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CSCI 5240

Combinatorial Search and Optimization with Constraints

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CSCI 5240

When Traditional Classroom Lectures Meet MOOCs/SPOCs

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Discrete Optimization with Fable-Based Learning

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Brotherhood at the Peach Garden

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The Celestial Old Man

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The Magical Tablet

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Power of the Magical Tablet

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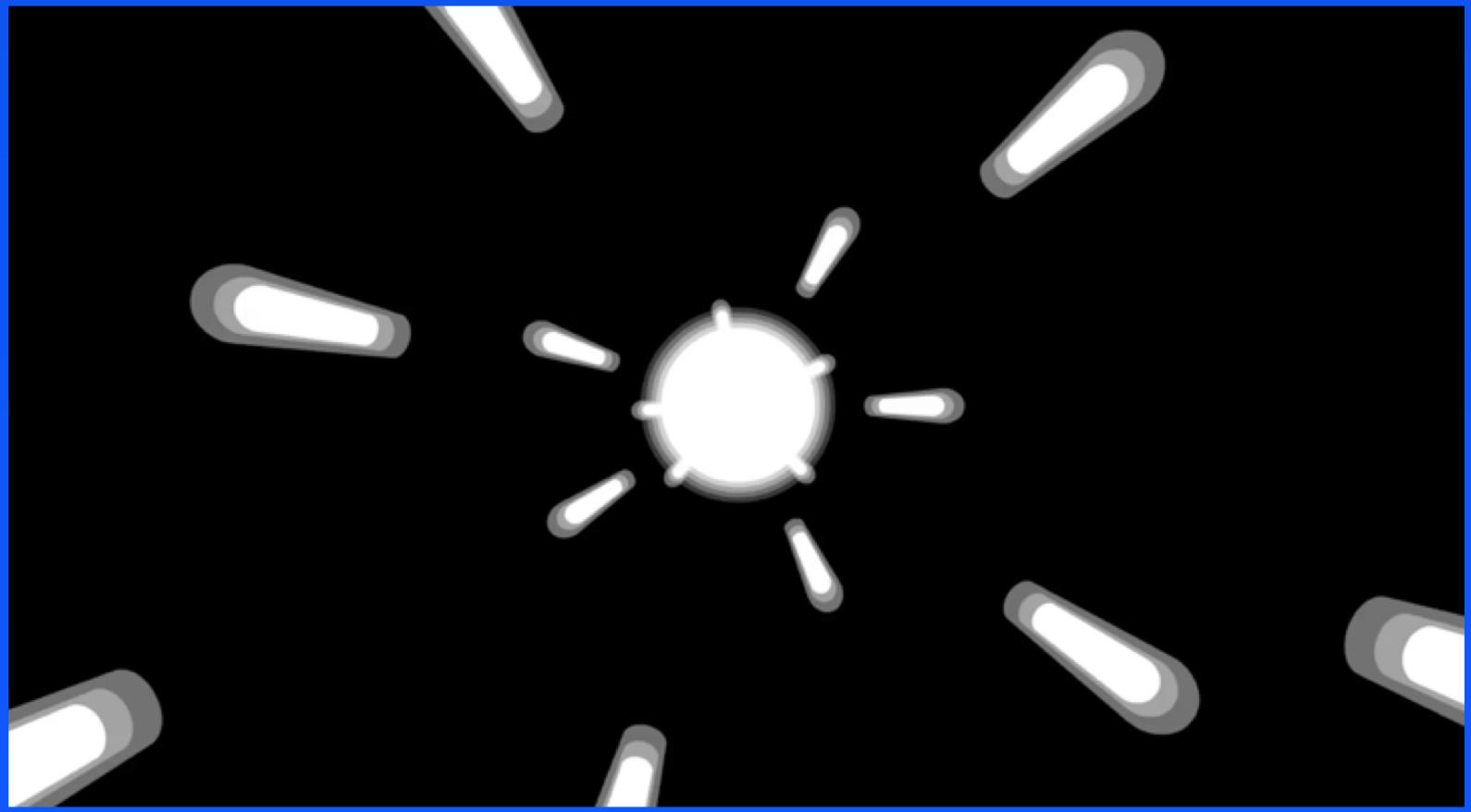
Through the Wormhole



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Starting Every MOOC Lecture

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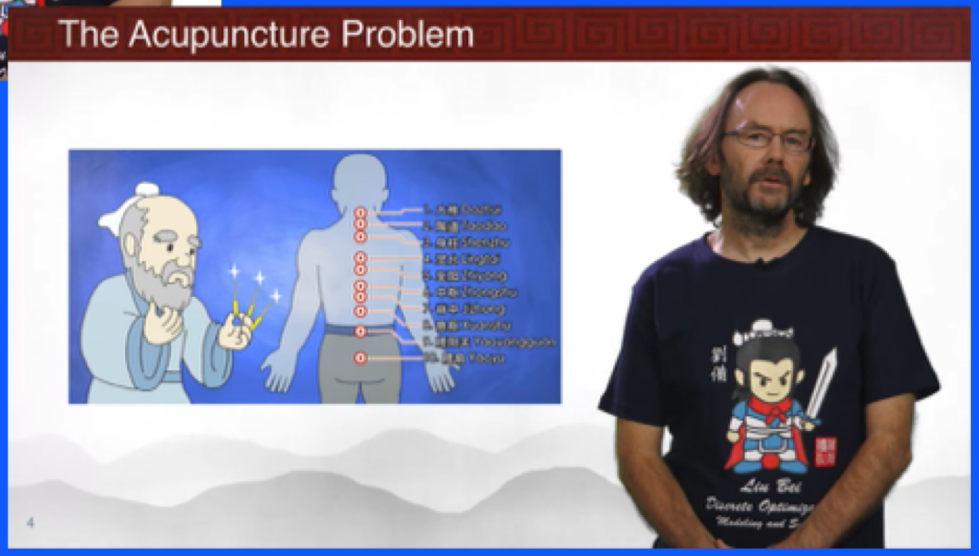
Video Lectures



