

1. 专业的选择最好的选择:
学士学数学, 硕博学习偏数学的工程.
现在, 最好在硕士学习偏数学工程.
2. 就业导师: 包括选择专业需人指导.
- "个人兴趣" "个人素质(形象或逻辑思维)"
- "专业前景"
3. 经常面对自己: 我是谁(主要因为诚实的情况太少了)
4. 在美国, EE是衰败专业, 如果想回国,
那可以学工的顶层(中国没有工顶层)

Introduction to Electrical Engineering

By Dake Liu

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Professor of ASIP, CIE, BIT



全英文班工程概论



Introduction to the introduction

It is a compulsory course, with one point and 16 teaching hours, using my slides as the text book & web as your reference book

1. (2H) Your lifetime career: what is EE & what is EE industry
2. (2H) What shall you learn to manage your lifetime career
3. (2H) How can you successfully master the four years study
4. (2H) To speak in real English, manage intercultural impact
5. (2H) To know yourself, who you are and plan for your life
6. (2H) Survive: to build a lifetime learning skill and lifestyle
7. (2H) What will you do after graduation (of bachelor & Master)
8. (2H) Discussions and reviews (everyone will have a chance)

A Homework score + interactive Q&A score = your final exam

How to use my knowledge



- Relaxed learning mode
- It will be easy to pass the exam
- Keep my ppt slides, it might be lifetime useful
 - When you start a new course, the ppt will offer you a birdsview and the way of learning
 - It will be a guide to your future self-promotion

In a future view,
4 years are too short.

Claim

- Each professor shall have his/her own way of thinking, understanding, and way of teaching
- The seminar is only FYI for your information 仅供参考
- Based on my accumulated information, It might not be fully acknowledged. Sorry!
 - **www.wikipedia.org** is acknowledged
- Limited distribution because it is just a draft

Why we offer the short course

- You already started learning EE knowledge.
 - You need an overview on what/why/how to learn
 - The classification of the knowledge to learn
 - The curriculum (relation between) each course
 - The way and tricks to learn each course
- You need to plan for your future.
 - An introduction to the way for lifetime learning
 - An overview on job opportunities

The way we offer the short course

- The slides are in English and Chinese
 - The easy parts will be in English
 - Difficult parts with many new words will be in Chinese
- The talk will be in English
 - I try to use simple English and speak slowly
 - You are welcome to break my talk when you are puzzled
- We go through the course with an interactive way
 - I will keep asking your questions. The Q and A will be part of your final exam score

IEEE Code of Ethics 道德守则

We, the members of the IEEE (You can be a IEEE member after graduation), in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

无论如何，绝对不可撒谎

1. To accept responsibility in making decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
2. To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. To be honest and realistic in stating claims or estimates based on available data;
4. To reject bribery in all its forms;
5. To improve the understanding of technology; its appropriate application, and potential consequences;
6. To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. To treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. To avoid injuring others, their property, reputation, or employment by false or malicious action;
10. To assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

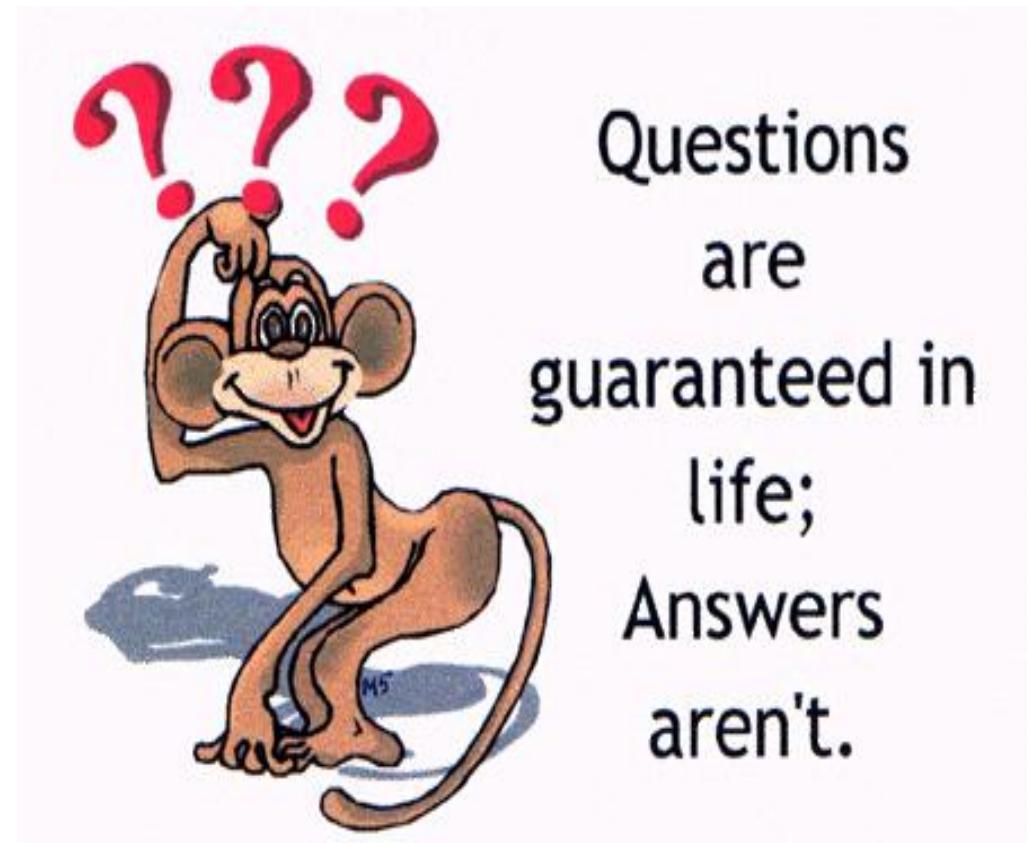
Do you have any question so far

- Is my pace adapt to yours
- What is a teaching method you really like
- Do you understand my English
- What you want to know and I did not prepare it in the plan list
- What you want to do after graduation, why you are a student of international EE program



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Your lifetime career: what is EE & what is EE industry (Part 2 of the course)



Contents

- What is Engineering
- What is electrical engineering
 - The outline
 - The partition
 - The activities

Science 和 technology
区别在哪儿？

What is engineering

- Engineering is the discipline, art, skill, profession, and technology of acquiring and applying scientific, mathematical, economic, social, and practical knowledge, in order to design and build concepts, structures, machines, systems, devices, materials and processes.
it's about \$4

Engineering

Scientists study the world as it is;



Engineers create the world that has never been.

—西奥多 冯 卡曼 Theodore von Kármán
professor of "钱学森"

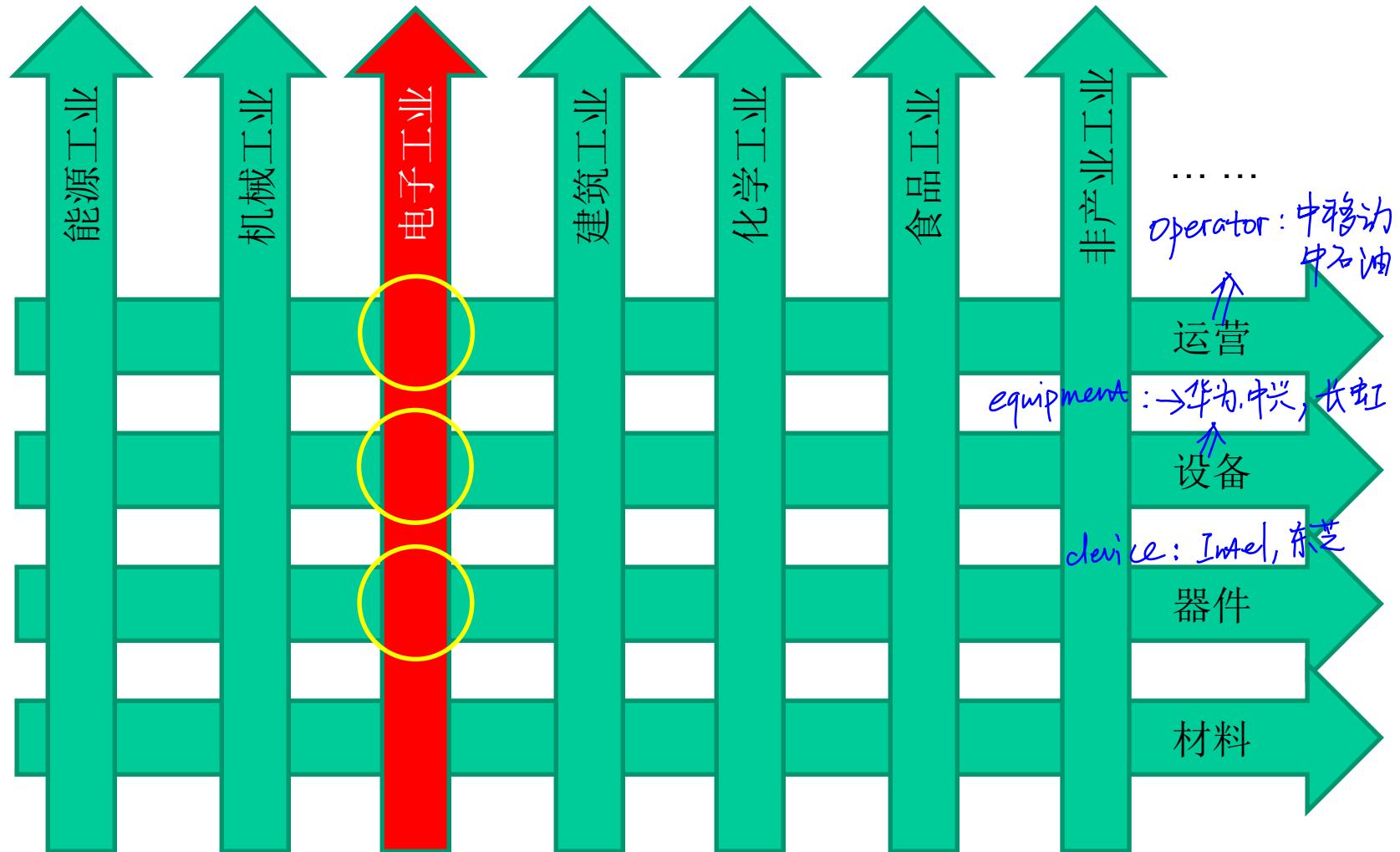
"工程没有最好，只有更好" → 每个人都是创造者

- There is no Number one in Engineering
- There is no Number two in Science

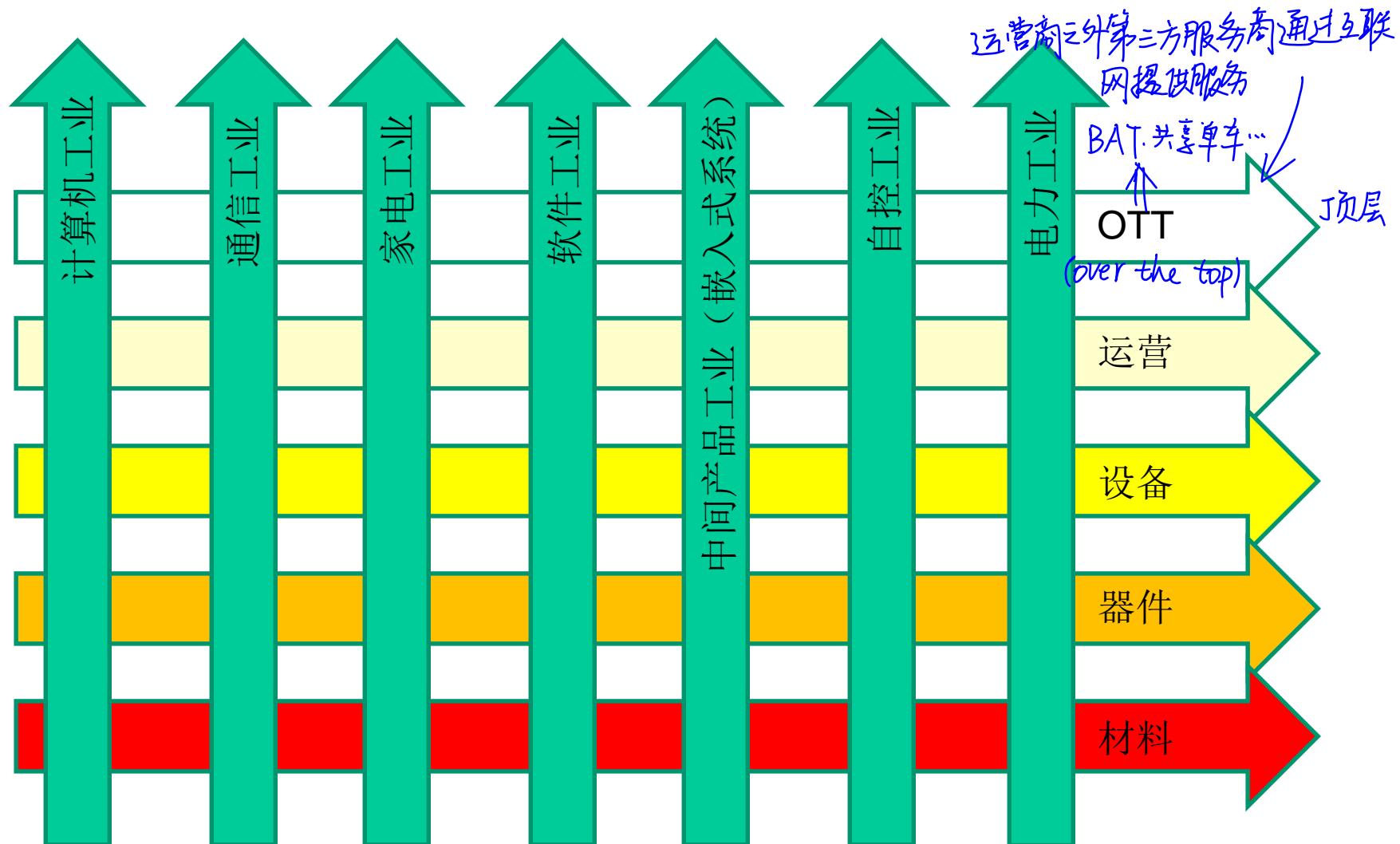
Samuel Chao Chung Ting 丁肇中

Industrial view of Electrical engineering (EE)

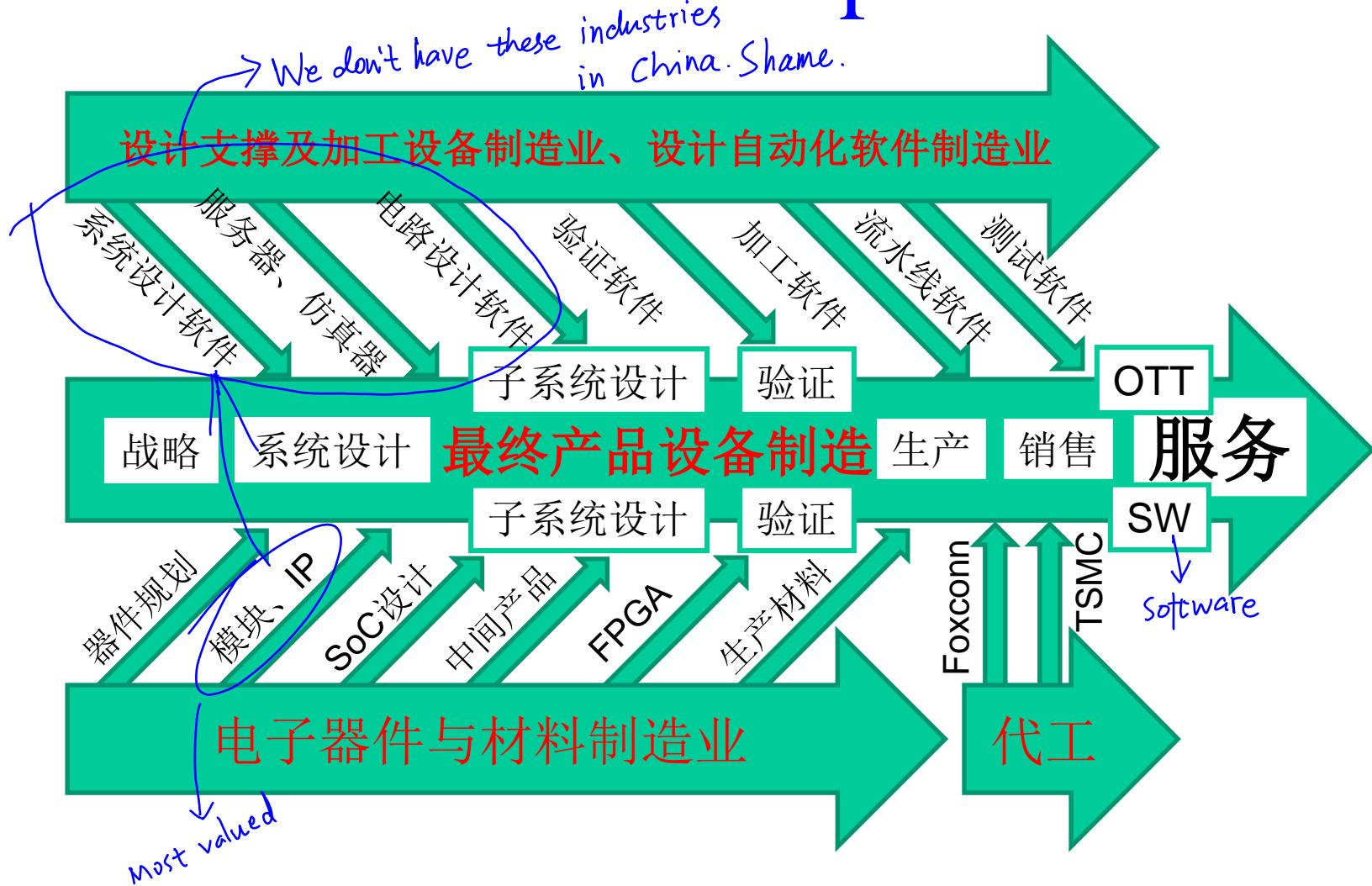
What is EE engineering



Horizontal and vertical view of EE



Research and development of EE



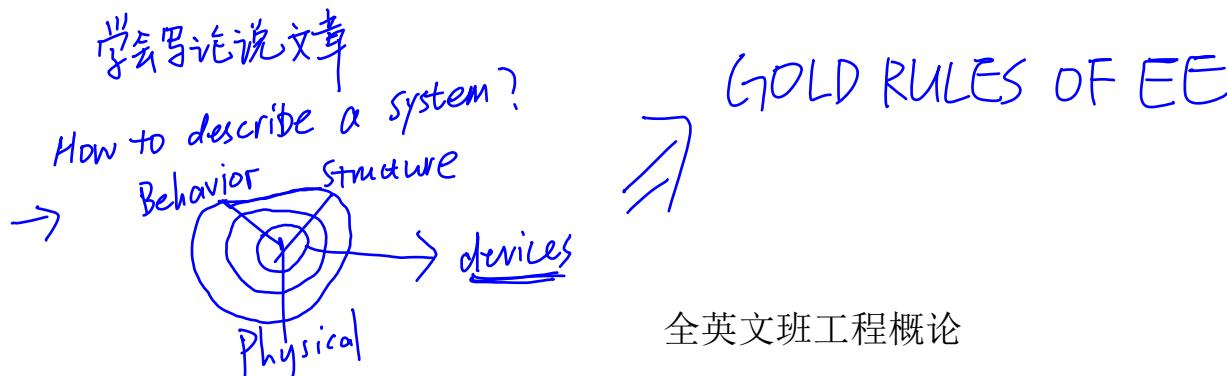
Be relax! It is not difficult, it is just exciting

- Oh my god! There're so many things to learn and I knew nothing.
- Be relax, that is why you are here and that is why you need us.
- Let us get releated knowledge together and you will be better than me soon

Academical definition of Electrical engineering (EE)

Introduction to Electrical engineering (EE)

- Electrical engineering is a field of engineering that generally deals with the study and application of IT, electricity, electronics, and electromagnetism.



