

Introduction to
Computer Science and Engineering
コンピュータ工学のすすめ

Lecture one
Overview of the course

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Contents of Today's Lecture

- Overview and purpose of the course
- Class Schedule (tentative draft)
- Some basic knowledge to understand the computer science and engineering (CSE for short)
 - Differences of Science and Engineering
 - Generally speaking
 - Computer science and computer engineering (CS and CE)
 - Some sense on the target of CSE
 - Basic concepts and courses of CSE
 - Advanced Research fields of CSE
 - Other related disciplines
- Homework

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Overview : Main contents of the course

- Concept and scope of computer science and engineering
 - What are Computer Science and Engineering, what are not ?
- Key concepts and fundamental courses/subjects of CSE
- Advanced research fields in CSE, specially in University of Aizu
- How to apply CSE and ICT to real business (visiting ventures)
- Skills for studying the CSE
 - Know the overview and have your own map on the CSE
 - Skills for searching information and presentation
 - Opportunities of discussion with each other students
 - Familiar with some professors doing advanced researches, and being able to access and get advices from them

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Purpose of the course: Objectives and attainment goals

- The students can understand
 - the basic concepts and basic courses for computer science and engineering (CSE for short).
 - And know some advanced research field in CSE
 - In addition, students will have opportunities, to visit local venture companies using ICT and knowledge of CSE
 - to make presentation based on their understanding on CSE,
 - and to discuss with each other on the topics to enhance their understanding of CSE.
 - Moreover, the students can have broad views and familiar with the methods for learning computer science and engineering

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Class schedule and topics (1)

Quarter 3

- 1) **Nov. 1 Introduction to the course, some basic concepts (S. Tei)**
- 2) **Nov. 8 Orientation for oversee students in Advanced ICT program**
(Dr. Zhou supported by Prof. Kansan, Mr. Watanabe)
- 3) **Nov. 15 Basic concepts and courses of computer science and engineering (1) (Prof. S. Tei)**

Computer Architecture, OS, Computer Networks

* 11月22日 no classes

- 4) **Nov. 29 Presentation by students on “My understanding on Computer Science and Engineering (Prof. Tei, Prof. Junbo Wang)**

Quarter 4

- 5) **Dec. Visiting local venture company 1 (coordinator Prof. Kansan)**
- 6) **Dec. Visiting local venture company 2 (coordinator Prof. Kansan)**
- 7) **Dec. Visiting local venture company 3 (coordinator Prof. Kansan)**
- 8) **Jan. Report & presentation on the visiting of ventures**
(Prof. Tei, Prof. Kansan)

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Class schedule and topics (2)

2017 Spring, Q1

- 9) **Introduction to the divisions, curriculums, fields and graduation thesis,**
- 10) **Basic concepts and courses of computer science and engineering (2)**
Algorithms, Computer Languages, Compiler, Database
- 11) **Advanced and strategic researches on UoA (1)**
Introduction to Deep Learning and Robotics
- 12) **Advanced and strategic researches on UoA (2)**
Cloud computing on the Big Data, healthcare and bio-engineering
- 13) **Advanced and strategic researches on UoA (3)**
Introduction to High-performance computing & Security, & VR, CG,
- 14) **Introduction to the graduate school (Prof. S. Tei)**
- 15) **Debates & discussion (including Japanese students) & report**
On “ What Should We Learn and How to Learn ”

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Comparison of Science and Engineering 理学と工学の比較

Problem 1 :

Could you put the following terms into the table below

Investigating
Possibility

Discover

How

Theory

Why

Invention

Method

Find
solution

理学 Science	工学 Engineering

Comparison of Science and Engineering 理学と工学の比較

理学 Science	工学 Engineering
なぜ Why	どのように How
可能かどうか Possibility	なんとか Try to solve
発見 Discovery	発明 Invention
理論 Theory	方法 Method