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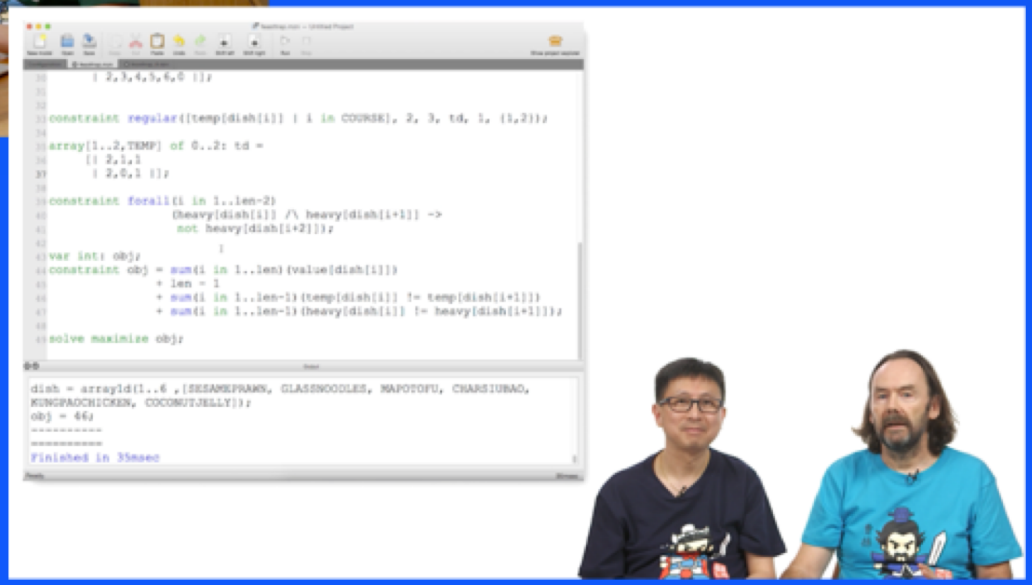
After Each Module

Live-coding
Workshops

Challenging
Assignments



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Fable-Based Learning

- By following and becoming part of a story plot
- Problem-based and Immersive
- A form of Anchored Learning
  - Situated, interesting and realistic
  - A single fable plot to serve as anchor/context throughout the course for all learning