IT information technology (信息)

- Information tech: Design, develop, install, and operate around IT systems
- Hardware platform: Sensing (transfer measures to electronics information), computing (processor, interface, and storage), information transfer system (internet over broadband, wireless, and last mile), and driver (display, loudspeaker, pump, motor, vehicle) 
将终端用户接入通讯网络
- Software running over platforms for applications (APP etc.) and handling of platforms (OS, Lib, DB etc.)

发电 → 输配电 → 供电

Electricity (电力)

- Electricity is the science, engineering, technology and physical phenomena associated with presence (GEN) and flow of electric charges (Trans).
- Electricity gives a wide variety of well-known *electrical* effects, e.g. lightning, static electricity, electromagnetic induction and the flow of electrical current in an electrical wire.
- In addition, electricity permits the creation and reception of electromagnetic radiation (radio waves)

模电根本原理
这是最简单东西，但这是最能深入本质的东西。

晶体管实际是个控制器，用小电流控制大电流，因而体现为放大器。(而晶体管之所以能做到是因为有一个电容去筛选)

Electronics (电子)

需要额外电力驱动

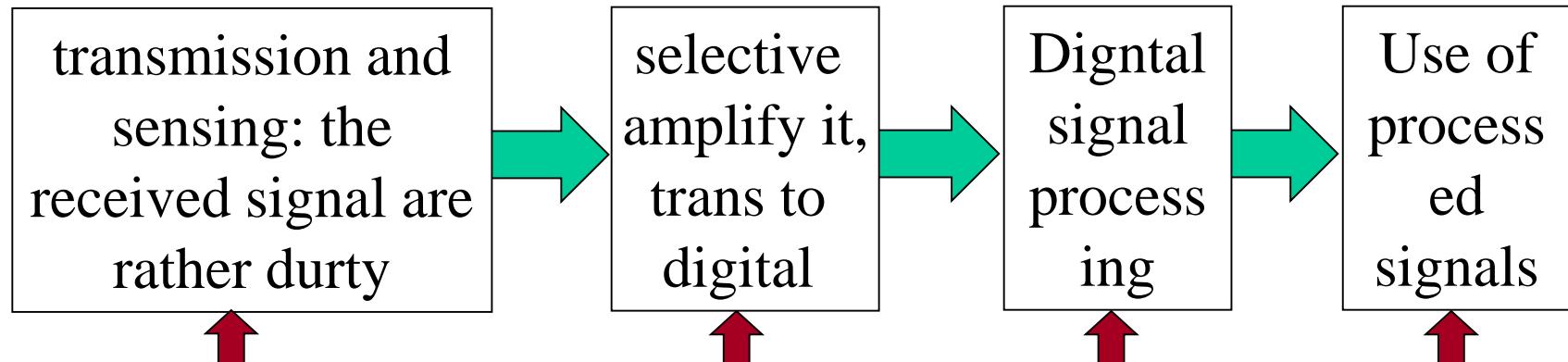
- Branch of physics and engineering circuits involving **active** electrical components(有源器件): transistors(三极管), diodes (二极管), IC (集成电路), and vacuum tubes.
 - Ability to control electron flows makes amplification of weak signals possible, applied to information / signal processing.
 - The ability of electronic devices to act as switches makes digital information processing possible.
- And interconnections: RLC, packaging(封装), boards(电路板), cables, and other varied forms of communication infrastructure complete circuit functionality and transform the mixed components into a working system.

Electronics

Old



Modern



Control and user interface

Electromagnetism

- Electric fields & magnetic fields. Both fields are simply different aspects of electromagnetism, and intrinsically related. A changing electric (magnetic) field generates a magnetic (electric) field. This effect is called electromagnetic induction, and is the basis of operation for electrical generators, induction motors, and transformers.
- Mathematically speaking, magnetic fields and electric fields are convertible with relative motion as a 2nd-order tensor or bivector.

The share of EE income in GDP

Global GDP is 74 Trillions USD

排名	国家	GDP (名义, 2015年)	占世界的比重 (%)
1	美国	18.0万亿美元	24.30%
2	中国	11.0万亿美元	14.80%
3	日本	4.4万亿美元	5.90%
4	德国	3.4万亿美元	4.50%
5	英国	2.9万亿美元	3.90%
6	法国	2.4万亿美元	3.30%
7	印度	2.1万亿美元	2.80%
8	意大利	1.8万亿美元	2.50%
9	巴西	1.8万亿美元	2.40%
10	加拿大	1.6万亿美元	2.10%
11	韩国	1.4万亿美元	1.90%
12	澳大利亚	1.3万亿美元	1.80%
13	俄罗斯	1.3万亿美元	1.80%
14	西班牙	1.2万亿美元	1.60%
15	墨西哥	1.1万亿美元	1.50%
16	印尼	0.9万亿美元	1.20%
17	荷兰	0.8万亿美元	1.00%
18	土耳其	0.7万亿美元	1.00%
19	瑞士	0.7万亿美元	0.90%
20	沙特	0.6万亿美元	0.90%

Global EE GDP share is 11 Trillions

- 11/74 trillions \$, 14.87% of global GDP
- 11/82 trillions ¥, 13.42% of China GDP
 - The % could be higher if real estate is not sick
 - However, EE in China is based on assemblies
 - Chinese EE industry promotion is our mission
- Anyway, it is an exciting business or career
 - Let us learn it and make money from it!

About integrated circuit IC

- Global IC sales is 400B\$, only 7.5% or 30B\$ is from China
- IC import is about 270B\$, domestic IC product is less than 11.2% of imports.

集成电路产业的七加一描述

各层的设计加工验证软件

系统应用

根据系统需求定义集成电路和应用软件

基础软件

操作系统、基础库、编程支撑软件

设计

模拟功能模块、数字功能模块、片上系统设计

一条生产线几亿美元

Fab加工生产线将集成电路设计变成芯片DIE

封装

将DIE封入一个壳内，同时完成产率测试

设备

支撑工艺和封装的精密物理机械和化学加工设备

材料

工艺和加工的各个步骤所需要的半导体材料

一个国产芯片中自主技术占有比例

各层的设计加工验证软件

中国仅有一个华大九天，占比不到百分之一

系统应用

行业软件我们有50%，通用软件我们有5%

基础软件

OS没有、库没有、编程支撑软件没有

设计

模拟模块5%、数字模块5%、片上系统25%

工艺

高端FAB不在国内，落后7年，距离在拉大

封装

中国是封测大国，70%低端，10%高端

设备

美国50%、日本25%、欧洲25%（荷兰19%）

材料

没有！非主流的一点，主流的没有，落后25年

总结：说实话，我们还是集成电路的打工族

你们毕业后可能就业的机会比例

中国仅有一个华大九天，占比不到百分之一

各层的设计加工验证软件

系统应用

行业软件机会 50%，通用软件机会 0%

基础软件

OS 0%、库 10%、编程支撑软件 0%

设计

模拟模块5%、数字模块5%、片上系统20%

工艺

3%

封装

5%

设备

2%

材料

0%

总结：我们就业机会主要在电路设计和行业软件

Febless 集成电路设计的六大分块

设计分解	Febless 集成电路的设计工作描述
SoC片上系统设计	<p>是啥: 定制芯片：工控机、基带片、AI推理、ARVR、IoT</p> <p>干啥: 系统设计：算法设计，硬软分解，算法实现与优化</p>
数字功能模块设计	<p>是啥: 自主逻辑电路：例如arm、视频模块、ISP、基带</p> <p>干啥: 数字功能模块硬软件设计验证或IP购买选型验证</p>
模拟功能模块设计	<p>是啥: 自主模拟电路：例如数模转换、射频收发、放大器</p> <p>干啥: 所需模拟功能模块的设计验证或IP购买选型验证</p>
非功能模块设计	<p>是啥: 非应用：例如产率测试电路、频率源、电源、PMU</p> <p>干啥: 系统所需非功能模块的设计验证或IP购买选型验证</p>
SoC片上系统集成	<p>是啥: 硅集成：实现功能、性能、功耗、开销的需求</p> <p>干啥: 用片上总线连起来模块，跑起系统，灌入验证软件</p>
后端设计和流片	<p>是啥: MPW：多项目硅圆，工业坯：咱自家的全硅圆模板</p> <p>干啥: 将已经设计的功能变成版图、送到Fab、然后封测</p>

一个服务器主芯片的开销揭秘

- IP付费: 3亿 (P8 2亿 + 其他一亿)
 - 其他: DDR、USB、PCIe、Ethernet、SATA、CAPI、NoC
- 设计费: 4亿 (>1000人年)
- 模板付费: 1亿 (12nm, 2018)
- 硅圆付费: (12nm, 2018, 8万¥一盘/150片, 530 ¥/片)
- 封装付费: 每片200 ¥ (超高端倒扣2000管脚封装)
- 分成付费: 每片100 ¥ (IBM、Synopsys、台湾)
- 利润: 销18万片, 每片800\$ (5200 ¥), NRE 4445¥片,
每片总成本为 $4445+530+200+100=5074$ ¥, 毛利126 ¥片☺
。总毛利2000万。结论: 18万片以下不可能进入!

一个手机主芯片的开销揭秘

- IP付费: 8000万 (ARM4000万 + 其他4000万)
 - 其他: DDR、USB、MIPI、ISP、Video、Audio、NoC、LEDdriver
- 设计费: 2亿 (>500人年, 基带百人年、固化软件百人年、基础软件百人年、验证百人年、其他百人年)
- 模板付费: 1亿 (12nm, 2018)
- 硅圆付费: (12nm, 2018, 8万¥—一盘/1500片, 53 ¥/片)
- 封装付费: 每片20 ¥ (高端倒扣400管脚)
- 分成付费: 每片40 ¥ (ARM、Synopsys、高通、台湾)
- 利润: 销1000万片, 每片25\$ (160 ¥), NRE开销38¥片, 每片总成本为 $38+53+20+40=151$ ¥, 毛利9 ¥☺。总毛利9000万¥。结论: 1000万片以下不可能进入!

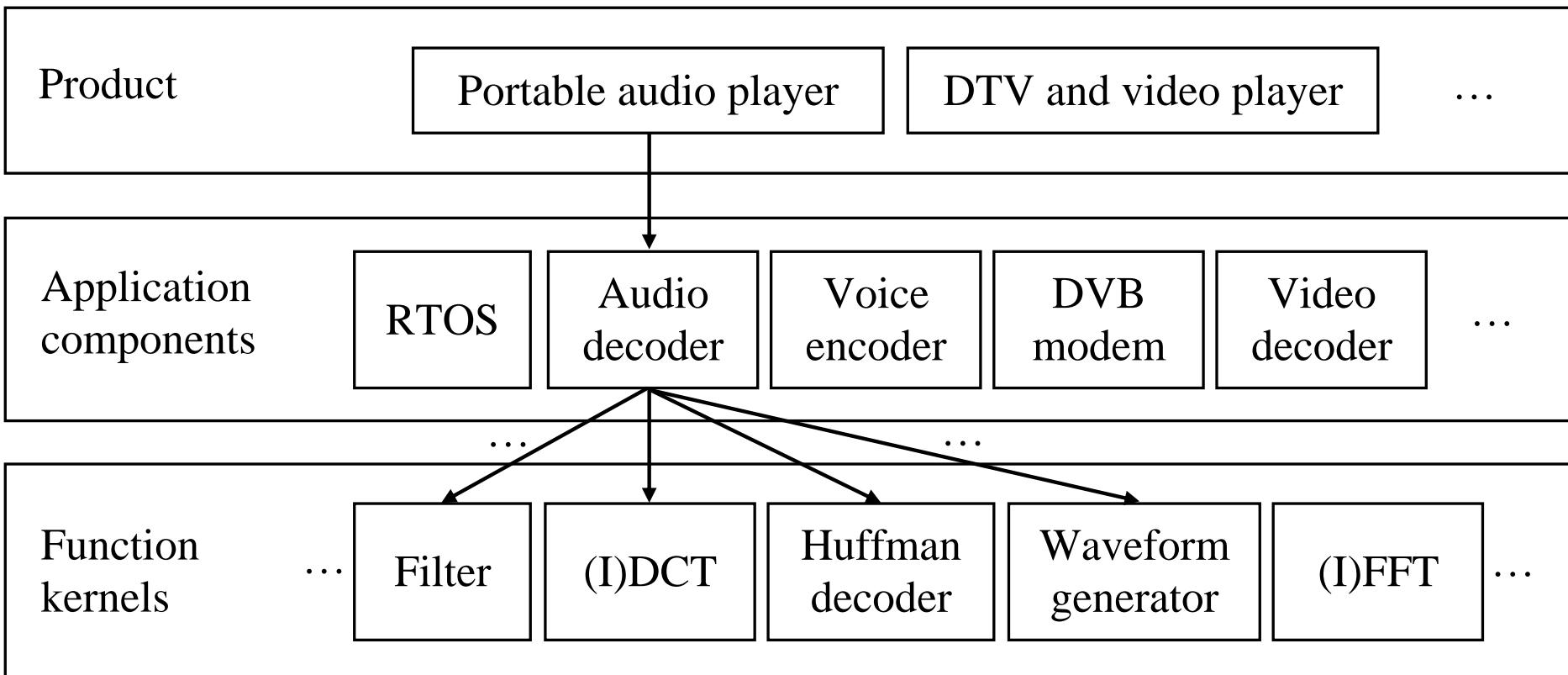
考察一个EE系统

Let us kook into a mobile phone

- **Follow me step by step on the white board**
- **Receiving useful electromagnetic waves**
- **Set up links between BS and MS**
- **Receiving a call / email / SMS / TV program**
- **Receiving your payload**
- **Use your payload (voice, audio, video, image, text)**
- **Interact your mobile phone**
- **Finally: A system view of a Mobile phone**
- **Ultimately: System view of global communication**

这是专业的人干的事情，这是
他们思考的方式

Review: Hierarchical Thinking



Innermost loop design for DSP

Let us see: How electronics works: Review the mobile from technology point of view

- Electronic devices
信号系统就是玩儿数学的。
信号处理过程就是处理微分方程的过程
- Electromagnetic waves
- Analog and digital Electronics
- Information technologies and DSP
就像深度学习，用黑箱去修正发现微分方程
- Computer, internet, and the intelligence
无论是什么设备，也
无非是一个系统，
一个信号。
- Design and implement a complicated system
 - System design methodology → implementations
- Idea→Device→OEM→Operators→Users
原始设备制造商

Thanks ! Questions ?

!



?