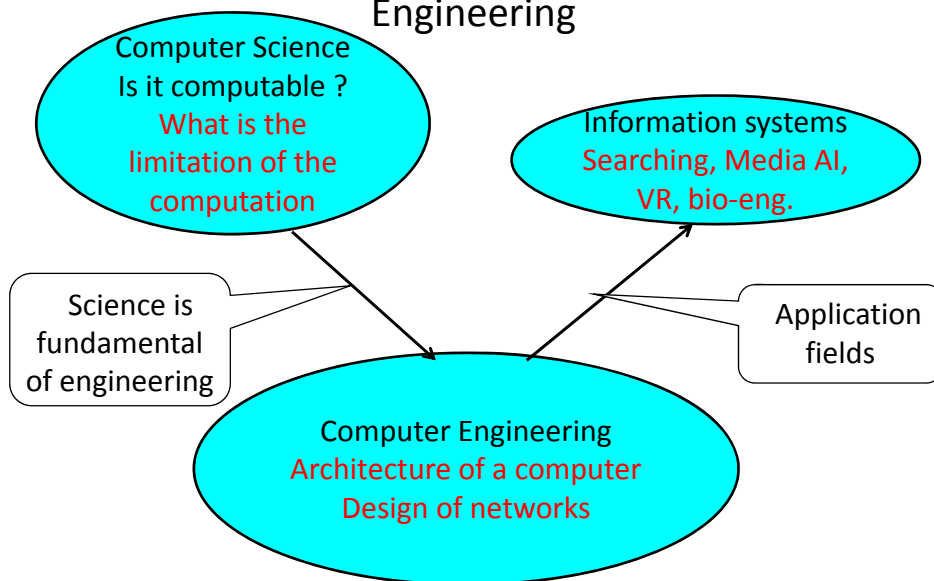
Quiz (1)

Science Or Engineering
理学 それとも 工学 ?

- ① 電磁波発見
Discovery of Electromagnetic wave
- ② 携帯電話の開発
Develop of Mobile phone

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Relations of Computer Science or Computer Engineering