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Production Planning

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Rostering

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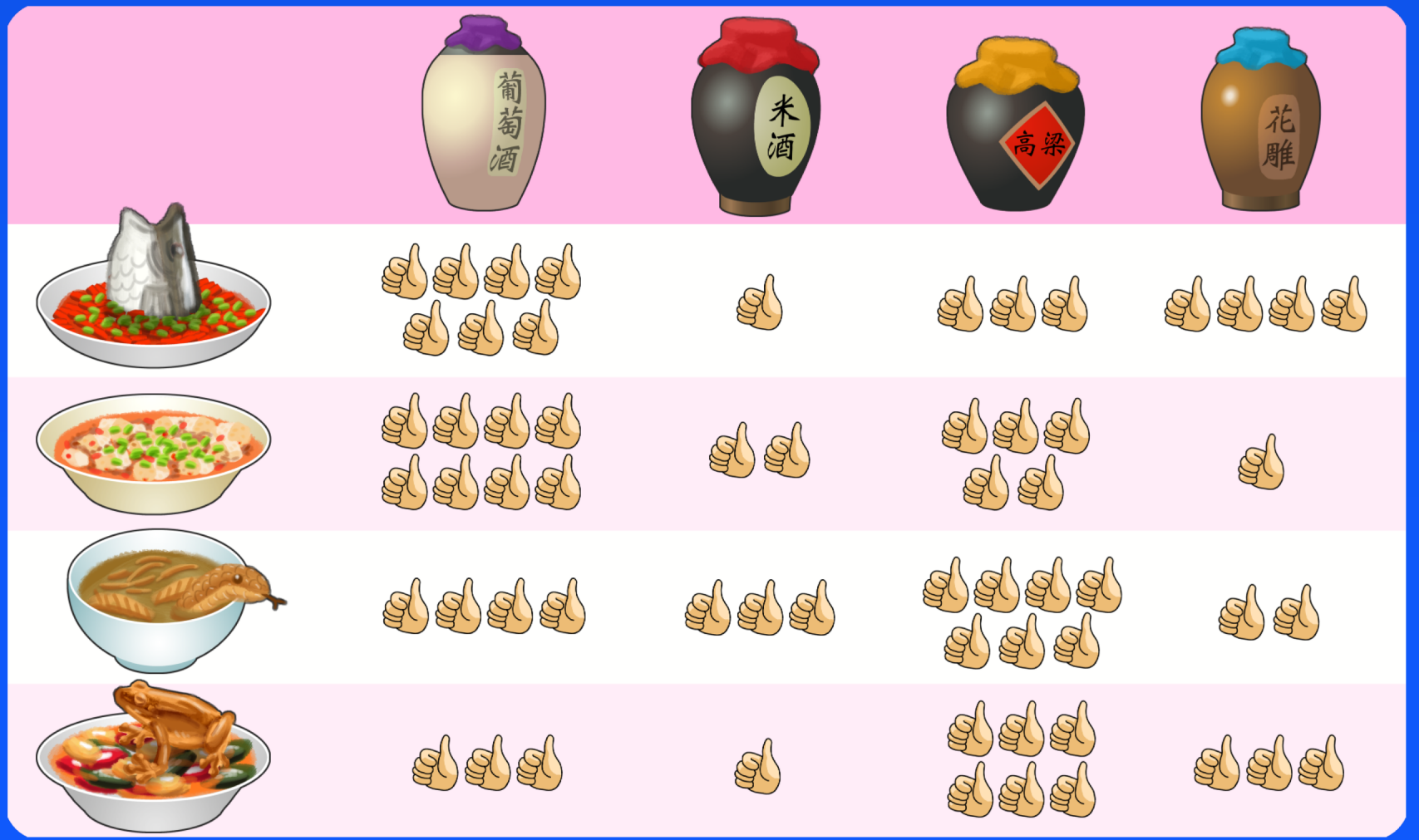
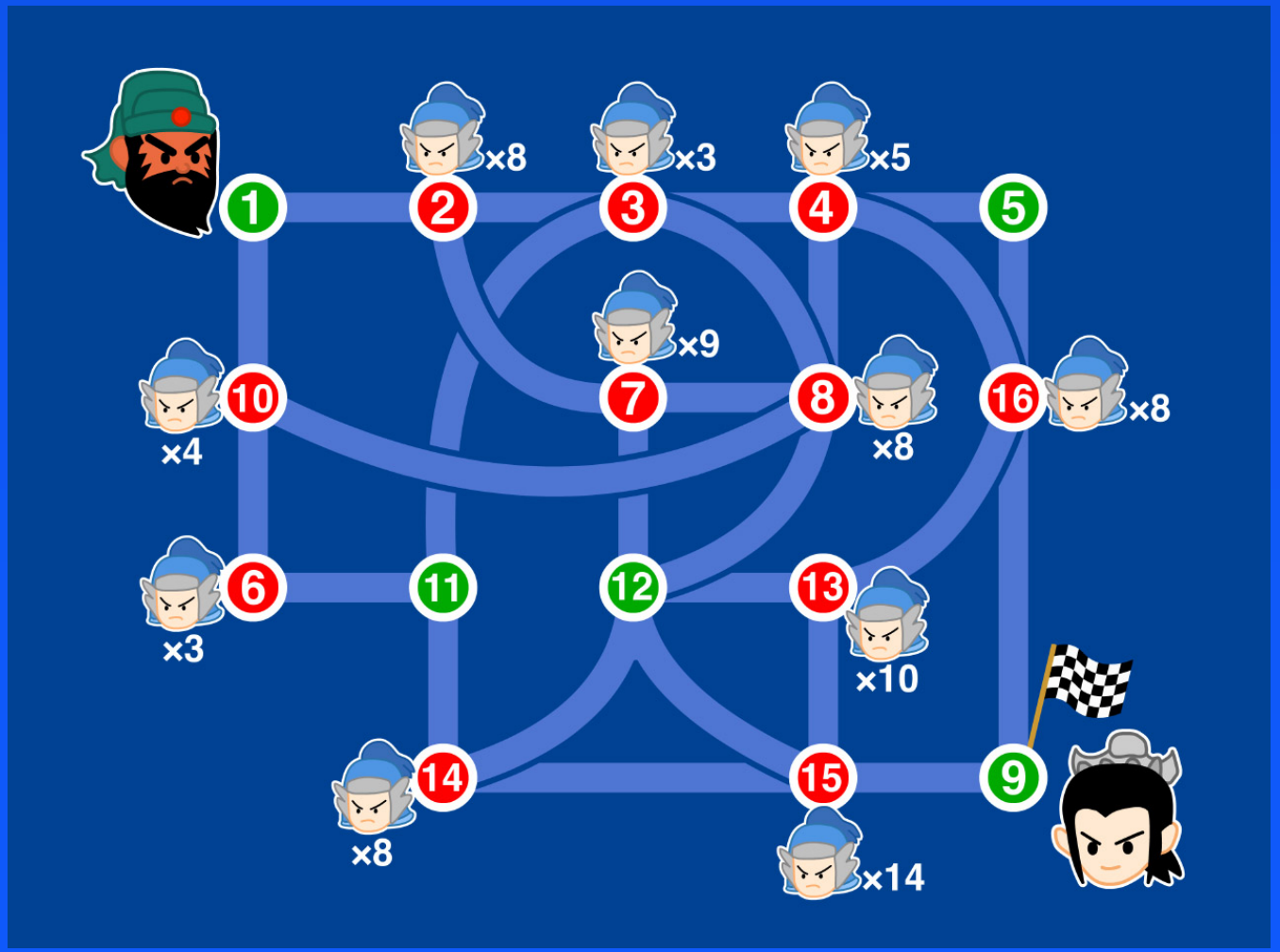
Assignment Problems