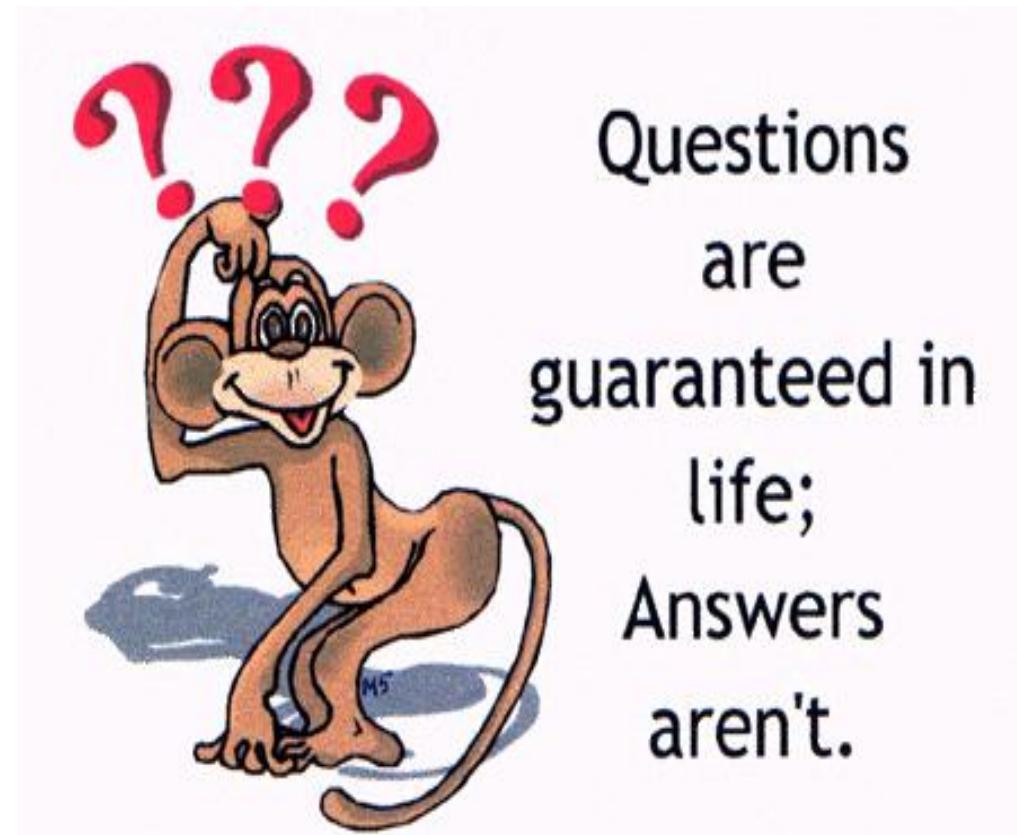
Do you have any question so far

- What is engineering and what is EE engineering
- What is OEM
- What is a R&D process of an OEM product,
what is the CAD role and the component role
- Why EE industry is so important in China



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Questions
are
guaranteed in
life;
Answers
aren't.

What shall you learn to manage your lifetime career (part 2 of the course)



What is your plan for your career?

1. Continue for your master and PhD study
 - ① Go abroad to study in a world ranking university
 - ② Get a master position in a top domestic university
2. Eventually to find a job of your EE career
 - ① Engineer of (device, OEM, operator, OTT, gov)
 - ② Manager for product, project, cooperative, monitoring
 - ③ Researcher for discovery, new product, standards
 - ④ Teacher in university and school

So, what shall you learn during the four-year study?

What to learn: Fields of study

Power:

Creation, storage, and distribution of electricity

老师一直在强调微分方程这个东西



Control:

Design of dynamic systems and controllers for the systems



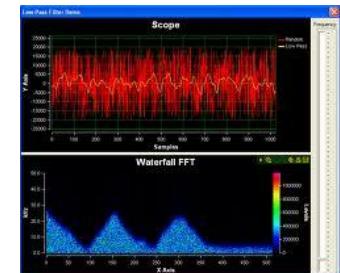
Electronics/Microelectronics:

Design of integrated circuits, microprocessors, etc.



Signal Processing: Analysis and design of signals and systems

全英文班工程概论



What to learn: Fields of study

Telecommunications: 远程通信

Design of transmission systems (media, data)



Computer:

Design and development of computer hardware platform system and software running on it



Instrumentation:

Design of sensors and data acquisition equipment



Classify what shall we learn

八大类知识不是八个课群

1. Circuit and analog circuit system
2. Processor and digital circuit system
3. DSP - Digital Signal Processing
4. Electromagnetics & transmission
5. Computing and programming
6. Design and design methodology
7. Implementation & fabrication
8. Sales and operation

自學的东西

老师40岁融会贯通了
知识,我必须更年轻,这是自己悟出来的

In what way(新工科) shall we learn

- To follow the Emergent Engineering Curriculum
- To get both comprehensive fused knowledge and creativity discipline
- We need to be
 - 1. **Enthusiastic:** the attitude to stimulate you everyday
 - 2. **Well planed:** you got much freedom, use it correctly
 - 3. **Efficient:** Best utilize limited available time
 - 4. **Work hard:** you build your future and you enjoy it

1.概念引入

2. 学习数学推导,看:

(1) 怎么去推导?

(2) 为什么用这样的数学推导?

3. 例子

(1) 看他用了怎样例子?

(2) 为什么用这个例子?

4. 范围

Comprehensive fused knowledge

- Broad, based on correct physical understanding
 - Analog hardware, digital hardware, hardware organization, software basic, modeling basics and skills, electromagnetics, system concepts, design method, management, from customer need to sales
- Konw-how (way to think, to prove, to model, to design, to code, to verify)

Creativity discipline 创新之六步

基于最新的知识融合还有市场需求.

1. Through market prediction and knowledge fusion to identify & achieve opportunities
2. To specify a product from market concept
3. To decompose and refine a product spec
4. To plan and execute a project under budget
5. To be the best through approaching limits
6. Be cooperative, be tough, be realistic

去做一件事时, realistic,
抛去辩证法, 走投无路时,
利用辩证法柳暗花明

二流
寻找物理
极限, 因为
完全的创新(一流)是
极其困难的。三流是
对标, 跟着别人模仿。

Three ways of thinking 三种思维方法

华为云、百度云、阿里云的“逻辑型工作”最赚钱
仿真的逻辑优化、查错是逻辑型工作，这是
中国没有的核心技术

The focus of
your study

一个国家人民工资上涨之后，
就不能再继续抄袭别人科技了，
因为这只会再带来利益了。
80年代日本转型从抄袭到了创新，
90年代韩国转型，都跟成功

- Circuit
- El&Mgn
- SysModel
- DSP

Thinking of
markets

- Methodology
- Implementation
- Sales
- Operation

Physical
thinking

Abstract
thinking

CS

- Logic
- Program
- Tools
- Safety

Be realistic and see what shall we learn

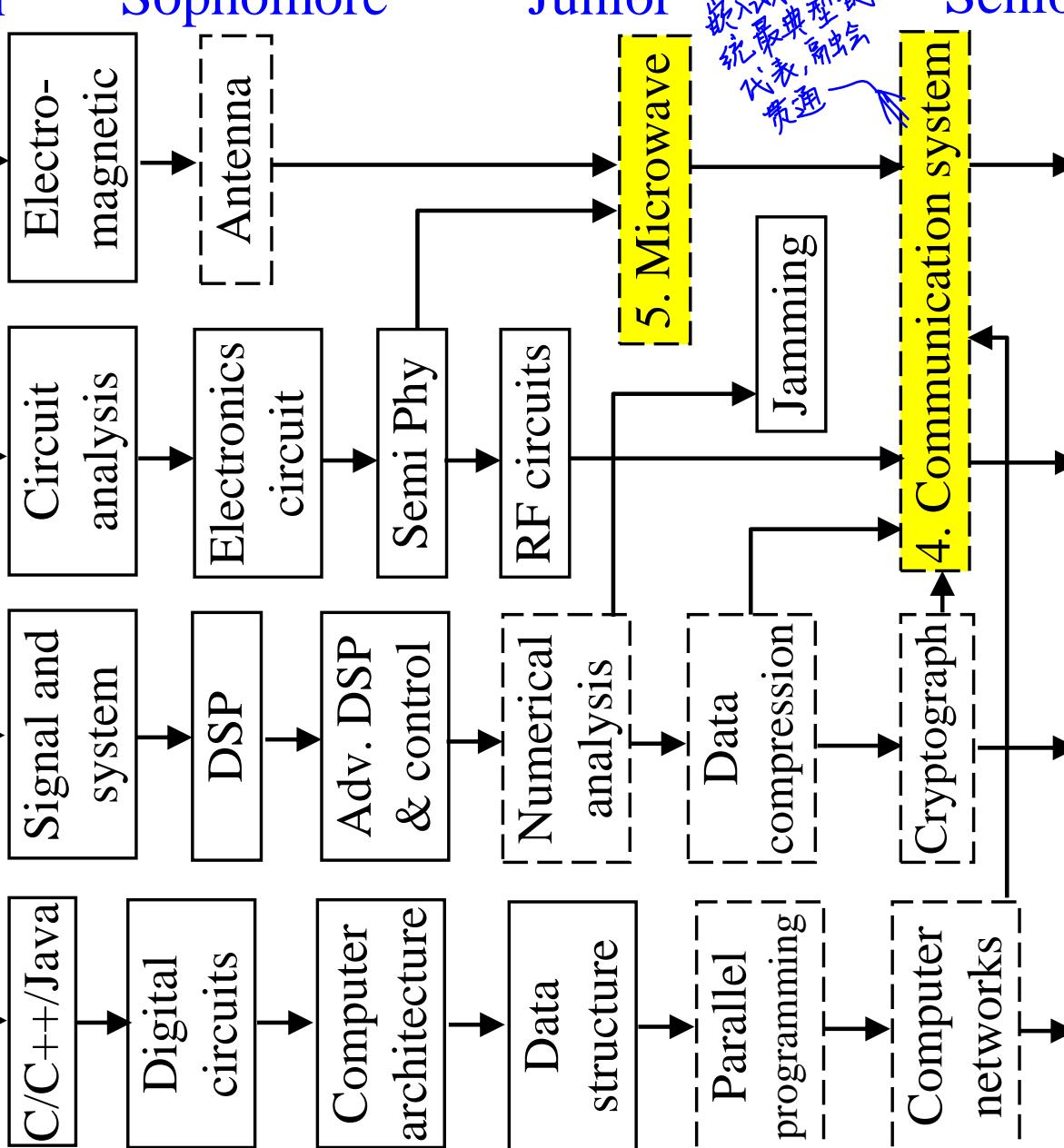


四条线

Program of EE in English

Freshman Sophomore Junior Senior

Fundamental study on Math etc



1. & 2. Design and verification of embedded system
3. Digital & analog VLSI, 6. Power Dev & sensors?

Circuit and analog system

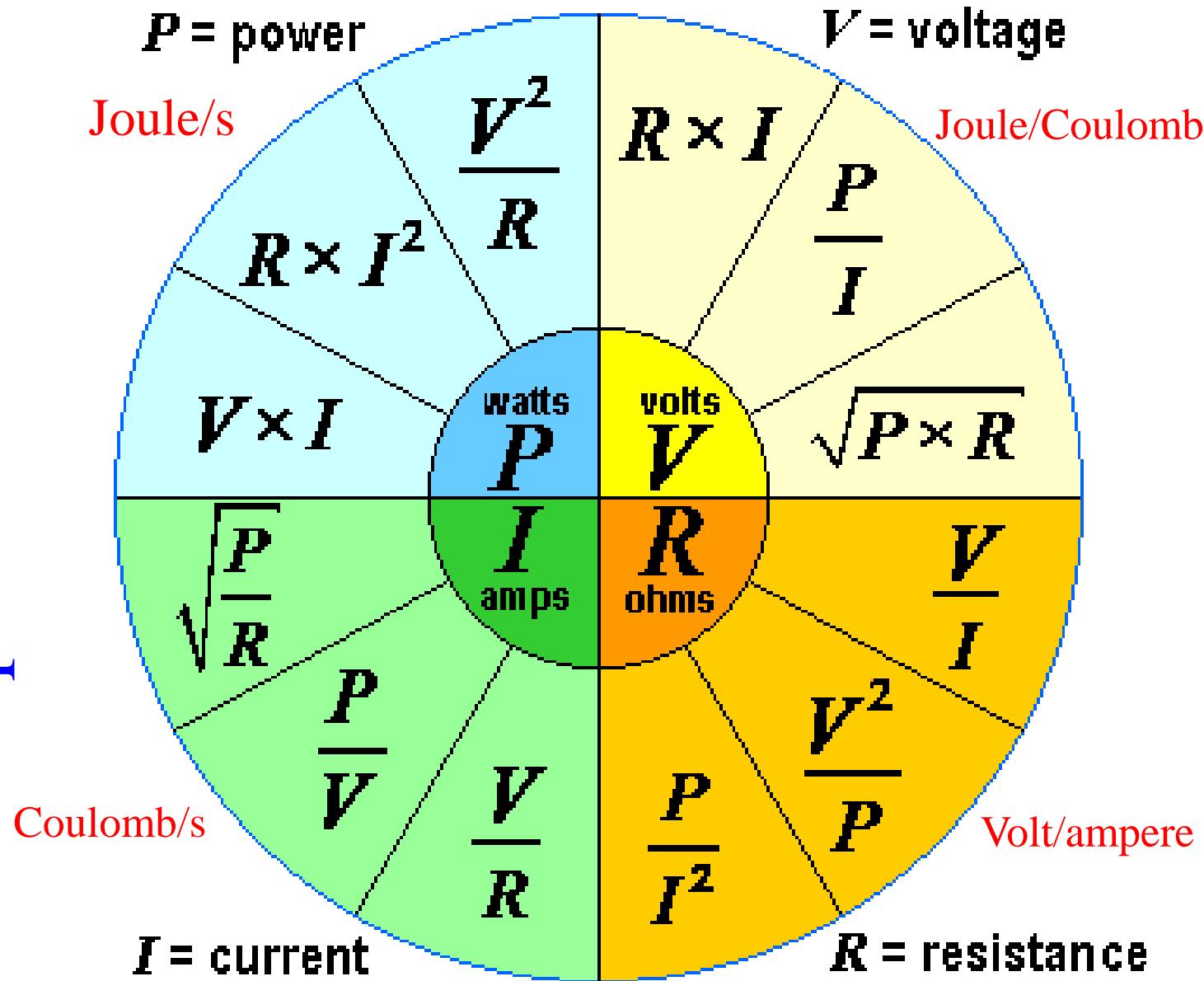


Circuit & analog system courses

1. Circuit analysis 自学: 晶体管原理
2. Electronics components (introduction)
3. Analog circuit (CMOS and bipolar)
4. RF electronics (distributed systems)
5. (CMOS) Analog integrated circuit
6. RF integrated circuits (Si and III/V)
7. Analog system design & implementation

A pizza pie presentation of 参数与量纲

Circuit parameter relations



and parameter dimensions

Circuit analysis

- To understand circuit principle, the way to calculate and finally to optimize circuit parameters.
分析电路功能
(把电容做短路)
建立工作环境
- Why DC circuit (bias) and AC circuit (function)
 - Why in time domain and in frequency domain 换一个角度
- Way of learning: Understanding principles, way of modeling, analysis, and calculation
- Way to learn: start thinking "flow" of understanding, modeling, simulation, & verification.
- To build a matrix through relations, and solve the math
- To realize that **matrix solver** is needed everywhere!

We start from here: EE design career

Whatever you design, it is under the 7-step process

1. Product and physical understanding
2. Mathematical modeling of the system 能软不硬(\$\$)
3. Prove behavior model codes through simulation
4. System specification through HW-SW co-design
5. Hardware design, implementation, and verification
6. Software design, implementation, and verification
7. Integration, fabs, logistics, sales, and services

You therefore follow the flow

1. Physical understanding
2. Methematical modeling
3. Simulation and verification
4. Design and implementation

You need to know where you are and what are you doing at the step of:

1. Physical understanding
2. Methematical modeling
3. Simulation and verification
4. Design and implementation

You therefore need to learn:

Way of thinking: from absolute correct to engineering acceptable

↓
scope)

Way of thinking

- Adapt to new way of thinking
 - From absolute correct to engineering acceptable
- Soon, you need to think of
 - The scope of the knowledge can be used
 - The relative correctness for your case

Electronic components

We always start a design at component selection

The understanding, simulation, and design of

- Passive components
– R, L, C, connectors (packaging), wires
- Active components *(small I controls large O)*
– *Nolinear* transistors for amplification and switch
- Distributed components *(电阻2mm长, 波长2cm, 机电参数)* *当波长短于元件尺寸时, 传的就是波而非电流.*
– Cannot be modeled using RLC (**size ~ wave length**)
- Integrated components (IC) *①绝对值是准的(元件)*
- Way of learning: **Concept + quantitative view**

Circuit analysis 电路分析课

- Someone gives you a circuit, you analyze it and understand the circuit behavior
 - Voltage on each node and current in each branch
 - V/I can be bias, functional parameters, or noise
更小的功率 \rightarrow 更小的尺寸
 - Power consumed in a component or in a circuit
 - A circuit parameter can be AC or DC, yet it is linear and static parameters, not dynamic parameters!
- **Analyze circuit V/I behavior in T/F domains**

测噪声时只能测功率，因为 V/I 只能有统计数据。 $\Rightarrow \sqrt{\sum I^2}, \sqrt{\sum V^2}$. 设计一个功能时，

就是设计电流和电压，因为它们易于测量：

Analog circuit 无论何时当你讨论模电 两部分电路：工作点建立电路、功能电路

Understanding, simulation, and design of

- **Analog circuit** with a **continuously variable signal**, in contrast to digital circuit with only 2 different levels.
- 七大挑战: bias, function, speed, power, noise, distortion, and temperature. 电分 = 理想电路(高中), 模电 = 实际电路(大学)
- Where and how: set up DC **biases** for AC functions
 - DC: let AC floating at certain point to reach max dyn range
 - AC: added on DC, as the function of the circuit
- It is not amplification, It's about small controlling larger

Tricks to learn analog circuit and digital circuit 模电和数电

- 什么是模电什么是数电
 - Amplification
 - It is not amplification. It is about control by a small signal over a large signal
 - Digital abstraction
 - We will discuss digital circuit. Do not think a gate circuit details, think of logic relations
- 忘掉模拟电路,只考虑逻辑关系。但是在一定的限制条件下的范围内。

高频下选择
一个带宽：选混波器，很
困难，方法是两个频率相乘，
两个正弦，结果是频率
和与差，差中
选带通滤波器 (LJ 中选 RBJ)

原因
① 做收发机(电子)
(Arm strong 这个人，做
做收发机(电子))

40G的超宽带放大器，他是家
中国不讲

RF circuits and electronics

是对模拟电路的特性提升和延展

- RFC is the continuation of analog circuit
- Special circuit for applications in higher frequency
 - 1. Ultra broadband circuits: for broadband data
 - 2. **Tuned circuits**: wireless or instrument applications
- 挑战: higher frequency, broaderband, noise (from components or circuit), and linearity (distortion)
- Way to learn: **Level 1. physical understanding,**
Level 2. quantitative approach