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What is CSE

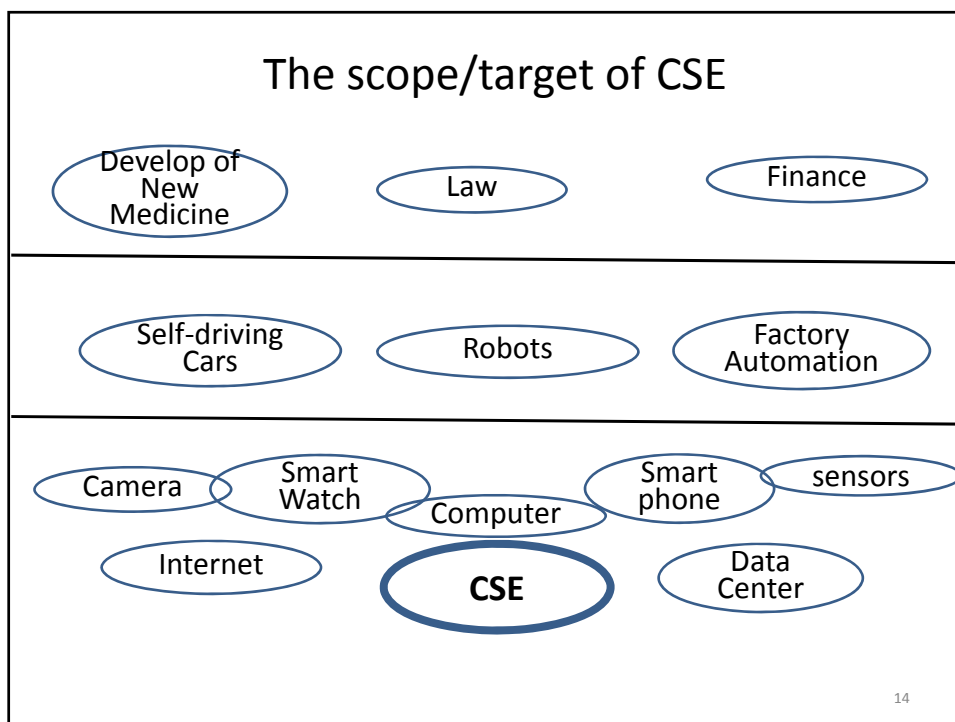
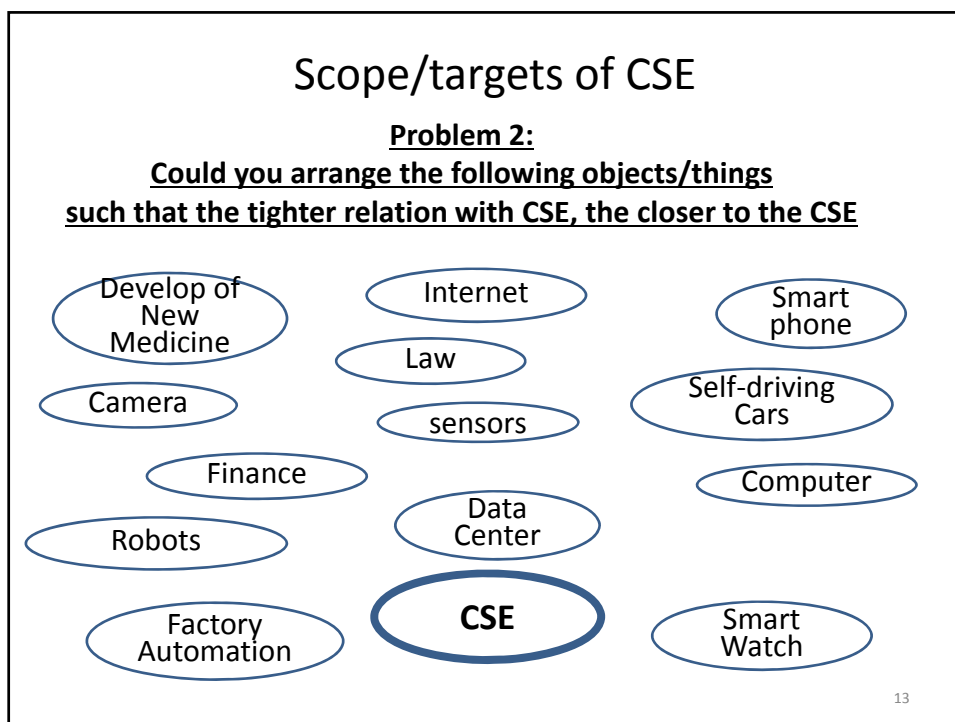
- A field to study consisting of
 - the theoretical computation process and
 - the design of computational systems,
 - including algorithmic process, computing paradigms, hardware, software, and networks.
- Structure and components of CSE, Just mention a few
 - Theory of computation, Mathematics of computing, Algorithms and data structures, Operating Systems, Compilers, Computer architecture, Communications and wireless networks, Computer vision and robotics, and more
 - Research fields, for some examples
Theoretical works, Security, Cloud computing and Big Data, Advanced computer networks, and IOT, HPC and super computing, Artificial Intelligence and Robotics

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Some basics of CSE

- Basic architectures
 - von Neumann architecture
 - Layered architecture (network)
- Basic theories (science)
 - Automata theory (Computation)
 - Queuing theory (Communication)
 - Graph theory
 - Optimization theory
- Basic methods/paradigms
 - Theoretical approach
 - Experiment approach
 - Simulation approach
 - Data analytic and mining approach

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Quiz (2)

Which one is closer to Science and Engineering

- ① Using SNS to share information with friends such as photos etc.
- ② Developing a new SNS to share the knowledge and experiences learnt

For 3rd year students,
Could you add new quiz question and give the answers,
in similar ways

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Find mapping of the works with the subjects