Routing



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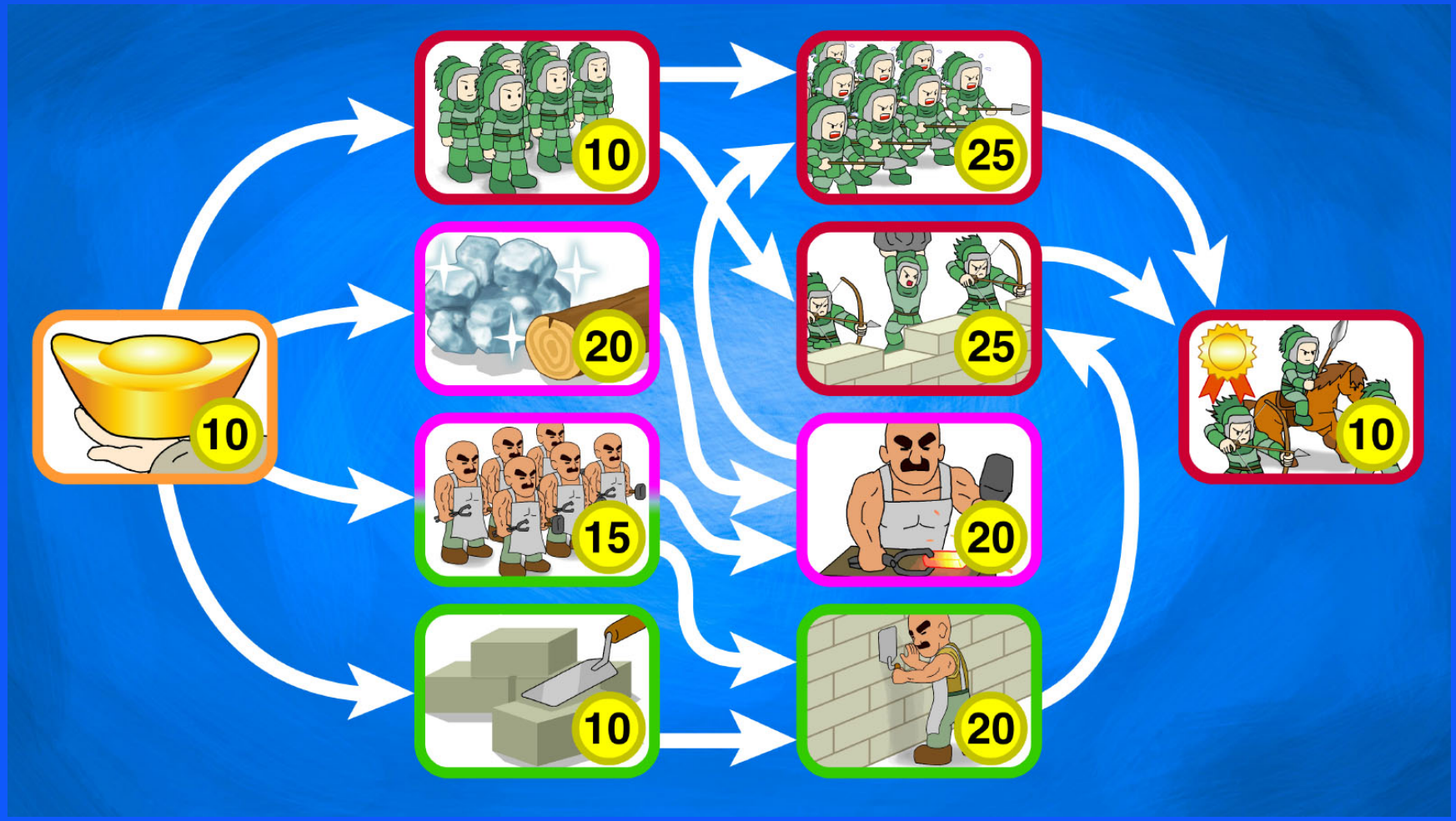
Scheduling