Analog/RF integrated circuit

- To integrate analog/RF circuits into an IC.
- Challenges:
 - Correctness: cannot be changed after tapeout.
 - Some components cannot be integrated in IC.
 - Challenges: Limited components and parameters.
- IC is different from normal PCB based circuits, it is a new technology or a new academia.
- Way to learn:
 - Think of constraints, flow, quantitative approach

Processor and digital system



Processor and digital system

1. Digital circuits (fundamentals)
2. Computer arithmetics (optional) *��老师真正的职业*
3. Processor architecture (organization) *↗*
4. Computer systems (SW-HW)
5. Digital integrated circuits
6. Internet and computer networks *↗ 协议*

Digital instead of analog

数字电路：用二进制计算与控制

- 目的: Analog to digital → function → back to analog


forget about analog, think of logic
- Why digital / why not digital \rightarrow it's stable
 - Temperature independent, accurate, keep information stored.
 - Why not: latency problem, storage cost,
- How digital system work (combinational, clocked)
- Way to learn: Think of digit not inside a logic gates

Computer arhthmetics

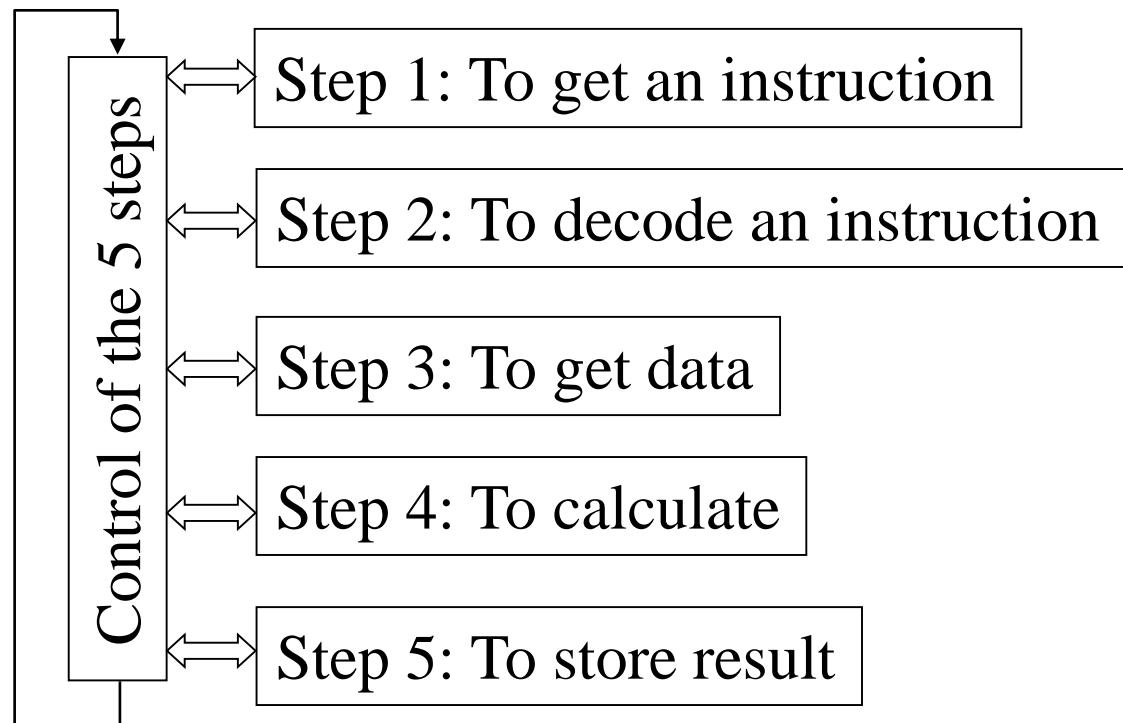
运算单元：如何建造 $+$ 、 \times 模块

- Basic digital components for computing
 - Arithmetic: $+$, $-$, \times , and logic devices
 - Function: \div , $1/x$, \sqrt{x} , $\sin(x)$, $e(x)$, $\log(x)$, $\ln(x)$
- How an adder work, how to substract
- How a multiplier work, how to run it faster
- How to design a functional module (SW HW)
- It is optional and within other courses.
- Way to learn: Enough on concept level

Processor architecture

硬件原理与汇编语言执行原理

- Basic principle
- To be faster
- To store data
- **Ways to learn**
 1. **Data flow**
 2. **Data access**
 3. **Control flow**
 4. **Assembly instruction**



Computer systems

- Computers perform four general operations
 - input, process, storage, and output
- Technically:
 - A processor + peripheral to process user's functions
- Input and Output (peripheral, including IP):
 - For us, they are I/O's with diff requirements
- Storage: memory subsystem (life time to learn)
- Hardware, HW Control (OS), and Software

Digital integrated systems

数字系统：实现各种复杂功能

- Such as a computer, **an embedded system**, a communication system, a control system, a medical electronics system
- Or specific processing system with digital and analog interfaces and storage devices.
- Ways to learn:
 - Formal methodology and application specific

Internet and computer networks

计算机网络：把未知设备和人连起来

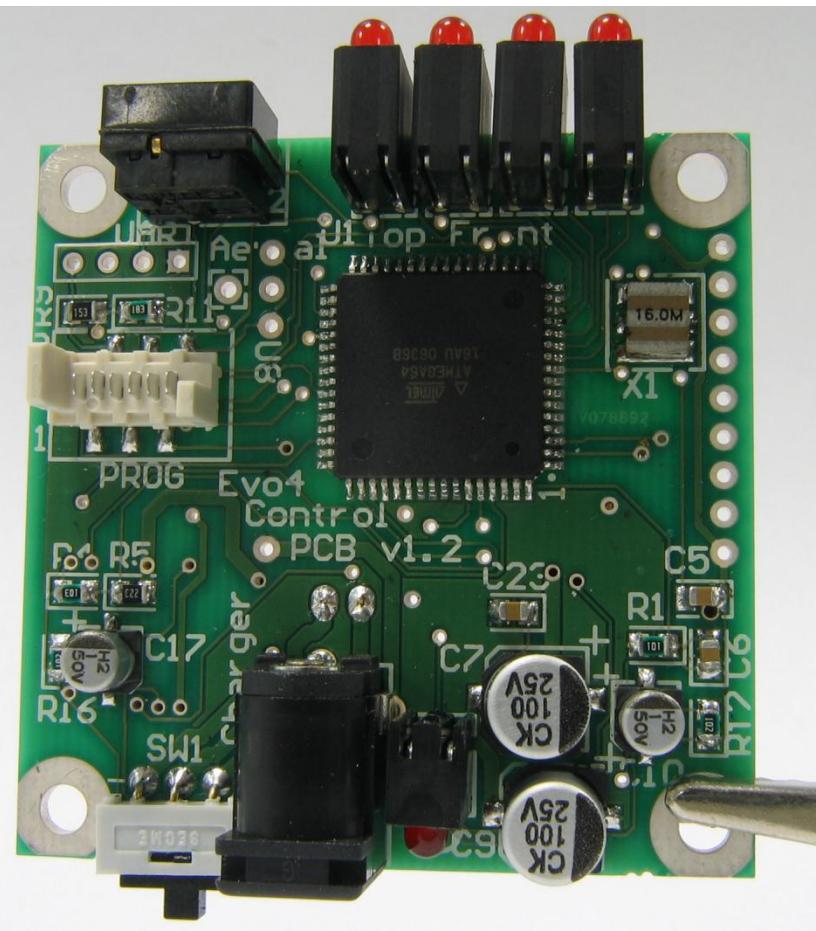
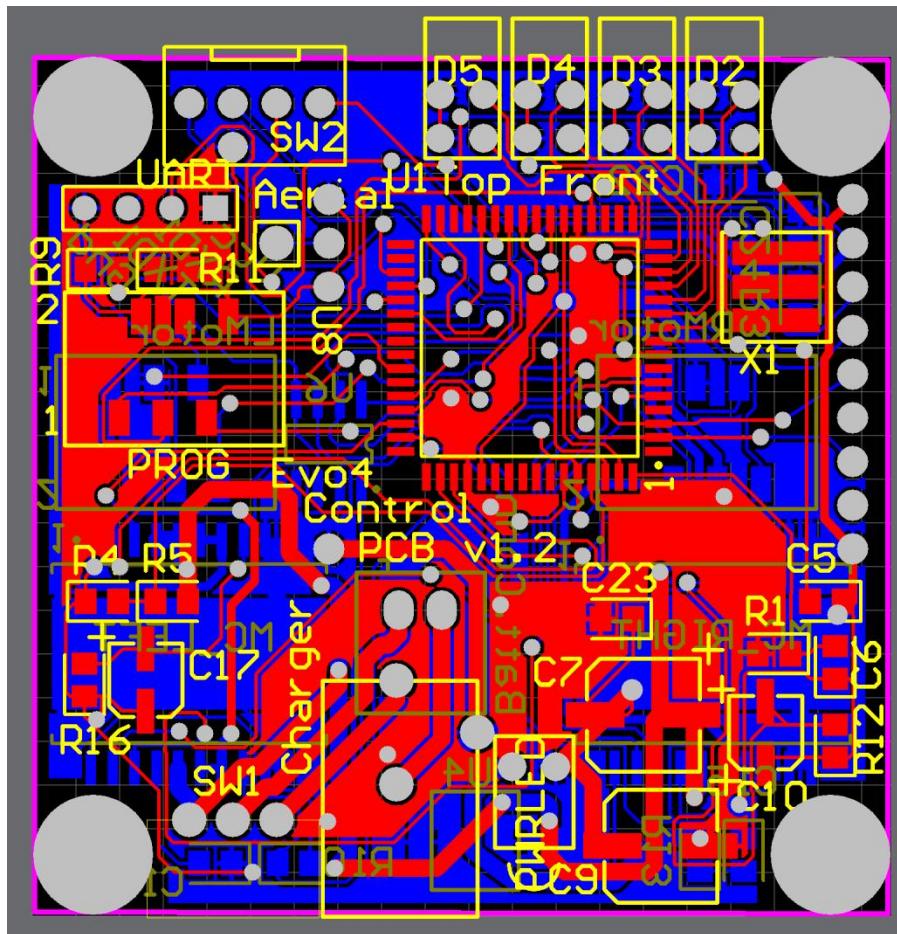
- INTERNET: I do not need to know your hardware and I can communicate with you.
- OSI: 7 layer open System Interconnection model to build an absolute general purpose MtM
- Think of the layer you work on, to simplify your way of thinking and development.

Digital integrated circuits

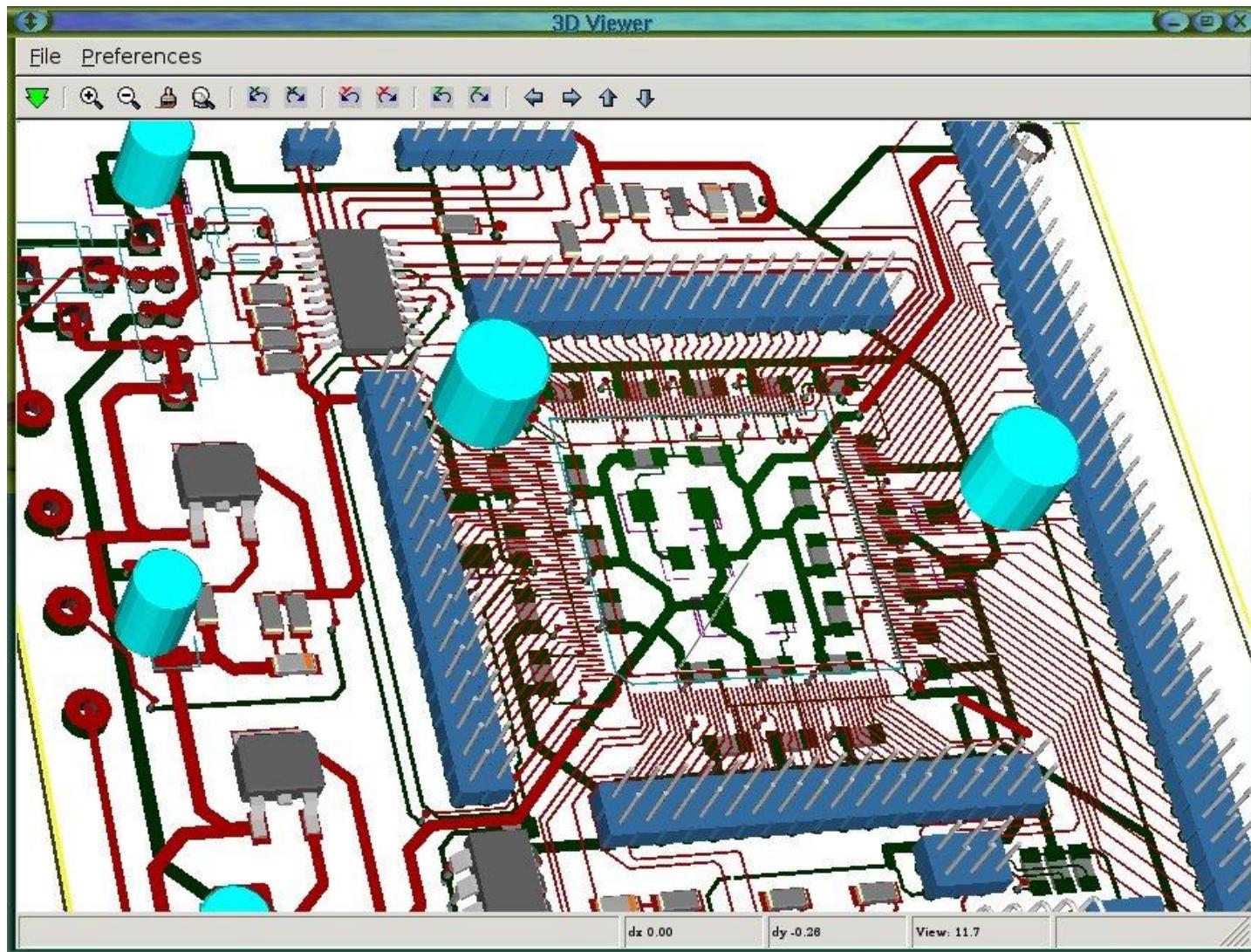
数字集成电路：01世界真奇妙

- Logic devices ASIC ASSP ASIP 刘老师主要工作
- Memories DDR EEPROM
- Processors CPU, MCU, GPU, DSP
- FPGA
- Mixed analog digital components

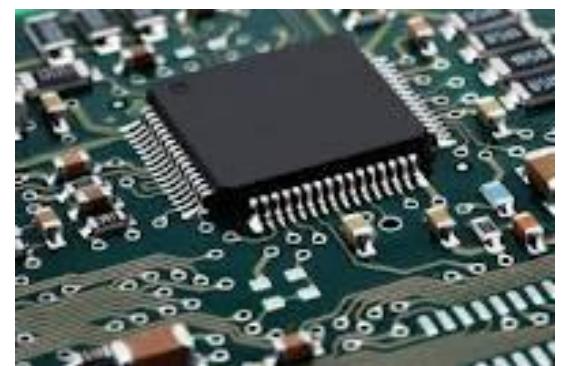
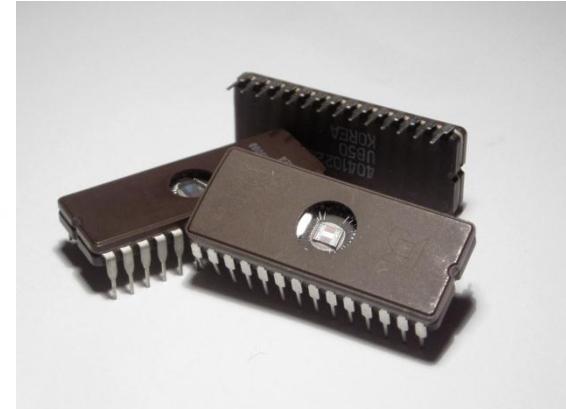
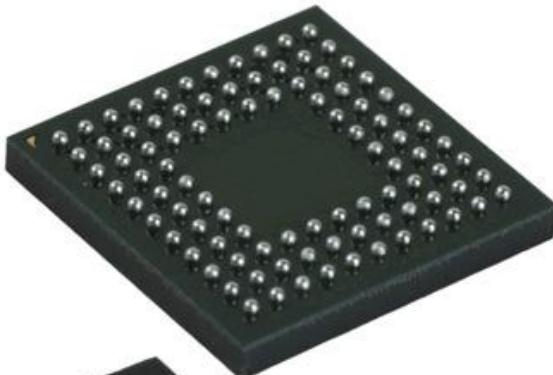
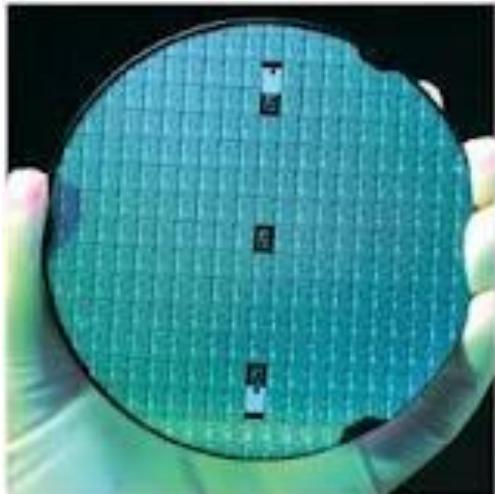
Printed Circuit Board



