CSE215
Foundations of Computer Science

State University of New York, Korea

course website

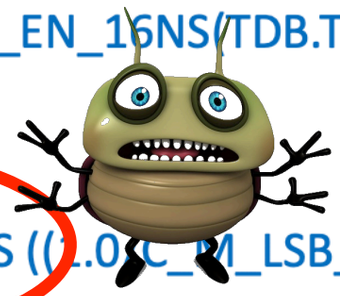
https://github.com/zhoulaifu/24_cse215_fall

Why Studying Computer Science?

French Ariane 5 Rocket, 1996

Ada code for Ariane 5 Rocket

```
if L_M_BV_32 > 32767 then
  P_M_DERIVE(T_ALG.E_BV) := 16#7FFF#;
elsif L_M_BV_32 < -32768 then
  P_M_DERIVE(T_ALG.E_BV) := 16#8000#;
else
  P_M_DERIVE(T_ALG.E_BV) := UC_16S_EN_16NS(TDB.T_ENTIER_16S(L_M_BV_32));
end if;
P_M_DERIVE(T_ALG.E_BH) :=
  UC_16S_EN_16NS (TDB.T_ENTIER_16S ((1.0/C_M_LSB_BH)*G_M_INFO_DERIVE(T_ALG.E_BH)));
```



$7 billion Software Disaster

Comparison:

SUNY Korea was awarded $0.05 billion for 10 years under an MKE grant
(Source: https://sunyk.cs.stonybrook.edu/)

From 2018 to 2020, South Korea GDP dropped $94 billion;
(Source: World bank)

- How to make reliable software?
- How to make efficient software?
- How to make energy-friendly software?
- We need to understand **deeply** how code works

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- Quiz: If Precondition holds, will Postcondition holds after executing this piece of code?

```
Precondition: x >= 0;

z = 0;
if (x != 0)
    z = x;
} else {
    z = z+1
  }
Postcondition: z > 0;
```

https://slideplayer.com/slide/14725881/

- Yes. We can **prove** it!

```
Precondition: x >= 0;

z = 0;
                          { x >= 0 && z = 0 }
if (x != 0) {
                          { x > 0 && z = 0 }
   z = x;
                       { x > 0 && z = x }
} else {
                                { x = 0 && z = 0 }
   z = z+1
                             { x = 0 && z = 1 }
  }
Postcondition: z > 0;
```

Propositional Logic

Predicate Logic

Proof

CSE215

Sequences

Sets

Functions

Relations

Expected Learning Outcomes

- An ability to check if a mathematical argument is valid
- An ability to verify the correctness of proofs of some existing theorems and prove some new theorems
- An ability to use the mathematical concepts of sequences, functions, relations, and sets in solving computing problems

Logistics

Meet the Instructor

- Email: <zhoulai dot fu at sunykorea dot ac dot kr>
- CSE215 and CSE216
- Research Interest: Software Security
- Previous Work: France, US, Denmark and Korea
- Education: École Polytechnique, France
- Personal: Happily married; like dreaming and playing with my child; no special hobbies or talents.

TA

1. **Jinsol Jung**
   Email: <jinsol dot jung at stonybrook dot edu>

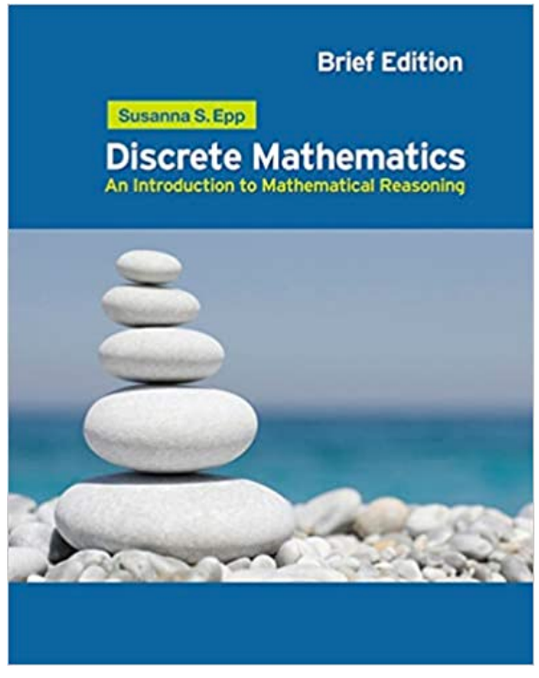
2. **Farouk Sadqi**
   Email: <farouk dot sadqi at stonybrook dot edu>