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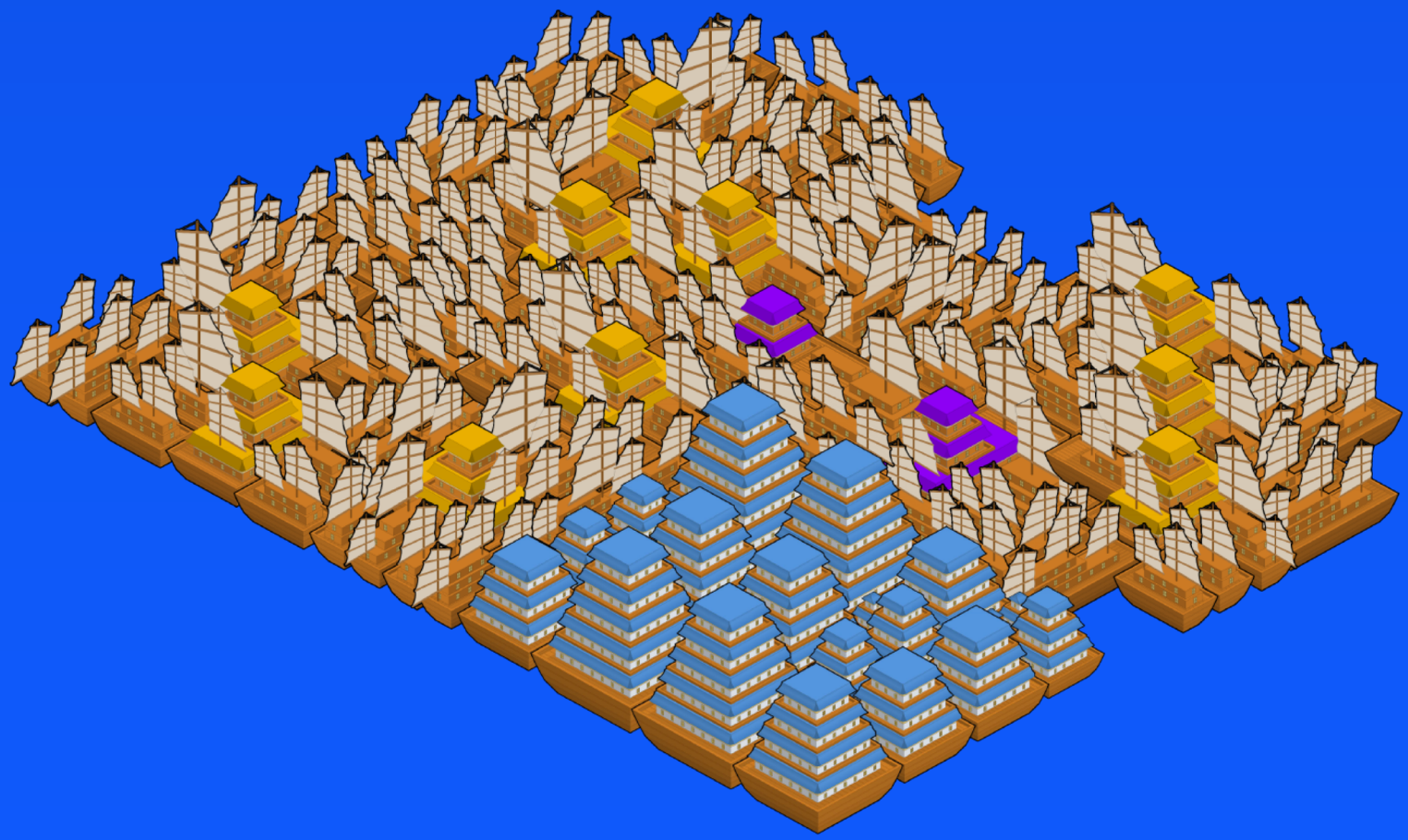
Carpet Cutting (Packing)



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Course Objectives

- Part 1: modeling complex and difficult real-life discrete/combinatorial optimization problems
  - You can already solve many interesting and practical problems … without knowing how!!
- Part 2: technologies/algorithms to solve these problems

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MiniZinc

- A declarative modeling language based on mathematical notations
- Developed at the Monash/Melbourne University
- www.minizinc.org
  - MiniZinc IDE
  - The MiniZinc Handbook

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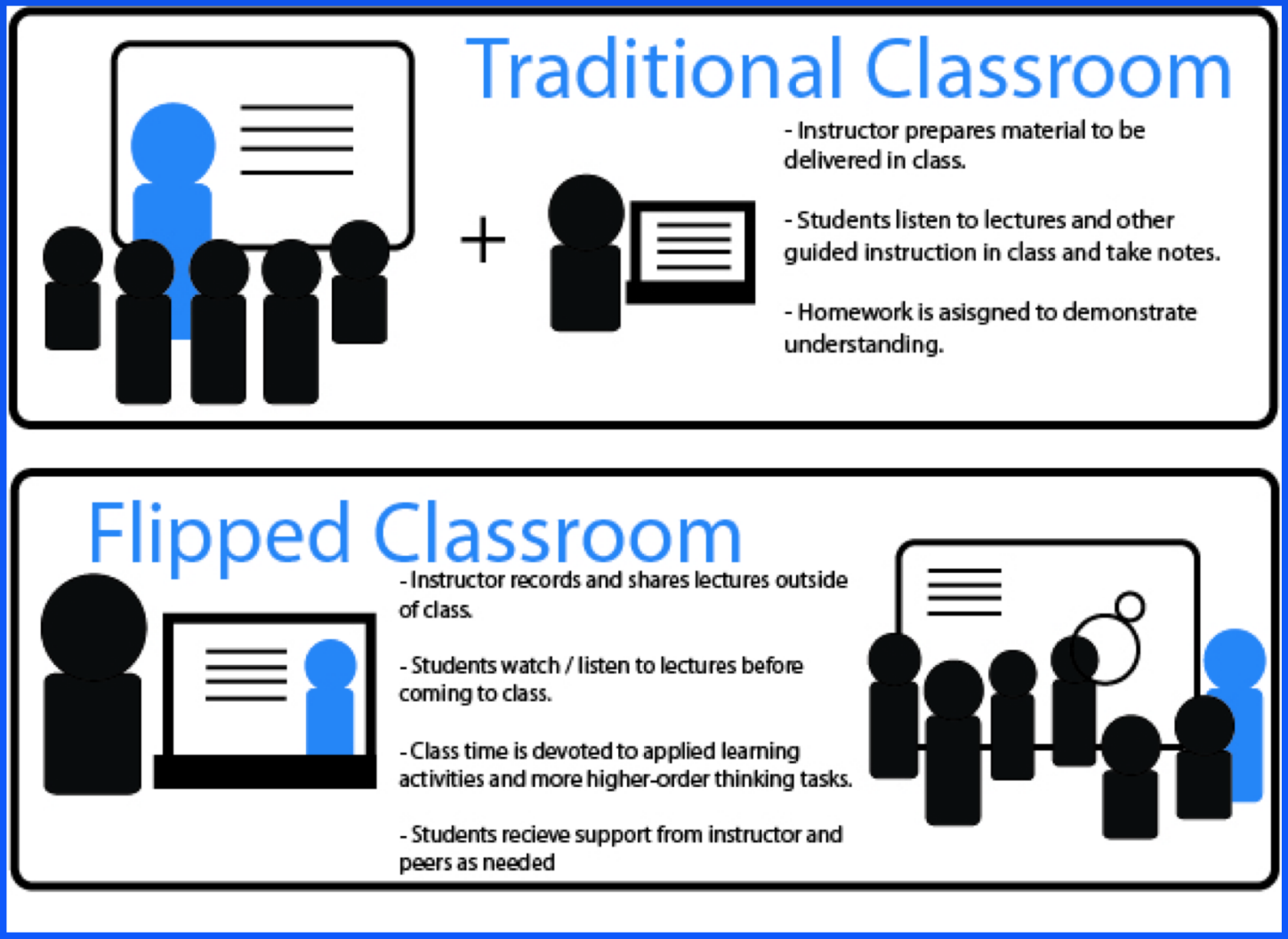
Flipped Classroom