Inside Printed Circuit Board

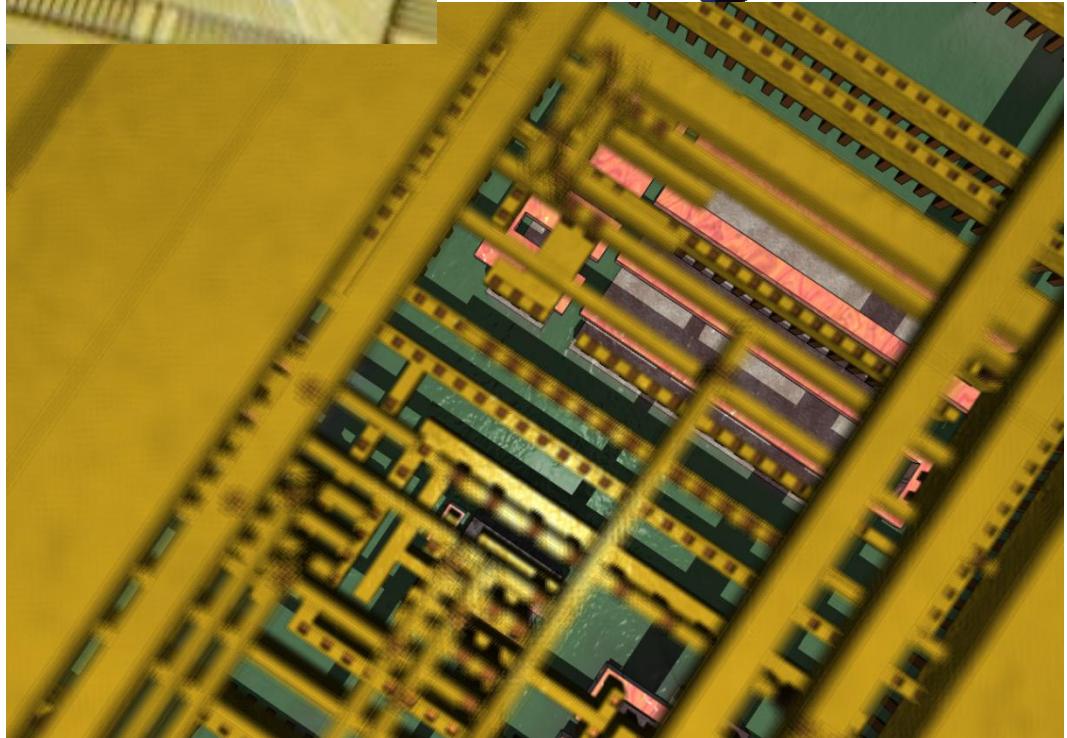
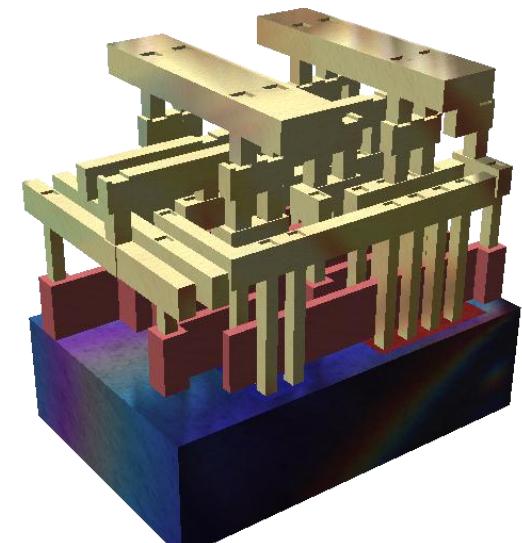
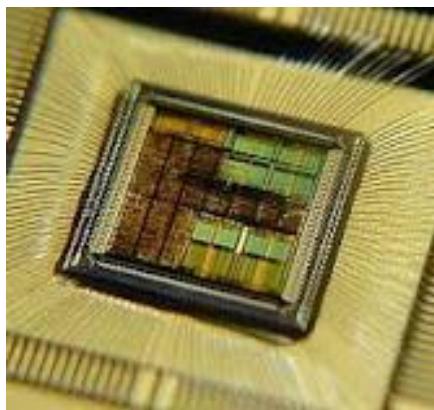
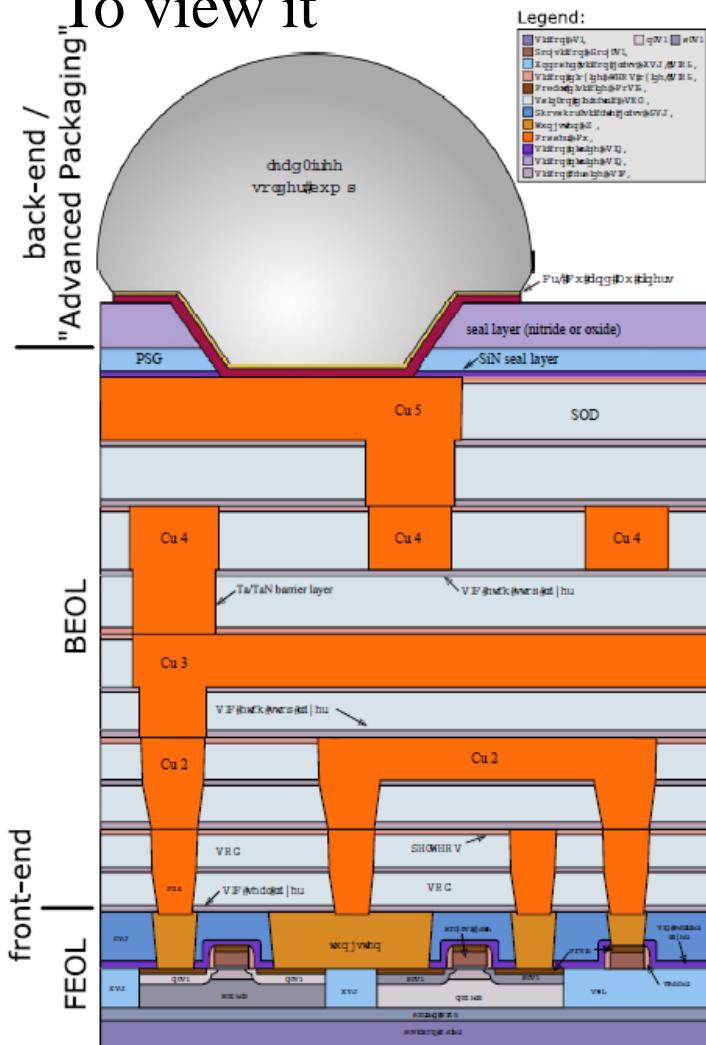


Integrated circuit



Inside integrated circuit

To view it



Digital Signal Processing



嵌入式程序编程原理.

Running software on hardware

- You have learned hardware, such as digital logic circuit, and processors.
- You can run different software on the hardware I just told you to get different functions.
- Therefore, how can you make right software for the function you want to have?
- You are going to learn the way of modeling of a system to get your function executed!
- You first model something mathematically, and then implement the model into binary codes, load into the hardware, and run it to make money!

Basic java → GPU java

编译.仿真.常用 C++ (不仅仅是 C) 84

Analytical and statistical model

- Analytical modeling 解析建模是指模型中的模型参数、初始条件和其他输入信息以及模拟时间和结果之间的一切关系均以公式、方程式和不等式来表示。我们四年所学，主要是解析建模和解析建模的解。
- Statistical modeling 统计建模以统计分析软件为工具，用统计分析方法对批量数据建立统计模型，揭示数据背后的因素，诠释现象，作出预测或判断。硕士期间现代系统设计是解析建模和统计建模的完美结合。
- Black box 黑箱建模不考虑物理过程，通过观测外部输入黑箱的信息和黑箱输出的信息的变化关系，来探索黑箱的内部构造和机理。其建模基于输入和输出时间序列的分析，现代系统设计分支，例如深度学习。

Courses related to digital Signal Processing

The theory of analytical modeling

1. Signal and system
2. DSP (Digital signal processing)
3. Advanced DSP
4. Digital telecommppunications
5. Data compressions & home E
6. Cryptography

Signal and systems

信号与系统

- Mathematical functional description of a system

What you want is $Y(t)$ =system description is $\int f(x)dx$ your input is x

- Signals are ... inputs and/or outputs of systems
- Most physical system can be modeled using signal and systems

Signal and systems

- Most physical system can be modeled as
input → system → output $out(in) = \int system(in) din$
- Quantitative modeling is essential for understanding and design
- Modeling in time and frequency domains
- Way to learn:
 - Think in Time, Seq, and Frequency domains

Digital signal processing

- Modeling and design in digital domain
- Application examples
 - Enhancements
 - Filtering, pattern, noise, reliable codec
 - Compressions
 - Efficient coding, voice/audio/image/video codec
 - Special purpose
 - Transform, Jamming
- Way to learn:
 - Using math and think physically

Digital telecommunications

- Modulate and transmit digital baseband signals on radio, cable, optics or others
- Why digital (no more noise, be stored)
- How it works (how to manage distortions)
- What should we learn (DSP extension)
- How can you be an expert: math (phy)
- Lots jobs for research, design, operates

Data compression

- Efficient (lossing/lossless) coding-decoding
- Why: to save trans/storage bandwidth
 - How it works Δ , resolution, convince people
- What should we learn (啥时应做啥事儿)
- How can you be an expert
- Jobs for research, design, and operations

Cryptography 密码学

- Hide!
 - The engineering to secure communication / storage in the presence of third parties.
- Why cryptography
 - Do different thing to right / not right people
- How it works: imbalanced FWD/BWD
- What to learn: math and way of thinking
- Jobs for research, design, and operates

Electromagnetics & transmission

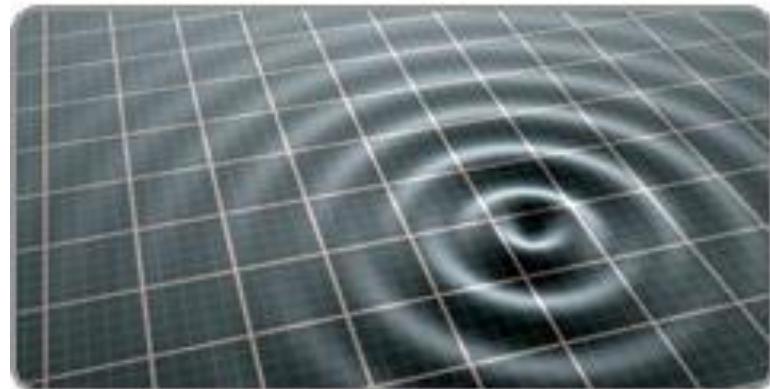
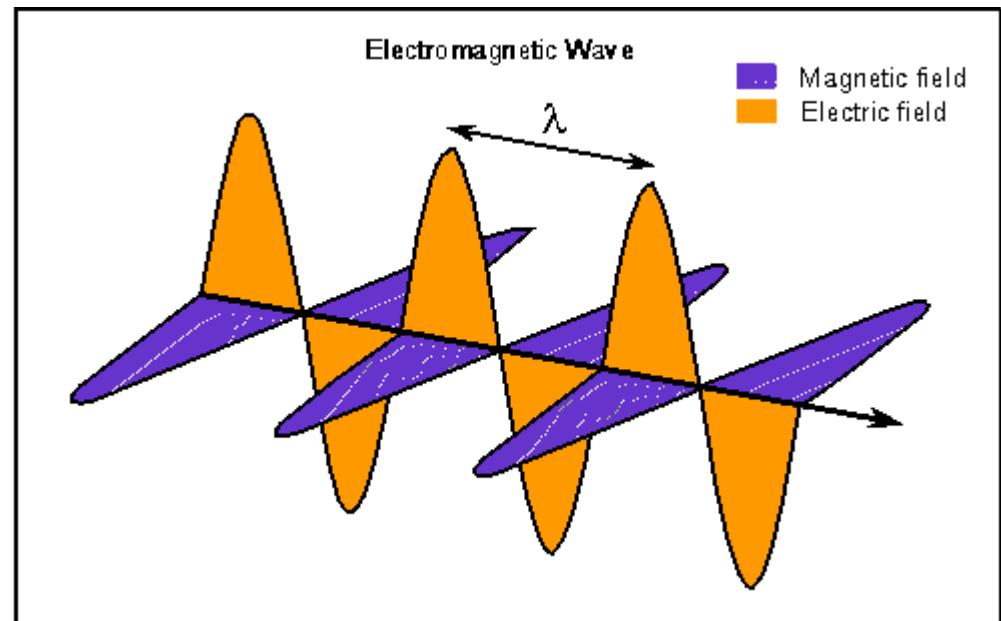


Electromagnetics & transmission

- Electromagnetics
- Wave and transmissions
- Distributed circuit / transmission lines
- Microwave circuit and system
- MMIC (monolithic microwave IC)
- Antenna theory and design

Electromagnetics

- **Electric field**
- **Magnetic field**
- **Electromagnetics**
- **Wave**
- **Way to learn:**
 - **Read in math**
 - **Think in 3D**



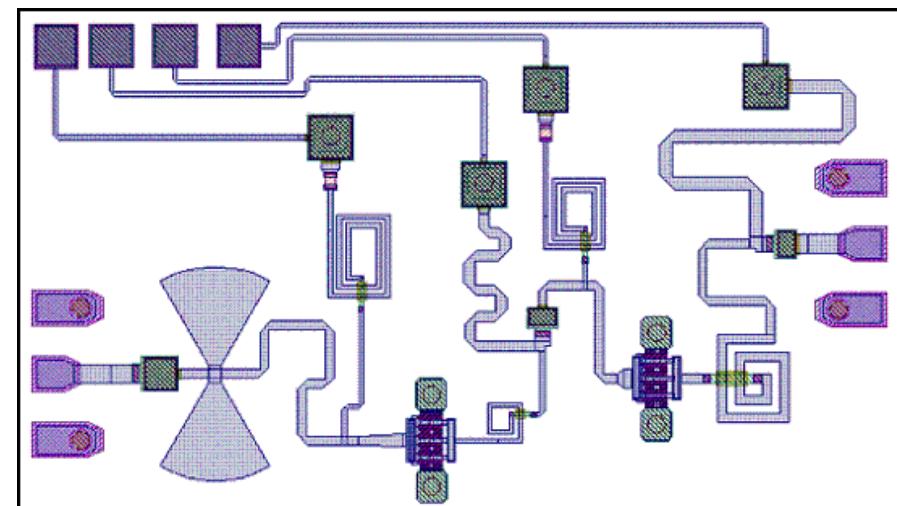
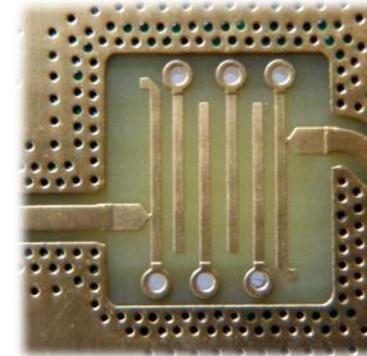
Distributed circuit and transmissionline

1. When the distance
is long
2. When the
wavelength is short
 - Think distributed
instead of lumped

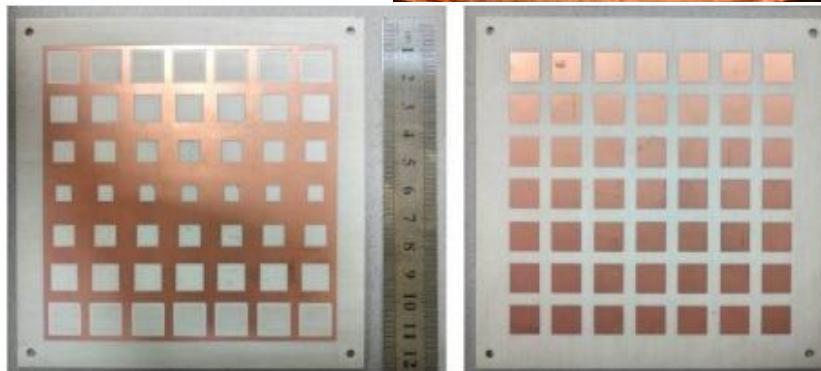
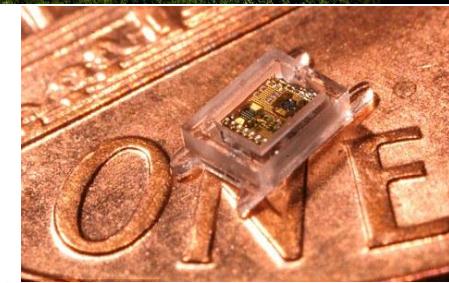


Microwave circuit and system

- **Distributed passive components**
- and Lumped active components
- In microstrip, wave guide, cable, and space



Antenna



Computing and programming



Computing & programming

- Data structure and C programming
- Numerical analysis
- Compiling and simulation
- Parallel programming
- Embedded firmware

Implementation of mathematics

Data structure

- It is a particular way of storing and organizing data in a computer, **to be used efficiently**.
- Different ways to present data
 - Data: precision, range, dynamic range, HW cost
 - String: sequence of symbols (like Chinese)
- Ways to organize data (Inductive, associative)
 - Array, list, tree, hashes, graphs
- Think: What is the purpose of arranging data

Numerical analysis

The ways to implement mathematics

- (Matrix, Transform, and function) solvers
- 内插、外推、回归分析、最佳化、微分方程、LUT
- Ways to optimize (to approach a goal)
 - Different ways of linear programming, CLP
- Cost of implementations
 - Precision, number of operations, memory cost
- Way of learning: Think of implementations

Compiling and simulation

- Compiler: code translator, to translate high level language (easy to write) to low level language (machine can recognize)
- Simulator: executer, the behavior model of a machine or an (executable) language
- Way to learn: **by yourself, no course available.**

Parallel programming/computing

- A form of computation, multiple calculations being carried out simultaneously,
- Large problems can be divided into smaller ones and solved concurrently in parallel.
- Levels of parallel: bit, instruction, data, and task.
- Challenges: Dependency, memory, traffic
- Way to learn: **Implementation knowledge**

AI and Deep (machine) learning

- If you can use analytical modeling, do it.
- If you cannot use analytical modeling, use DL
- What is training
- What is inference
- How many kinds of platforms and algorithms
- Business behind deep learning hypes

Real time programming

- Real-time programming: A result is correct in a real-time system means **not only the result is correct, but also the result is available in time.**
- For example: finish a frame of picture process using less than 1/30 second in a video stream
- And: finish a data frame processing before the arrival of the next data frame in a mobile phone.

