE PROBLEMS

After-class exercises: check your
understanding & prepare for quizzes.
For answers or solutions, come to OH.

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CLASS WEEKLY TIMETABLE

MON

S1 8-11

OH TBA
TO BE ANNOUNCED

11-11:30am

TUE

S2 8-11

OH TBA
TO BE ANNOUNCED

11-11:30am

WED

S3 9-12

OH TBA
TO BE ANNOUNCED

11-11:30am

THU

S4 9-12

QUIZ (a week after)

0005--

FRI

SAT

SUN

--2355

The online quiz is 1 hour and only 1 submission is allowed.



ATTENDANCE



Weekly attendance is required by the faculty.
Checked = your submission of a weekly quiz.

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REMINDER

01

Check the course **SYLLABUS**, know which topic is covered or coming up, and do not miss a deadline

02

Come to OH to **ASK QUESTIONS** about lectures or worked examples or to get help catching up

03

Come to OH if you need **DETAILED SOLUTIONS** to HW/quizzes — *bring what you have tried*

04

After each quiz is closed, log-in again to get **YOUR SCORE** and check the correct answers

05

How much work is expected? From your curriculum ...

3 - 0 - 6 HOURS/WEEK

Lecture - Laboratory - Self-study

Don't skip HW
and claim that
you don't have
solutions!

A path to Success!

Practice
Practice
Practice
Don't give up!

Difficulty
with English?
@@
Keep using it!

Vocabulary?
@@
Learn math
terminology!

Did it before
but forgot?
@@
Recall it!!

The only way to
learn mathematics
is to do mathematics.

Paul Halmos

**Mathematics is not about
numbers, equations,
computations, or algorithms:
it is about
UNDERSTANDING**

-William Paul Thurston