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Out-Class Activities

- Watch the videos
- Attempt the workshop problems
- Attempt the assignments
- Fill in a weekly questionnaire: required and part of the assessment!

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Survey 7

Form description

Please give your name *

Short answer text

Please give your CUHK student ID *

Short answer text

How much of Assignment 6 have you completed? *

- What? There is an assignment!?
- Seen it.
- Thought about it.

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Which of the following basic components of a MiniZinc model do you know? Tick as many as you want. *

- [ ] Variables
- [ ] Constraints
- [ ] Output statment
- [ ] Objective

Do you know the difference between a satisfaction and an optimization problem? *

- ( ) Yes
- ( ) No

Do you know how to run MiniZinc with the IDE? *

- ( ) Yes

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Have you attempted Workshop 3 yet? *

- No
- Thought about it
- Completed it

How much of Assignment 3 have you completed? *

- What? There is another ASSIGNMENT!?
- Seen it.
- Thought about it.
- Tried it.
- Finished it!!

Have you ever encountered errors in MiniZinc related to something called "option types"? *

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Which of the following is an example of unary resources? You can tick more than one. *

- [ ] A 7-seater car
- [ ] Prof. Jimmy Lee
- [ ] A soldier
- [ ] Zhuge Liang
- [ ] You yourself

What is a cumulative resource? *

- ( ) A resource that can be used by only one party at a time
- ( ) A resource that can increase efficiency of solving
- ( ) A resource that has multiple identical copies
- ( ) A resource that can be used by multiple parties at the same time
- ( ) NONE of the above

What would the attached MiniZinc model print? *

```
var 0..3: x;
constraint x = x + 1;
solve satisfy;
```

- x = 0;
- x = 1;
- x = 2;
- x = 3;
- =====UNSATISFIABLE=====

What would the attached MiniZinc model print? *

```
var 0..3: x;
constraint 2*x = x + 1;
solve satisfy;
```

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In-Class Activities

- You ask me questions
- I ask you questions
- Group problem-solving exercises

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In-Class Activities

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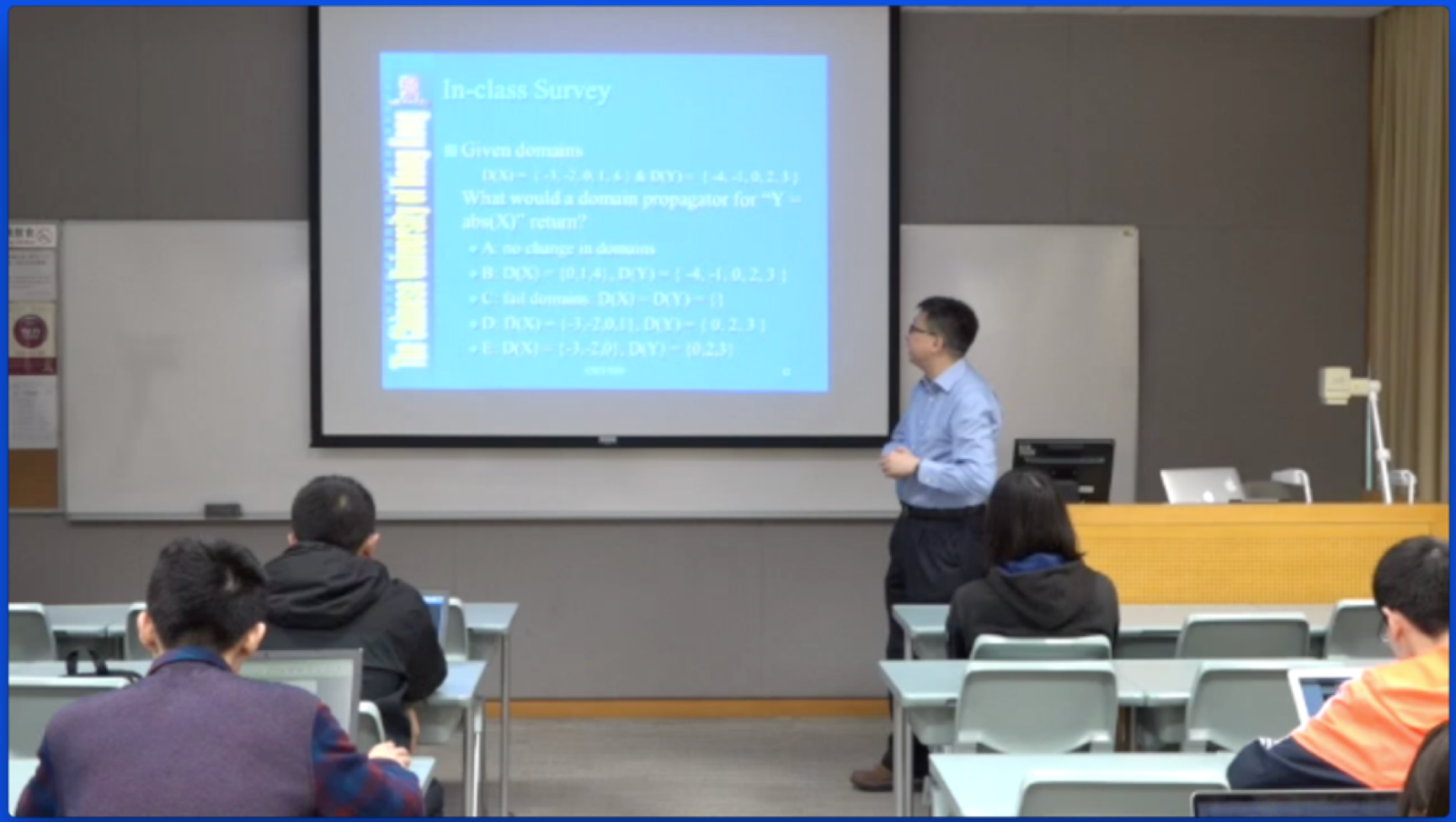
In-Class Activities