Firmware programming

- FW is SW with fixed functions and firmed (not yet HW) in a system (not a course).
- FW permanently installed in non-volatile memory, rarely changed.
 - Typical: baseband firmware in SDR processor, video CODEC firmware in TV, in Surveillance camera, motor control firmware in robot
- Essential way to make money in your life

Design and design methodology



Design and design methodology

1. 方法 Methodology
2. 过程 Design process
3. Project management
 - 计划的严谨性 Project plan
 - 执行的力度 Project execution
4. Team work
5. Concurrent engineering

Methodology 方法论

the philosophy of doing things

- 一般方法，三句话
 1. divide and conquer,
 2. refine and simulate,
 3. describe and synthesis。

完成诸多工程过程的三要素

1. 理解与建模 Modeling

- 定量: 功能、性能 (能力、开销、可靠性....)

2. 设计与实施 Implementation

- 优化、细化 and transform

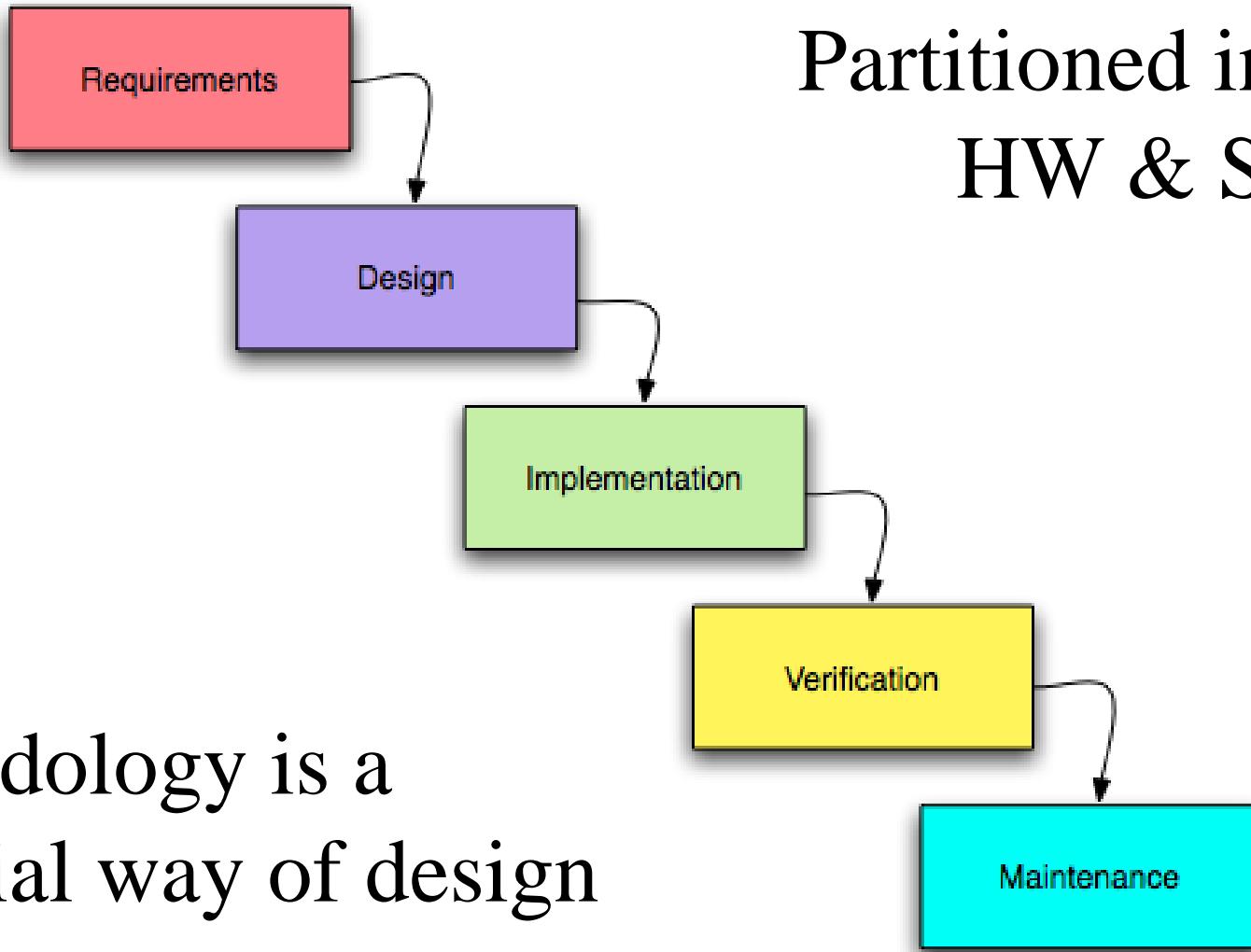
3. 验证与测试 Verification

- 对每一层优化与细化的功能与性能的确认

工程设计的六要素

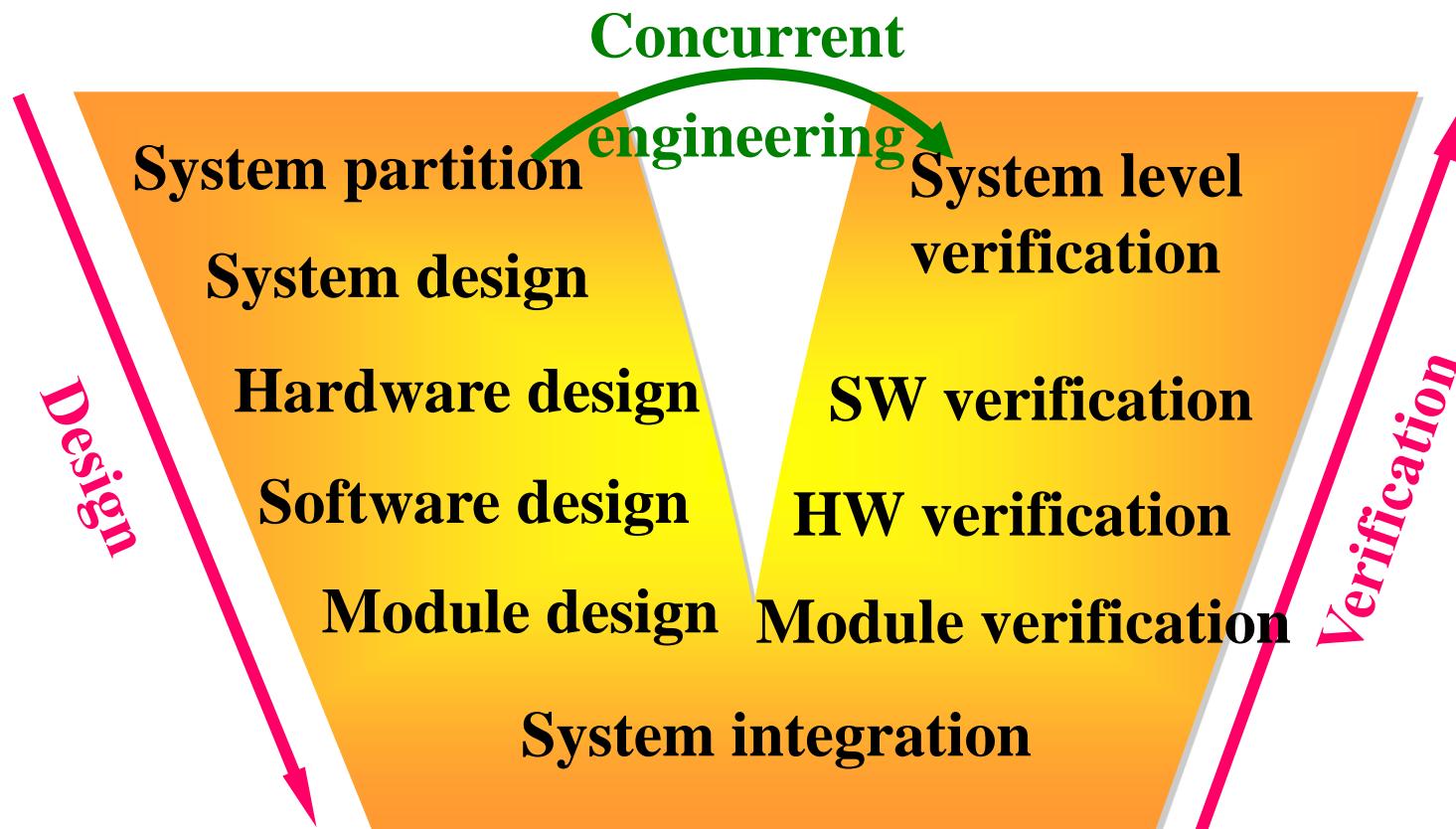
1. 作业分解的均衡性（功能、均量、冗余少）
2. 分解引出的额外作业的功能定义的正确性
3. 分块后每块作业是否真懂了
4. 分块后每块作业的实现方法是不是合适
5. 集成方法（分解法的反推）
6. 验证方法（一步步的一致性落实问题）

System development process



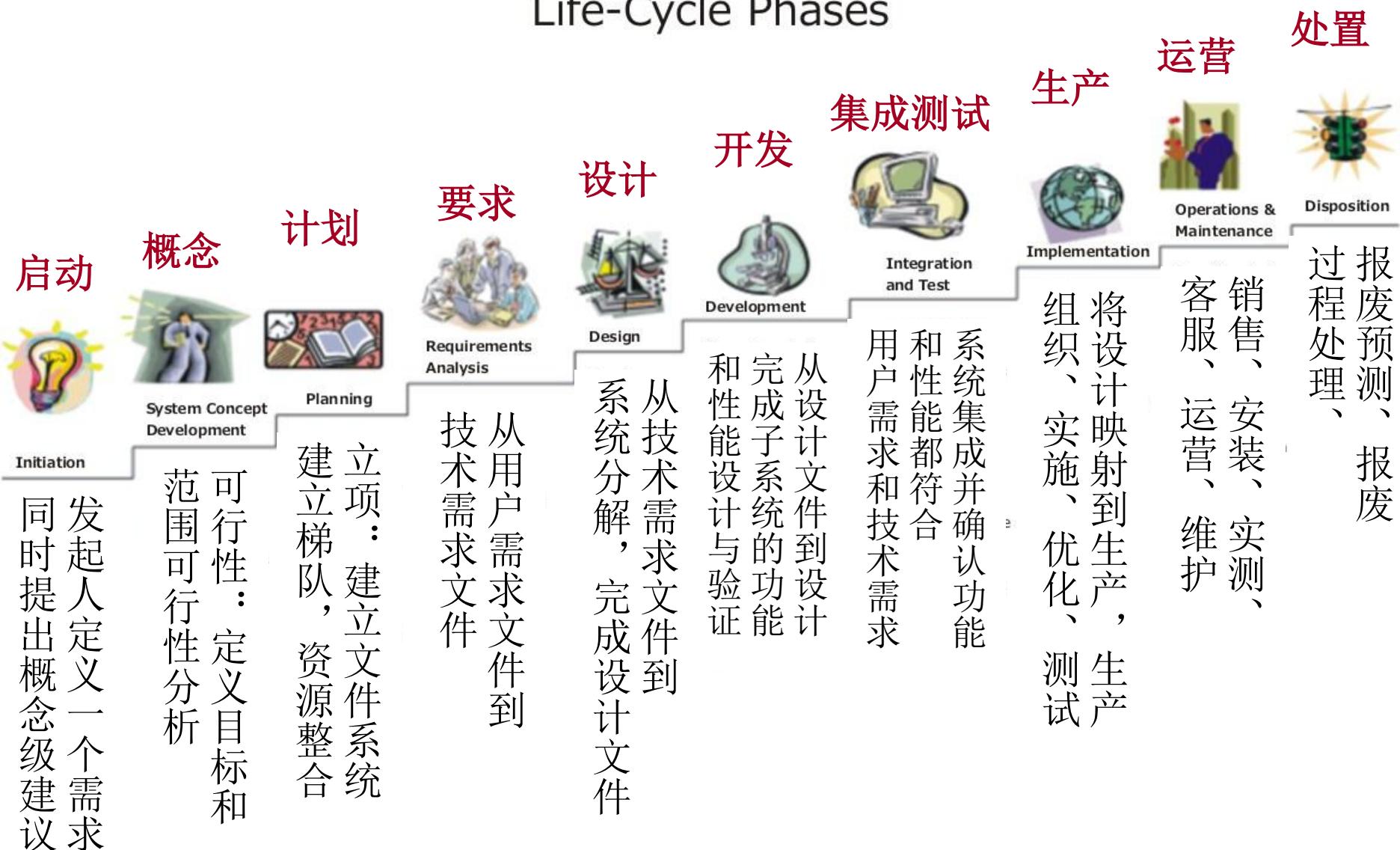
Methodology is a
essential way of design

V-shaped project description



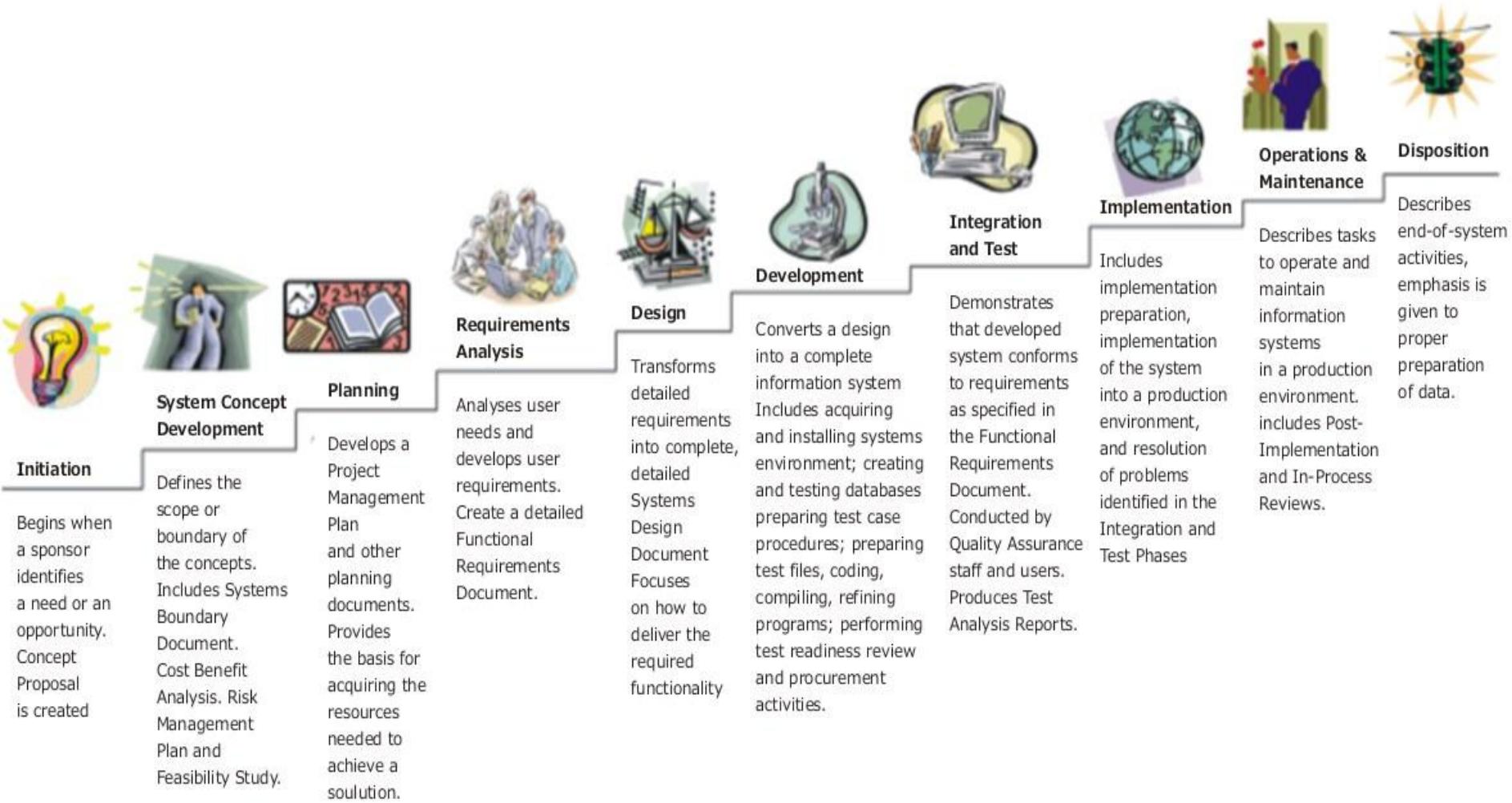
Systems Development Life Cycle (SDL)

Life-Cycle Phases

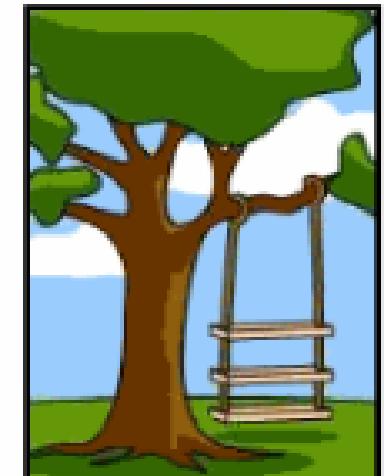


Systems Development Life Cycle (SDL)