Works

Data storing

Using CPU Efficiently

Connecting CPU,
memory, Bus

Finding efficient way
to get the results

Making a program

Communication
between computers

Changing a program
to executable code

Subjects

OS

Network

Database

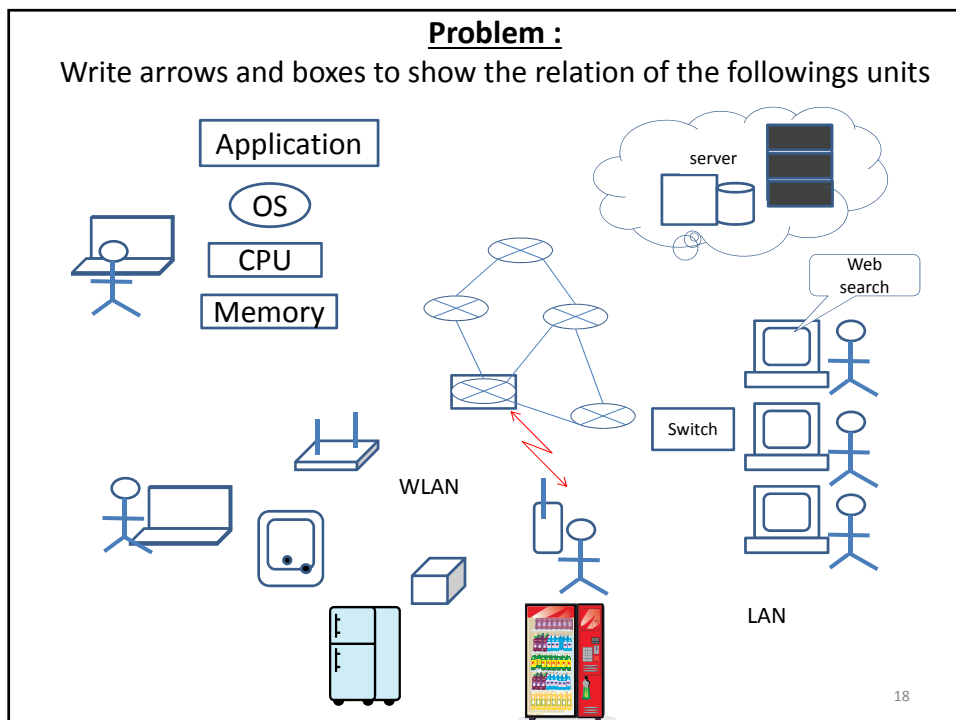
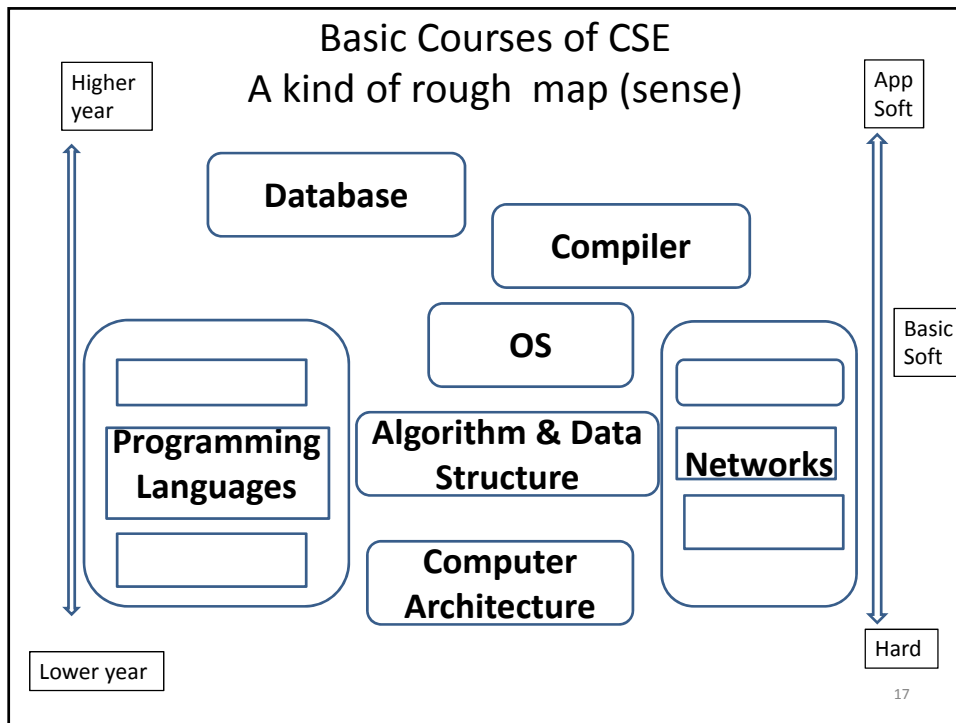
Compiler