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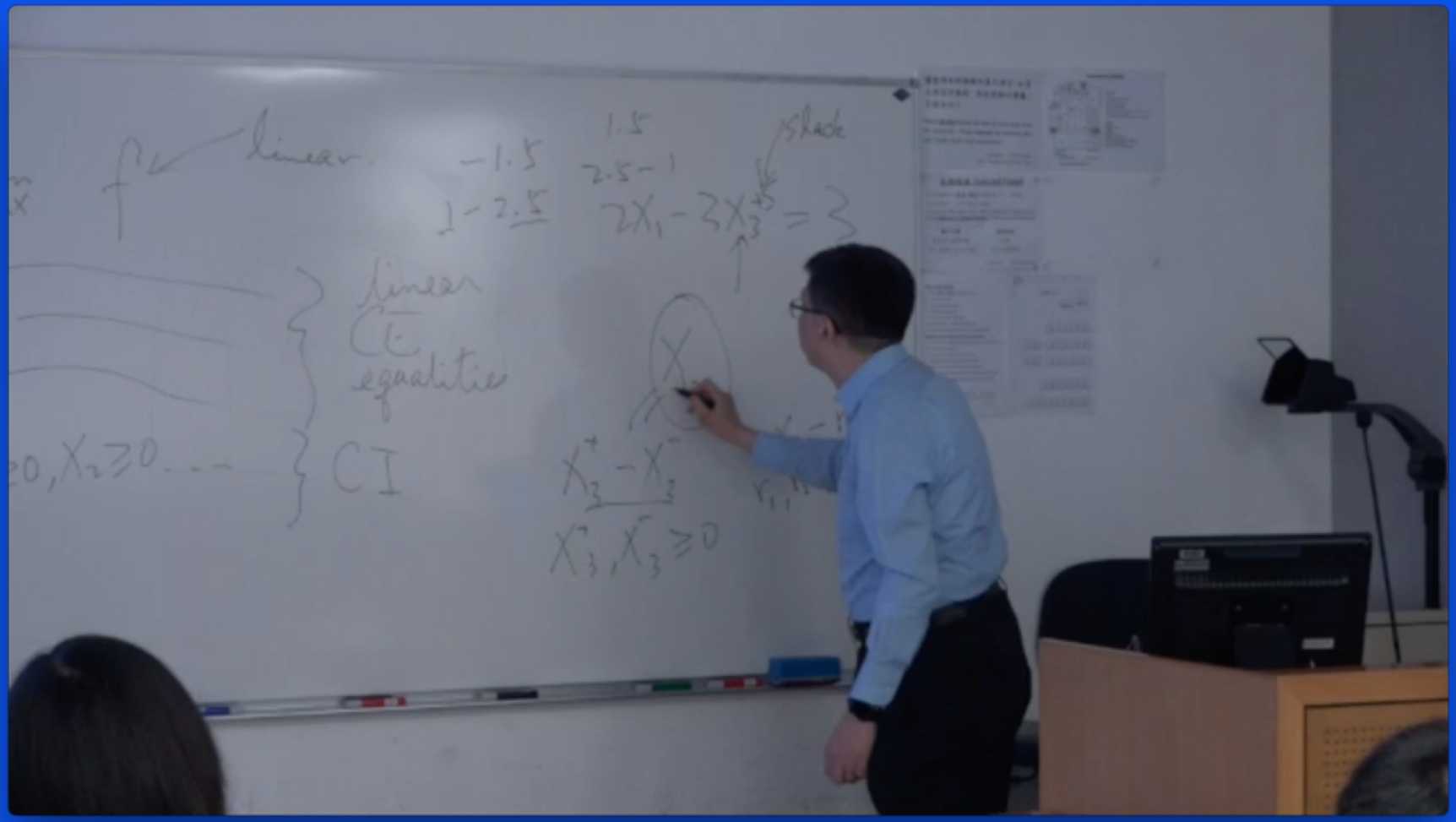
In-Class Activities