Life-Cycle Phases



一个工业过程并不简单，这里表现的并不一定是笑话，的确有发生。



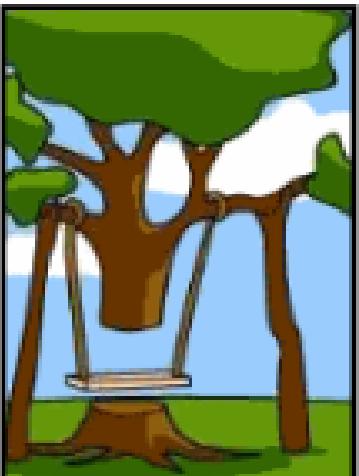
用户的描述

How the customer explained it



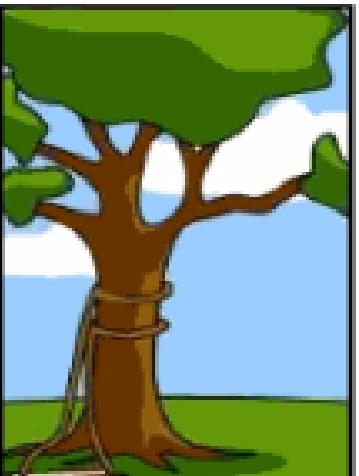
项目经理的理解

How the Project Leader understood it



高工的设计

How the Analyst designed it



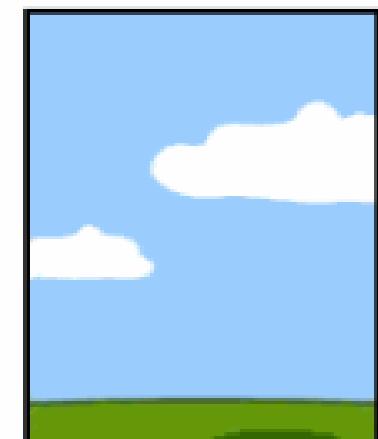
编出的程序

How the Programmer wrote it



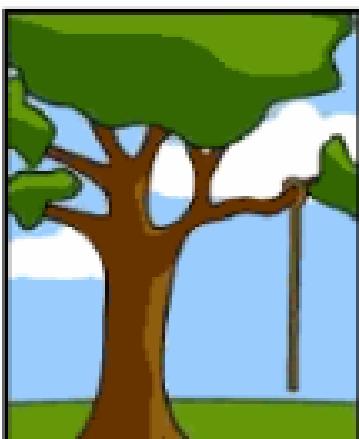
商人的描述

How the Business Consultant described it



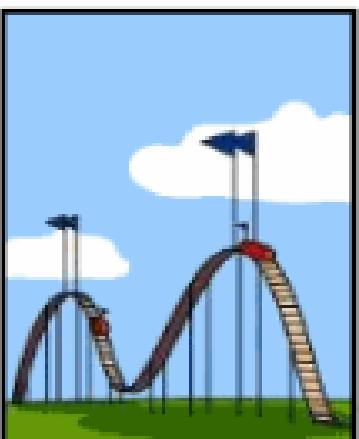
用户文件

How the project was documented



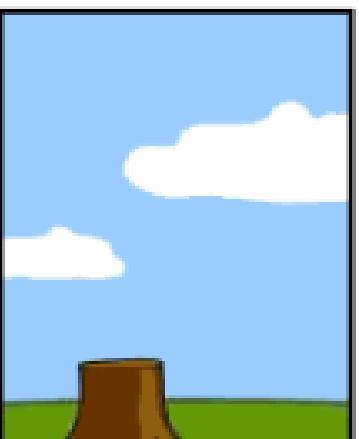
运营商的建设

What operations installed



用户的买单

How the customer was billed



客服

How it was supported



用户真实需求

What the customer really needed

做正确的事
正确的做事

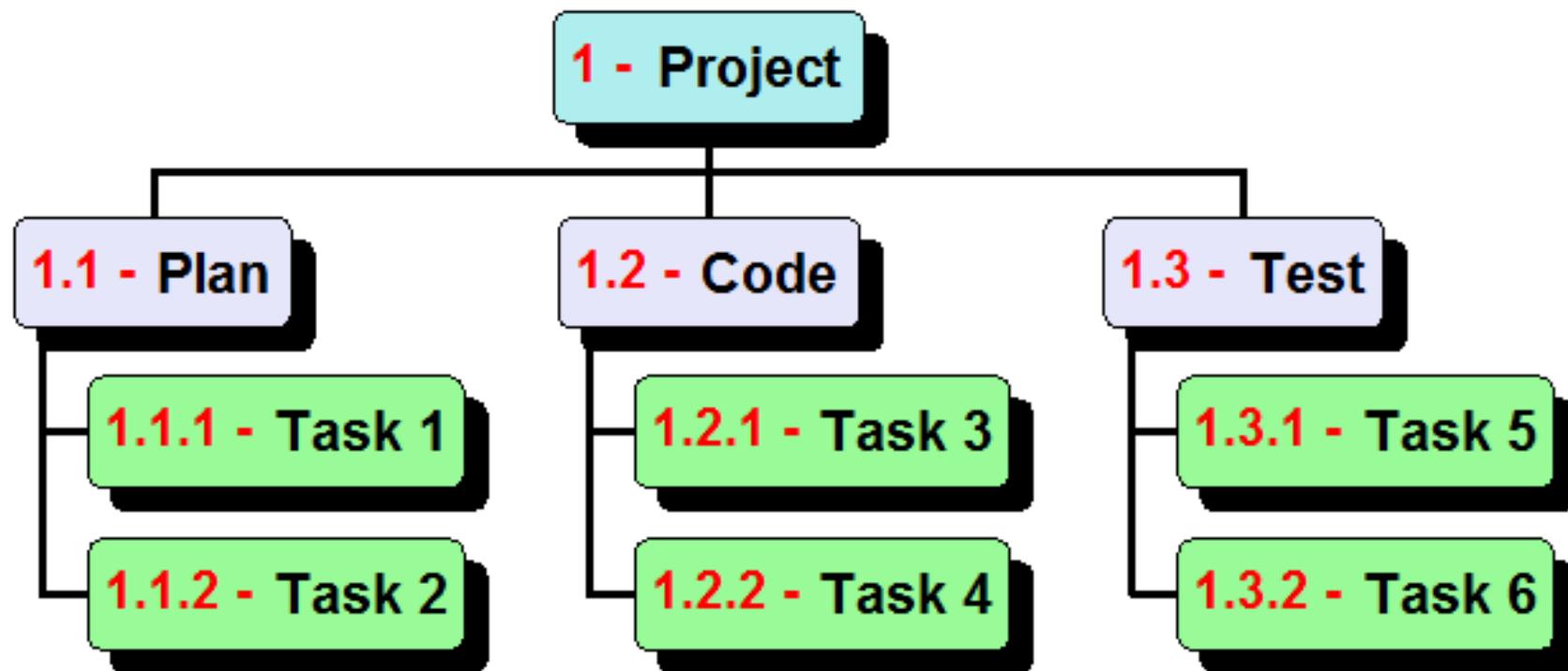
Product development and mamager 做正确的事

- The skill to define what shall we do
- To decide the right thing to do
- Where is the market chance, what is the strategy of the company, is it the right time to do, and can we do it.
- Way to learn: **No course, by yourself**

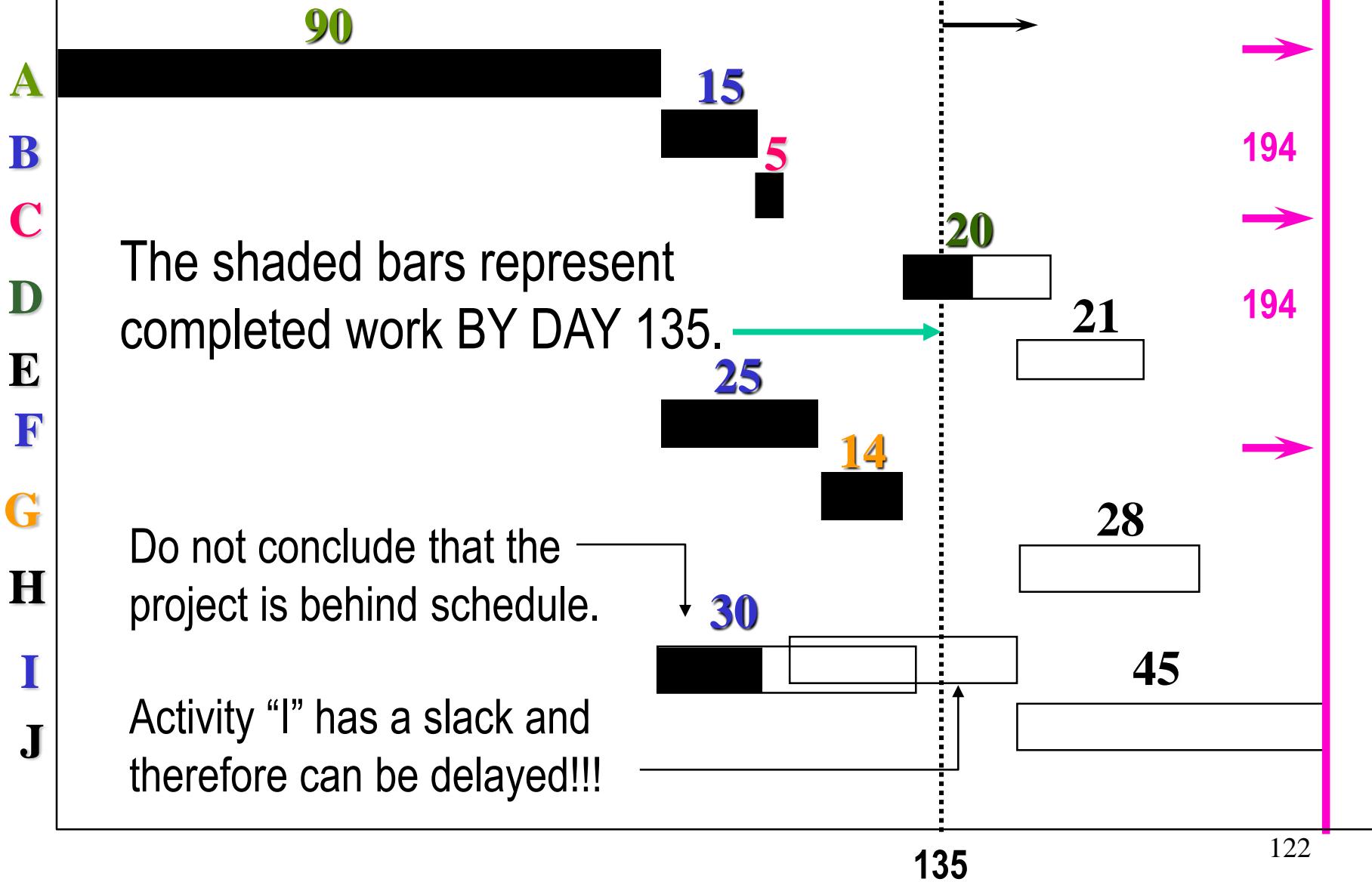
Project plan and execution 正确的做事 (计划的合理性和推进力度)

- The skill to define how can we do it
- Very useful skill for your study in BIT
- Plan: divide and conquer, HR, time, money
- Execution: To do the right thing, within the right time, using right amount money.
- Way to learn: during your lab, by yourself

Work breakdown structure, tool



自己学会用甘特图计划监督项目



Thanks ! Questions ?

!



?

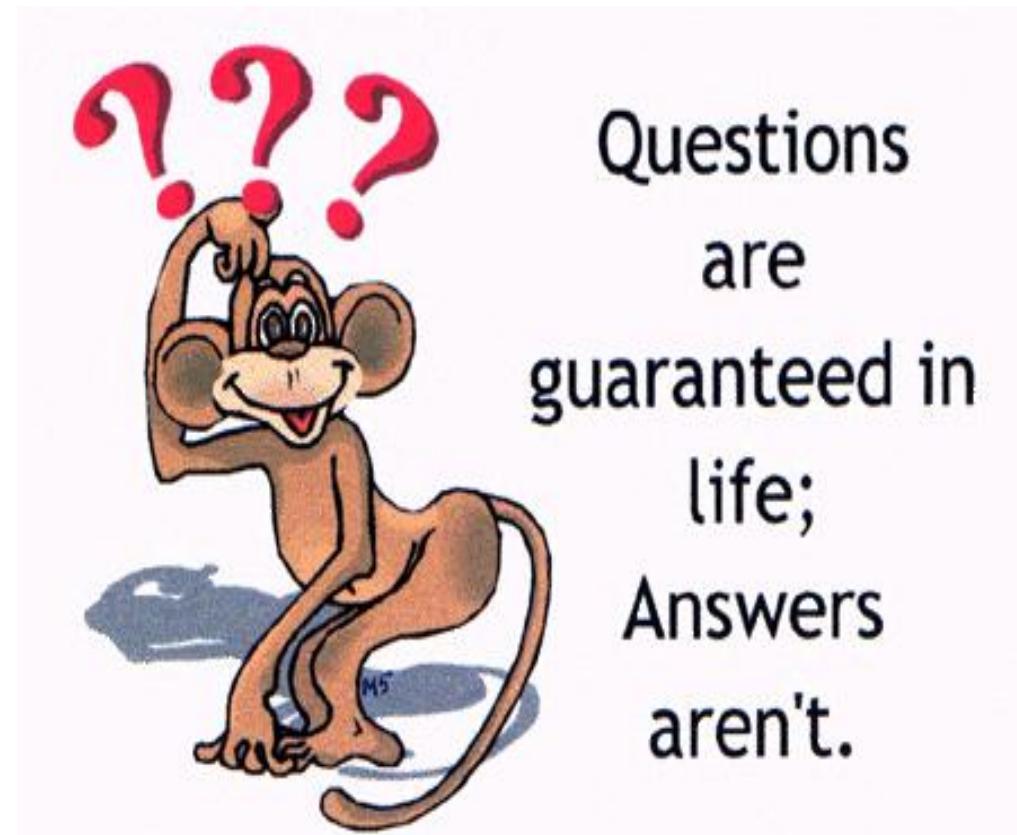
Conclusion of courses introduced

- 1. Circuit and analog circuit system**
- 2. Processor and digital circuit system**
- 3. DSP - Digital Signal Processing**
- 4. Electromagnetics & transmission**
- 5. Computing and programming**
- 6. Design and design methodology**
- 7. Implementation & fabrication through labs**
- 8. Sales and operation: learn it by yourself**



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Questions
are
guaranteed in
life;
Answers
aren't.

How can you successfully master the four-year study (part 3 of the course)



We are facing global competitions

- We need sufficient knowledge to survive in a competing career after graduation
- What is the knowledge infrastructure we need to build
- What is the discipline or skills you need to accumulate
- How can you adapt to BIT university life

We are facing to complex engineering

一是系统规模 scale induced complexity

- 足够规模是产生复杂性的必要条件，但不是充分条件；

二是系统结构 structural complex

- 系统构成的多样性、差异性、层级结构，是复杂性根源；

三是系统的非线性性 nonlinearity

- 系统内部要素间相互作用，它导致系统额外复杂性；

四是系统的开放性 open and complex

- 系统与外部的相互关系，是系统复杂性的另一重要根源。

We thus need to think systematically

We thus follows Washington Accord

华盛顿协议工程教育标准

- 1. 工程知识:** 能将数学、自然科学、工程基础和专业知识用于解决复杂工程问题
 - 问题分析: 能用数学、自然、和工程原理识别、表达、分析复杂工程问题, 获得有效结论
 - 设计/开发解决方案: 能设计复杂工程问题的解决方案, 满足特定需求的系统、单元部件或工艺流程, 并能在设计中创新, 考虑社会、健康、安全、法律、文化及环境因素
- 2. 研究:** 能基于科学原理并采用科学方法对复杂工程问题进行研究, 包括设计实验、分析与解释数据、并通过信息综合得到合理有效的结论
- 3. 使用现代工具:** 能针对复杂工程问题, 开发、选择与使用恰当的技术、资源、现代工程工具, 对复杂工程问题进行预测与模拟, 能理解其局限性
- 4. 工程与社会:** 能基于工程背景知识进行合理分析, 评价专业工程实践和复杂工程问题及解决方案对社会、健康、安全、法律以及文化的影响, 理解应承担的责任
 - 环境和可持续发展: 能理解和评价复杂工程问题对环境社会可持续发展的影响
 - 职业规范: 有人文社会科学素养、社会责任感, 遵守职业道德和规范, 履行责任
 - 个人和团队: 能够在多学科背景下的团队中承担个体、团队成员以及负责人的角色
 - 沟通: 能有效沟通和交流, 写报告和设计文稿、清晰表达。能跨文化沟通和交流
- 5. 项目管理:** 理解并掌握工程管理原理与经济决策方法, 能在多学科环境中应用
- 6. 终身学习:** 具有自主学习和终身学习的意识, 有不断学习和适应发展的能力。