3. **Yoora Kim**
   Email: <yoora dot kim at stonybrook dot edu>

Team

You	TA	Instructor	ChatGPT
Lectures	**Office hours**	**Office hours**	**Not do homework**
Homework	**Answer questions**	**Lectures**	**Answer questions**
Ask questions	**Grading**	**Grading**	
		Answer questions	

Textbook



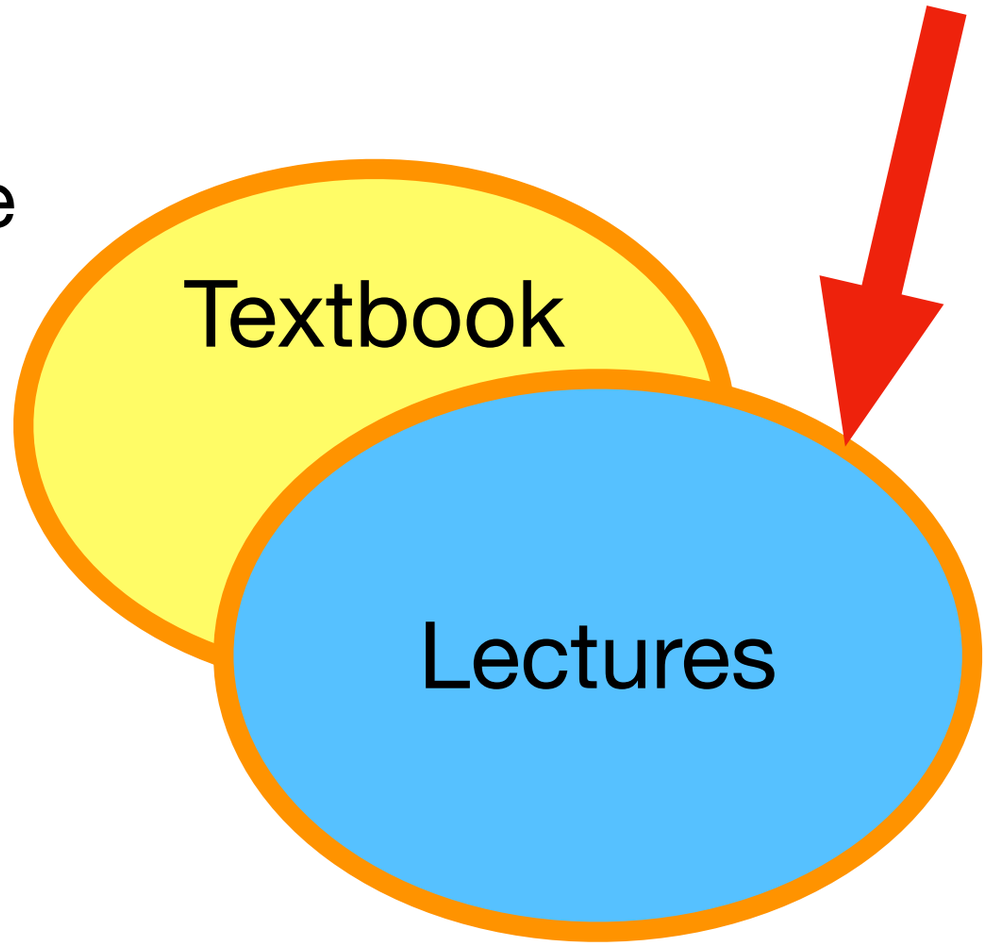
- Our course relates to Chapters 2-7

- Very helpful, but optional

- Suggestion: Skim the related chapter before the lecture; read deeper after the lecture

- Textbook may not cover everything in the exams; lectures do

Exam



Schedule

- Lectures: Mondays and Wednesdays, 10:30 AM - 11:50 AM, Room C107
- Recitation: Monday, 12:30 PM - 1:25 PM, Room C107
- Homework: Announced every Wednesday, with submissions due by the following Wednesday at 11:59 PM KST.
- Office Hours: Mondays, 4:30 PM - 5:30 PM, and Wednesdays, 12:30 PM - 1:25 PM, Room C107.
- TA office hours: TBA

Zoom In case

- https://stonybrook.zoom.us/j/93553126576?pwd=aDBQN1M2V3BUanpHRUtYd0VZbm5YQT09

Numerical Grades

- Homeworks: 20%
- Midterm1: 25%
- Midterm2: 25%
- Final: 25%
- Attendance: 5%
- Bonus: Students who consistently participate or provide constructive feedback will receive a bonus of 0.5 or 1.