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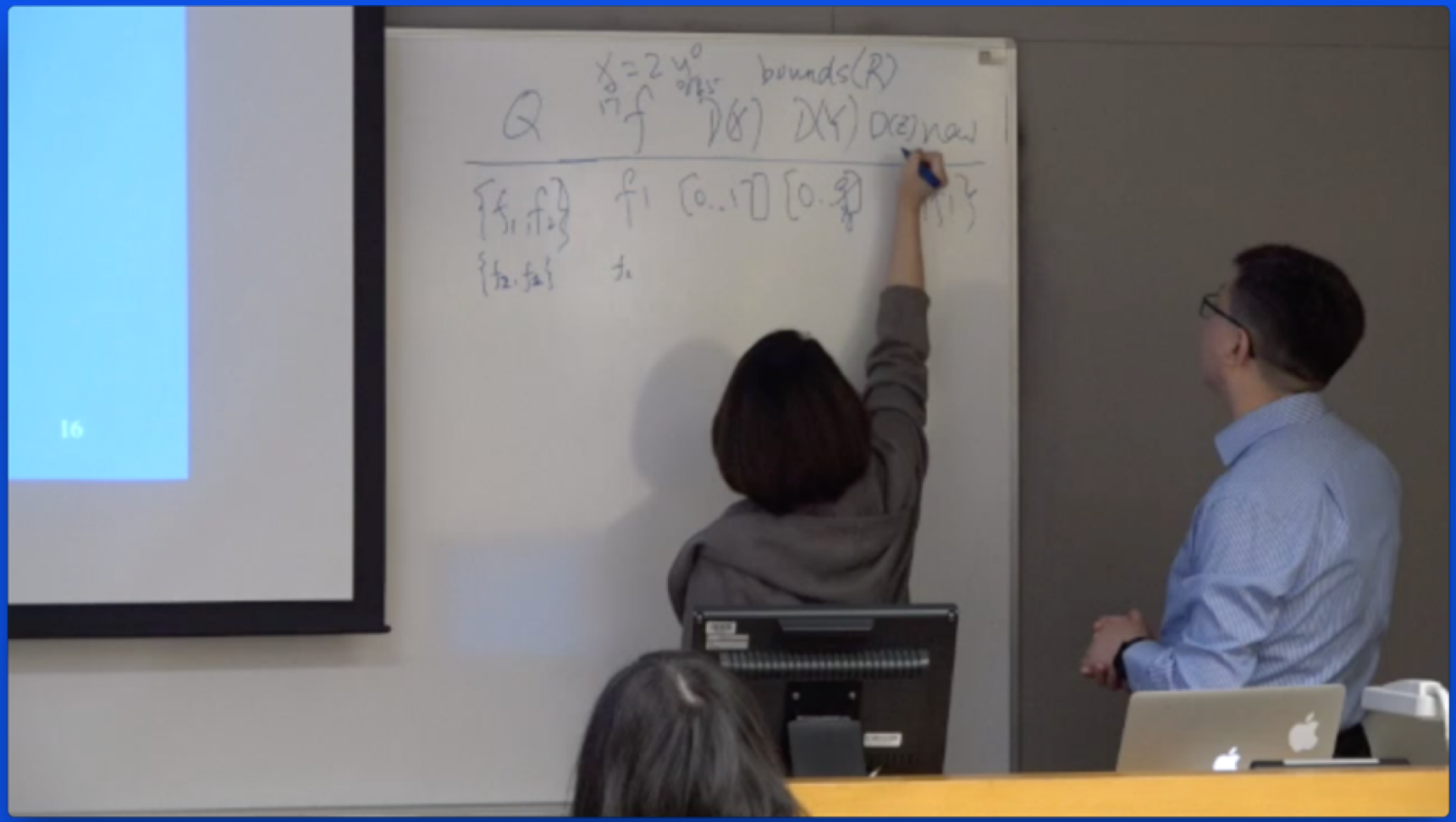
In-Class Activities



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In-Class Activities

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Only Half the Class Hours

- Classroom meeting only every other week
  - Sept 2 & 3
  - Sept 16 & 17
  - Sept 30, Oct 8 (spanned across two weeks)
  - Oct 14 & 15
  - Oct 28 & 29
  - Nov 11 & 12
  - Nov 25 & 26

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  - Nov 11 & 12
  - Nov 25 & 26

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The 3 MOOCs

- Coursera
- Three courses consisting of short modules
  - Basic Modeling for Discrete Optimization (4 modules)
  - Advanced Modeling for Discrete Optimization (5 modules)
  - Solving Algorithms for Discrete Optimization (4 modules)

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A Module = Roughly a Week

- Short video lectures
- Module summary
- Workshop (Exercise with solution video)
- Assignment (autograding engine)

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Administrative Tidbits

- Instructor: Jimmy Lee, SHB 1009, x38426, <jlee@cse.cuhk.edu.hk>
- Course homepage at <course.cse.cuhk.edu.hk/~csci5240>
- Evaluation criteria
  - 12 assignments
    - 12%: 1, 3, 5, 7, 9, (11 or 12) non-zero score to get 2% each
    - 38%: 2, 4, 6, 8, 10, (11 or 12)
  - 10%: weekly survey
  - 40%: final examination ($\geq$ 20/40 to pass the course)

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Plagiarism will not be tolerated!

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Immediate things to do …

- Go to the course homepage and enroll in the private MOOC sessions on Coursera using your CUHK official email (no aliases)
- Download and install MiniZinc
- Start enjoying the MOOCs