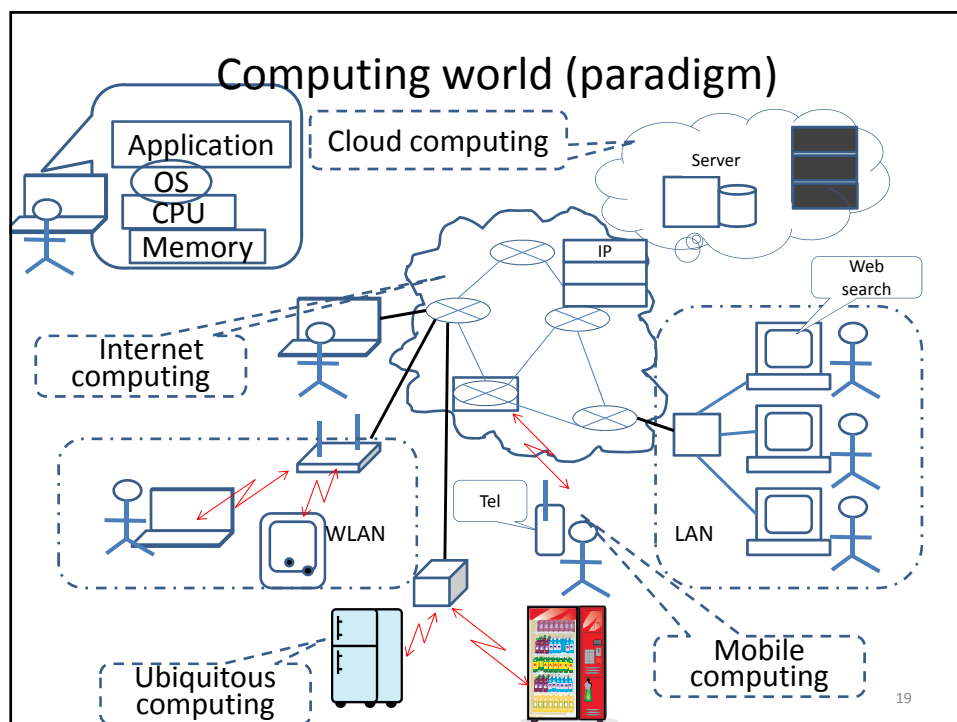
Algorithm

Programming
Languages

Architecture

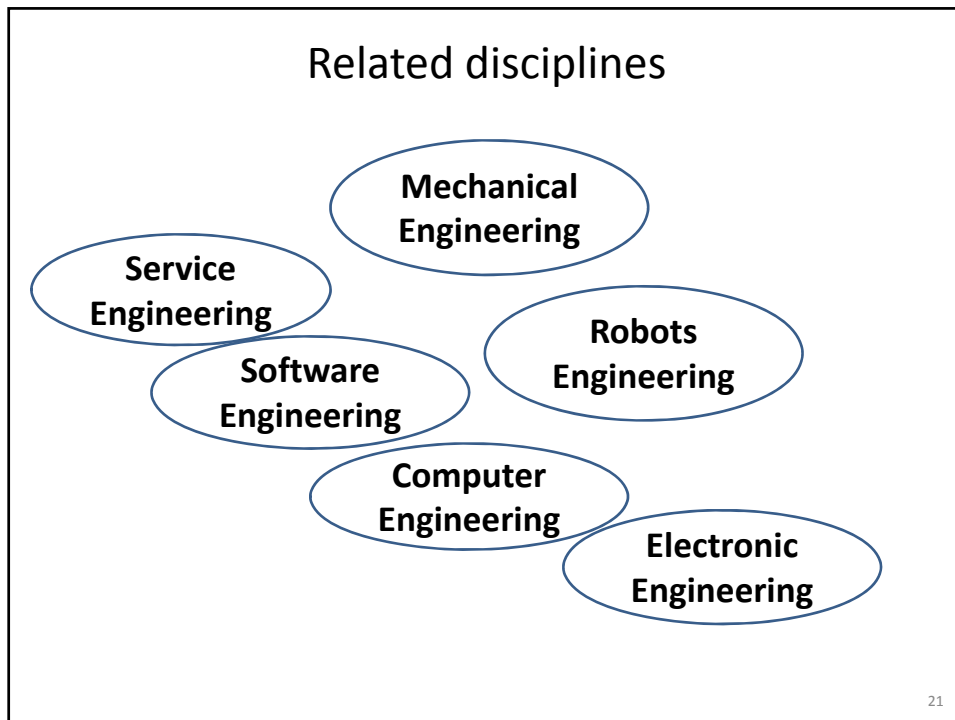
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Advanced Research fields of CSE in UoA

- Advanced and strategic researches in UoA (1)
 - Artificial intelligence (AI) and machine learning (ML)
 - Robotics
- Advanced and strategic researches in UoA (2)
 - Cloud computing on the Big Data
 - healthcare and bio-engineering
- Advanced and strategic researches in UoA (3)
 - High-performance computing
 - Security
 - VR
 - CG



- ### Summary
- This course will give you a guideline to study CSE
 - CSE is to study theoretical computation process and algorithms, and design of computational systems
 - It consists of many subjects, and research fields. Basic concepts, architectures, theories, and methods are key to study the CSE.
 - It has relation with other related fields such as Mechanical Engineering, Robots Engineering, Service Engineering, but is different
 - Having a big picture and knowing how to study the fields are important
 - Searching and surveying papers and materials
 - Presenting and discussion
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Homework (no need to submit)

1. Check the syllabus of UoA undergraduate programs, and find four courses which you are interested in.

<https://www.u-aizu.ac.jp/en/curriculum/syllabus/>

http://web-ext.u-aizu.ac.jp/official/curriculum/syllabus/1_E_000_000.html

2. Check the following page and answer questions

https://en.wikipedia.org/wiki/ACM_Computing_Classification_System

- What is ACM,
- How many categories in the classification ?
- How many subjects in the classification ?
- Should Operating System be included here?

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Homework (submit)

- Write a report within two A4 pages
 - Possible titles, not limited to the followings, you can have your own
 - Four examples on the differences of science and engineering
 - My understanding on a basic course/subject, or field in CSE
 - Submit to
 - Prof. Tei z-cheng@u-aizu.ac.jp, cc : sgu-office@u-aizu.ac.jp
 - Subject ReportCSE(1) by YYYYYY (YYYYYY means your name)
 - By Nov. 11 Fri. 20:00 Word format (or PDF)
 - Approach to the report,
 - Searching related WWW pages, a survey, or an article, on one of today's topics
 - Read the survey, paper, or article,
 - Write your comments and understanding on the reading
 - Write your interests/ideas related with CSE
 - Format of the report
 1. Overview of the report, mention why you select the examples, and what survey, papers, or articles you have searched and read
 2. Outline and your understanding of the survey, paper, or article
 3. Comments, ideas, and dreams related with the topic

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