Letter Grades

Absolute grading will be applied:

- **A:** [93, 100]
- **A-:** [90, 93)
- **B+:** [87, 90)
- **B:** [83, 87)
- **B-:** [80, 83)
- **C+:** [77, 80)
- **C:** [73, 77)
- **C-:** [70, 73)
- **D+:** [67, 70)
- **D:** [63, 67)
- **F:** [0, 63)

Definition of Force Majeure in Our Policies

Force majeure in our policies includes, but is not limited to,

- documented illness or family emergencies.

Note: A documented hospital visit alone is not sufficient to justify force majeure. The doctor's note must clearly state the reason for the absence and the recommended period of absence.

Attendance Policy

- Attendance will be checked irregularly.
- Arriving late will count as half attendance. "Late" is defined as arriving after the attendance check has been completed. After the attendance check, the TA/Instructor will mark any absences.
- Excuses are granted only in cases of force majeure. See the definition above for "force majeure."
- In the event of discrepancies between the signed attendance sheet and actual physical presence, names will be called. Students involved may be addressed privately.
- In accordance with Korean law, more than 20% absence will result in an automatic F grade.

Grading Policy

- Grading will be conducted by both the TAs and the Instructor.
- Factual errors in grades will be corrected.
- Non-factual grade disputes will not be considered.
- Plagiarism, including the use of AI-generated solutions for homework, will result in a grade of 0 and will be reported. Students involved may be addressed privately.
- Typewritten submissions are recommended; illegible handwriting may result in a grade of 0.

Late Homework Policy

- Late homework will not be accepted.
- Homeworks submitted after the deadline are only permissible in cases of force majeure. See above for the definition of "force majeure."
- Once homework solutions have been released, no submissions will be accepted under any circumstances.

Email Policy

- Please include **[CSE215]** in the subject line for all course-related email communication with the instructor.
- Use the instructor's SUNY Korea email address (see above) whenever possible.
- You can expect a reply within 72 hours. If you do not receive a response within this timeframe, kindly send a reminder.
- Emails without **[CSE215]** in the subject line may be missed.

ChatGPT Policy

We adhere to policies similar to those outlined in Stanford's Generative AI Policy Guidance.

- In general, the use of or consultation with generative AI is treated similarly to receiving assistance from another person.
- Using generative AI tools like ChatGPT to substantially complete homework assignments is not permitted.
- Students should acknowledge any use of generative AI tools (beyond incidental use) and should default to disclosing such assistance when in doubt.

Recipe for Success in CSE215

- Attend lectures
- Ask questions
- **Do homework (VITAL)**

Questions so far?

Quiz

- Where to find official course info?
- Homework due time?
- How attendance will be checked?
- How late homework will be handled?
- How to email the instructor?
- Who grade?

Course overview

A personal story

- Once upon a time, I worked for a project involving financial calculation
- I needed to sum up a number of floating-point values like
  - 0.1 + 0.2 + 0.3 + 0.7 + 0.9 + 1.2 + 3.5…
- There were billion of numbers like this, so performance was a key for the project's success
- We decided to use the state-of-the-art multi-core, parallel computing
- Parallel computing works like a divide-and-conquer:
  - (0.1 + 0.2) + (0.3 + 0.7) + (0.9 + 1.2 + 3.5) + …
- Now, let us think why it looks reasonable le to use parallel computing for this task??
- The reason is associative law. (a + b) + c = a + (b + c)

A problem

We get different results for each round, if we put parentheses differently each time.

- (0.1 + 0.2) + (0.3 + 0.7) + (0.9 + 1.2 + 3.5) + …
- becomes different from
- (0.1 + 0.2 + 0.3) + (0.7+ 0.9)+ (1.2 + 3.5) + …

Demo:

https://www.pythonanywhere.com/try-ipython/

Why?

- We made this assumption:
  - for any numbers a, b, c, (a + b) + c = a + (b+ c)
- This is a statement that can be assigned with true or false value, we call it a **proposition**
- The inner part has variables, and can be denoted as a statement with parameters (a, b, c). We call it a **predicate**.
- Many CS work involves determining if a proposition is true or false. To show the truth is called **to prove**.
- The reason for the problem is that the proposition above is false.

Summary for the story

The whole is called a proposition,
to which we can assign a truth value

$$\forall a, b, c \in I, (a + b) + c = a + (b + c)$$

quantifier

variables

set

Predicate

Summary

- The ultimate goal of this course is to learn fundamentals for understanding why our digital world works or fails.

- We will study logic (propositions, and predicates), proof, and math structures like sets as a language to reason about computer science

- Our next classes will be about propositions.