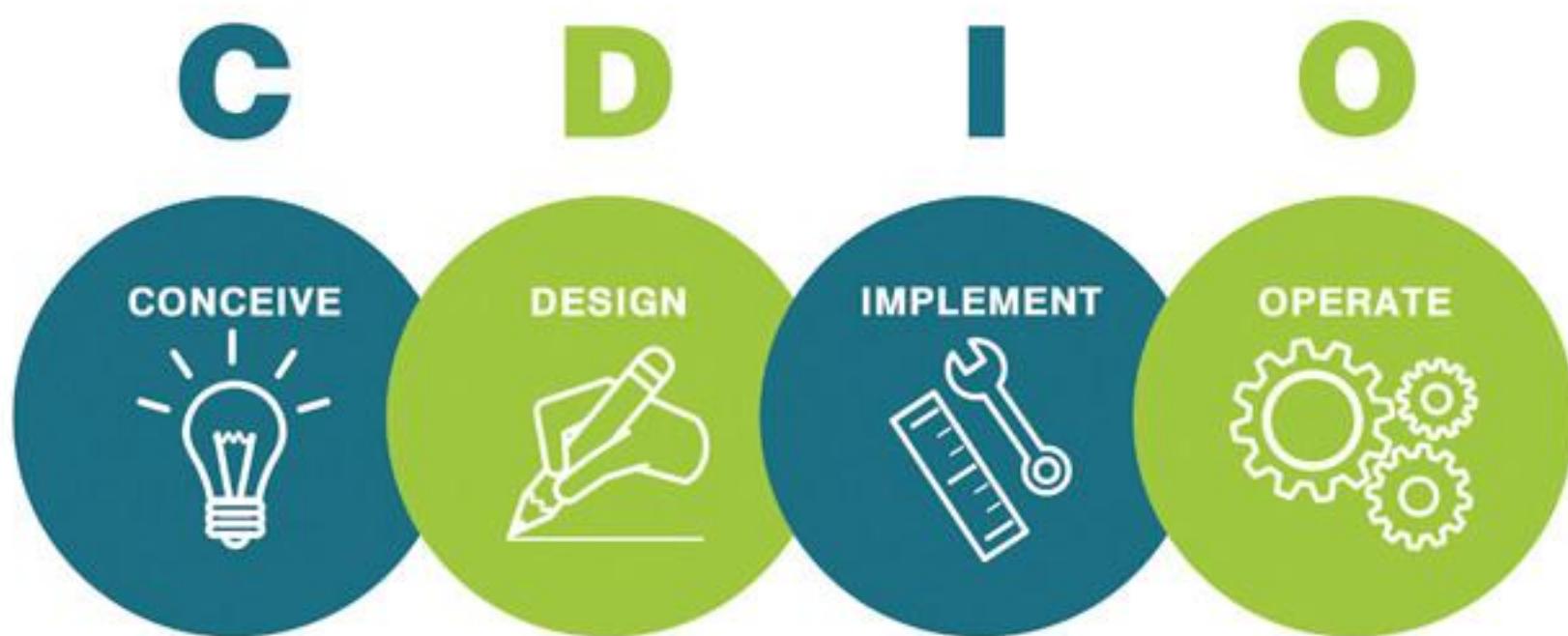
要达到的目标：华盛顿协议工程教育认证标准

人才培养特征	核心词汇
爱国情怀和社会责任感	为国家社会服务、社会主义合格建设者和接班人、家国情怀
全球公民素养	以天下为己任、世界担当、可持续发展、胸怀寰宇
理想信念	理想信念坚定、志存高远、理想高远、信念执着
德智体全面发展	立德树人、德才兼备、身心健康、健全人格
基础扎实	宽厚基础、基础扎实
能力突出	实践能力、适应能力、专业能力
创新精神	创新精神、创新意识
国际视野	全球视野、国际视野、国际化
人文情怀	人文情怀、人文底蕴深厚
科学精神	科学素养、科学精神、崇尚科学
终身学习能力	终身学习能力

985大学的目的是培养前三级工程师

1. 自己根据消费需求预测和市场预测想出一个新概念，并且能根据它做出一个新的东西，那是顶级工程师！
2. 能根据别人的概念，做出一个新东西，算是二等工程师了；
3. 能根据别人的概念，但必须看到别人的样品的才能做出那个产品的工程师，要排在第三等了；
4. 能根据别人的概念，但必须看到别人样品，还必须看到人家的产品说明才能做出那个产品的工程师，要排在第四了；
5. 能根据别人的概念，但必须看到别人样品，看到人家的产品说明书，还必须拆开别人的产品看了才能做出那个产品的工程师，要排在第五了；
6. 能根据别人的概念，但必须看到别人样品，还必须看到人家的产品说明书，而且还必须拆开别人的产品看了才能做出那个产品的一个或几个部件的工程师，要排在第六了；
7. 能根据别人的概念，看到别人样品，看到人家的产品说明书，而且还必须拆开别人的产品看了，在别人的指导下才能做出那个产品的一个或几个部件的工程师，要排在第七了

总的来说，这就是CDIO教育



CDIO: 你的训练 Conceive Design Implementation and Operation

C—构思		D—设计		I—实施		O—运行	
使命	概念设计	初步设计	详细设计	元件制造	系统整合与测试	全生命支持	演化
商业战略	需求	需求定位	元件设计	硬件制造	系统整合	销售和铺货	系统改进
技术战略	功能	模型开发	需求确认	软件编程	系统测试	运行	产品家族
客户需求	概念	系统分析	失效和预案分析	资源	改进	物流	扩张
目标	技术	系统解构	确认设计	元件测试	取得认证	客户服务	报废
竞争	构建	界面要求			元件改进	投产	维护与维修
项目计划	平台计划				交货	回收	
商业计划	市场定位				升级		

CDIO 之 conceive

- 从市场到产品构思的战略能力
 - 做什么：产品定义的能力
 - 怎么做：发现机会的能力
 - 是否靠谱：可行性研究的能力
 - 是什么：撰写产品定义文件的能力
 - 发现并定义客户需求和规划满足需求的能力

CDIO 之 design

- 设计的八大能力（包括适应流程的能力）
 1. 建立设计环境(包括数据库、版本控制)和工具链的能力
 2. 作业分解、硬软件分解、接口定义、系统定义的能力
 3. 行为模型建模、仿真验证、功能器件定义的能力
 4. 提取器件需求、阅读器件手册、IP与器件选型的能力
 5. 数字功能模块设计的能力 / 模拟功能模块设计的能力
 6. 非功能模块设计的能力 / 模块驱动设计的能力
 7. 硬件功能集成的能力 / 搭板子的能力
 8. 软件设计、实现、集成、与优化的能力

CDIO 之 design

- 设计把控能力

1. 作业分解的均衡性（量、功能、额外引出少）
2. 分解引出的额外作业定义的正确性
3. 分块后每块作业是否真懂了
4. 分块后每块作业的实现方法是不是对
5. 集成方法的可行性（分解法的反推）
6. 验证的完备性和方法的落实（一致性完备性）

CDIO 之 implementation

- 实施的能力（在互动中培养动手能力）
 - 编代码的能力
 - 代码映射到后端（FPGA、layout）的能力
 - 功能验证规划的能力
 - bug定位和debug的能力
 - 性能验证的能力
 - 集成验证的能力

CDIO 之 operation

- 项目管理的能力（现实的计划和执行计划能力）
 - 搜集知识、建立本项目所需知识体系、知识融合的能力
 - 项目子任务分解的能力
 - 基于分解的作业完成项目计划的能力
 - 搭班子和保证项目实施力度的能力
 - 遇到问题如何分析、定位、解决问题的能力
 - 准备和掌控 brainstorm 会议和技巧的能力

CDIO 之 operation

- 价值销售的能力（基于学术的销售概念）
 - 投入产出分析的能力
 - 强调价值和定价的能力
 - 分析客户需求完成定向销售的能力
 - 售后支持和产品全生命周期管理的能力
- 应急的能力（培养性格）
 - 当走投无路时如何解套（包括通过降低标准）
 - 获得各种柳暗花明技巧

CDIO 之 operation 谁、要什么？

	客户代表	客户需求
服务	终端客户	功能需求、群体压力、价格、性能
系统	运营经理	功能、性能、灵活、价格、功耗、寿命
子系统	系统总师	接口标准、功能、性能、价格、寿命
核心芯片	系统总师	生态环境、功能、性能、价格、外需求
配套芯片	系统总师	生态环境、功能、性能、价格、接口
IP、VIP	SoC总师	生态环境、功能、性能、价格、接口
接口	SoC总师	接口标准、功能、性能、价格
无源器件	系统集成师	接口标准、功能、性能、价格

Finally, the operation of CDIO

	启动	计划	实施	监控	收尾
范围管理 scope					
时间管理 time					
功能性能管理 function & performance					
费用管理 cost and budget					
质量管理 quality & ISO9000					
人力资源管理 HR and training					
沟通管理 communication					
风险管理 risc management					
综合采购管理 logistic & purchase					
销售与服务管理 Sales and services					

批判性思维 critical thinking

- ① 分析问题
- ② 选择逻辑论点和解决方法
- ③ 评价支持证据
- ④ 找出有矛盾的观点、理论和事实
- ⑤ 找出逻辑谬误
- ⑥ 验证假设与结论

批判是否定，不是阴谋论，要建立正面阳谋的和谐社会，批判是共同提升，国内学不到，因此要出国

Oh my got! So much do I have to learn, and what shall we do

- Obviously, the university knowledge volume is much larger than that of high school
- We cannot use the highschool way of learning
- What ways shall we adapt to survive ourselves

To build a right lifestyle

Everything is up to you

	Features	High school	University
1	Much more to learn	Only for exams	For future of yourself
2	More free time	Teachers use all the time	You plan for much free time
3	Less teacher control	Method given by teachers	Youself summarise methods
4	Teaching is faster	Teach everything	Teach only important points
5	No fixed classroom	Fixed room and neighbors	Different time diff rooms
6	Time schedule free	Escape is imporssible	You can sleep for a season
7	More social activities	Prepare exam most of the time	Social atractions to kill time
8	You are adult	No time to date	Can try different girls/boys

四年享乐终身后悔，四年奋斗终身受益

It is just up to you!

Self orientation and self going!

- When you left from high school, means that you are grow up. You have right to decide things by youself, and you should decide the right things to do in 4-year short time.
- We do not have much freadom to select what you want to learn when you are already here. You already decided what to learn.
- You must love EE first. If you didn't, you need to adapt your mind and try to **love it now!**

是什么同时导致了成功和热情？北大史蛟

- 那么如何产生爱呢？我们的梦想教父乔布斯说过：绝对不要屈就于一个你不热爱的工作。问题是：我们中有多少人，知道自己全心热爱、心所向往的职业是什么吗？
- 当前一碗最流行的鸡汤是“热情理论”。根据“热情理论”，年轻人只该去做自己全心热爱、心所向往的工作。为什么呢？因为热爱带来全情投入，全情投入带来成功，即使不成功，至少是快乐的。是不是很美妙？无懈可击。
- 但热情理论需要一个前提：你要有一种天赋的热情，你得知道自己具有这种热情。因此要找到这个热情。在谷歌搜索“找到热情”(Find passion)，的结果有七亿多条。所以，找不到热情是世界性难题。在欧美只有4%的大学生具有职业相关的热情。
- 但是有个事实不容忽视：就是成功人士往往确实对自己的事业抱有莫大的热情，这又如何解释？是热情导致了成功？还是成功导致了热情？
- MIT 的 Carl Newport 博士认为这是一个遗漏变量问题。其实是有第三方因素同时导致了成功和热情。这个因素是什么呢？是精通，是你对自己职业技能的精通。你达到大师级的水准，就会有信心和成就感，成功和热情也就随之而来。
- 从今天起，好好学习，天天向上！你精通了，你就爱了！

Self orientation and self going!

- In high school, you are told to do things
- In university, you plan for yourself
 - You may have happy and lazy time in four years
 - You may work hard and build your lifestyle
- It is just up to you! The life is yours
- What you should learn: lifetime learning skill
 - 养成习惯。It is a discipline. To train it every day
 - Gradually, you get it. You will succeed

Step 1 of lifetime learning skill

- Learn actively by yourself, not passively from teachers 我不相信弯道超车，唯有磨炼
- How to
 - preview it before a class (quickly go through it)
 - interactively participate a class (critically)
 - use multimedia: record / replay Audio & Video
 - review after a class (the diff from my pre-view)
 - prepare for lab work (beyond lab instruction)
 - solve your homework (to accumulate your skills)

Preview: prepare a lesson

- After homework of the previous class, you quickly read through the text of the next class, and answer following questions
- 哪是哪儿: 物理概念、概念推导过程、概念正确性证明、教学强化技巧、教材噱头(图森破跳过不看)、例题手法、难点、质疑、通过预习发现那些看不懂的, 从而准备听课的重点list。
- What are the physical concepts, the process of concept deduction, mathematical correctness proofs of the concepts, the strengthening skills, the gimmicks, the examples, the difficulties, and questions。
 - What are key concepts, the 1st important thing is the physical understanding
 - Where are concepts from (math or physics)
 - What are ways to prove the concept's correctness
 - Do I believe it, if no, what are my questions, make a Q-list!
- Carefully read the part I did not understand. List questions to ask
- Quickly go through examples, just note what's that

Actively, not passively participation

- To actively participate a class with prepared notes
 - For parts you already understood, lessen with critisize
 - For parts you did not understand, understand while lessening, and try to know why you did not understand
- To learn how to make questions
 - Formulate Qs exactly, & briefly. To ask questions in Elglish is the best way to build communication skills
- You cannot concentrate in all 45m, record audio or video!

Self and reinforcement learning

- 自我强化学习
- Reinforcement will enhance your understanding and memory
- How many reinforcement methods
 - 做笔记： 预习笔记、听课笔记、课后笔记、作业笔记、实验笔记。
It is just up to you! 自己找规律，检查笔记是否有用，改进笔记技巧！
 - 讨论： 物理概念、数学描述、语言建模、值域、局限性
 - 实验： 自己每年根据 CDIO 流程做一件事，我们为你们建立条件

Step 2 of lifetime learning skill

- You already succeed if you passed step 1 in one year
- The next step is to try to pass a course or a text book by yourself (lucky if you have a mentor)
 - How to select a text book which is suitable for you
 - Why should I learn the book, what do I really want
 - Is the book really a book suitable for me
 - Do I have suitable pre-knowledge to learn the book
 - How to plan for reading (goal, time/pace plan, ways)
 - How to find key points and manage homework
 - How to diagnose the quality of my self-reading

Step 3 plan the life for yourself

- Do you know whom you are? What do you love to do?
- Do you want to be an expert, a manager, or a professor
 - 政治家、总师专家、企业家、教育家、科学家、外交家
- Let us know & we will guide you to fulfill your dream
- However, what you really need to train yourself are:
 - **思的能力:** 系统思维、逻辑思维、辩证思维、创新思维、培养CT (critical thinking)
 - **行的能力:** 主动(首先是习惯)、理解力、建模力、设计力、验证力、推动力、协调力、创新力

Impact of dormitory group culture

- You are lucky.
 - You experienced in the academy culture 书院文化
 - You got more contact and knew other programs
- But, your dormitory culture is heterogeneous
 - Some of you might enjoy stimulating cultuer
 - Some of you might be suffered in the vulgar culture
- You need to build and influence the culture
 - 物质文化 (**set-up, and share facilities properties**)
 - 制度文化 (宿舍规章制度的合理性、完备性、和执行的力度)
 - 行为文化 (学习、娱乐、消遣、交往、守法、不妨碍他人)
 - 核心文化 (观念文化、判断是非、理想、追求、价值观)

Impact from class group culture

- The impact on....from the group of our EEinE program
- The class group culture
 - 管理制度
 - 凝聚力
 - 建立正面文化
 - 人人共同努力
 - 补偿无统一宿舍文化带来的问题
- I love you and the university bless you!

To avoid

- 越来越多的机会会在网上或手机中看新闻或阅读自己感兴趣的信息，这也往往带来这样的结果：原本计划看一小会儿休息而已，但新闻太吸引了从而由入“迷”而忘返，占用大量时间
- Game fan, or game addicted
- Hormone controlled

五大家，你将是哪方大神

政治家 politician 来自百度

- Two kinds of: 政治家 和 政客
 - 政治家: 具有远见和才干、掌握权力并对社会历史发展起着重大影响作用的领导人物
 - 政客: 以政治活动为职业, 为本集团或个人某种政治需要而搞政治投机、玩弄政治权术的人
- Requirement, 权力行使正确, 精于领导艺术, 善于识人用人, 总揽全局思路, 记忆能力超人, 粗懂各种业务, 善于分析社会, 理论颇有建树
- Personality, 有魅力, 有从政与获得权力的欲望, 有对工作和事业的热情, 有坚强的意志超常的自信, 举止得体, 言语清晰, 干脆果敢。

总师专家

- Two kinds of: 总师专家
 - 专 Expert: knows almost all in detail in a specific area
 - 宽 Principle: knows a lot related to a product domain
- Requirement, 学习、分析、观察、创造、实践、计划、沟通、协调、管理的能力
- Personality, 热爱所管理的产品和项目、作风严谨、品格优秀、敬业、勤奋、包容
- 清华做官、北大坐牢、北理做工匠(出总师)。

企业家

- Two kinds of: Manager, Owner and Entrepreneur
 1. 一类是企业所有者并从事企业的经营管理工作
 2. 另一类是受雇于所有者的职业企业家
- Requirement, 情熵、智熵、胆熵、抓住机会的能力、统领全局的能力、用人的能力、富有远见、人脉好、制度制定和执行力、资金掌控力、
- Personality, 为人正直、远见卓识、懂资本运作、有冒险精神、管理能力强、沟通能力强、懂一些业务

教育家

- 通过亲力亲为的教育实践创造出重大教育业绩，对教育思想和实践产生重要影响的优秀教育工作者
- Requirement: 有自己的教育思想，独特的教学方法，丰富的教育实践，敢于人先创造精神，完善的人格。
- Personality(此定义太抽象，我的定义：诚实、耐心、博学):
 - 学生以教育家人格为榜样，在教育过程中，教师通过其人格魅力来点燃和唤醒学生学知学做和学会的能力。学高为师、身正为范。
 - 人格魅力：循循善诱、为人师表、以身作则、诲人不倦、注重方法、教学相长、与时俱进、终身学习。友善尊重、仁慈宽容、耐心、兴趣广泛、品德高尚、注重仪表、公正坦率、有幽默感

科学家

- 对常人不知之事知之颇多之人
- Requirement:
 - 观察敏锐：注意瞬间或异常现象，并与已知之事关联思索，得到普通人见不到的观察与定论。
 - 好奇心强：关注研究问题的各个有关方面，不断地去摸索。
 - 大胆想象：乐意试用新的观点和方法。
 - 真实客观：思想活跃，接受批评和采纳建议、亦提及前人的贡献。
 - 聪明理智：能形成独立的主见和建立方法。
 - 小心谨慎：应根据控制条件和统计分析陈述结论，要有实据。
 - 训练有素：能胜任他所承担的研究领域以及有关的研究领域。
 - 合乎情理：用有限的人力与物质源探索限度内的领域。
 - 精确诚实：真实报告结果，正反两方面的资料都拿出来。
 - 长期坚持：对复杂的事或困难问题长期地坚持追踪，直到水落石出

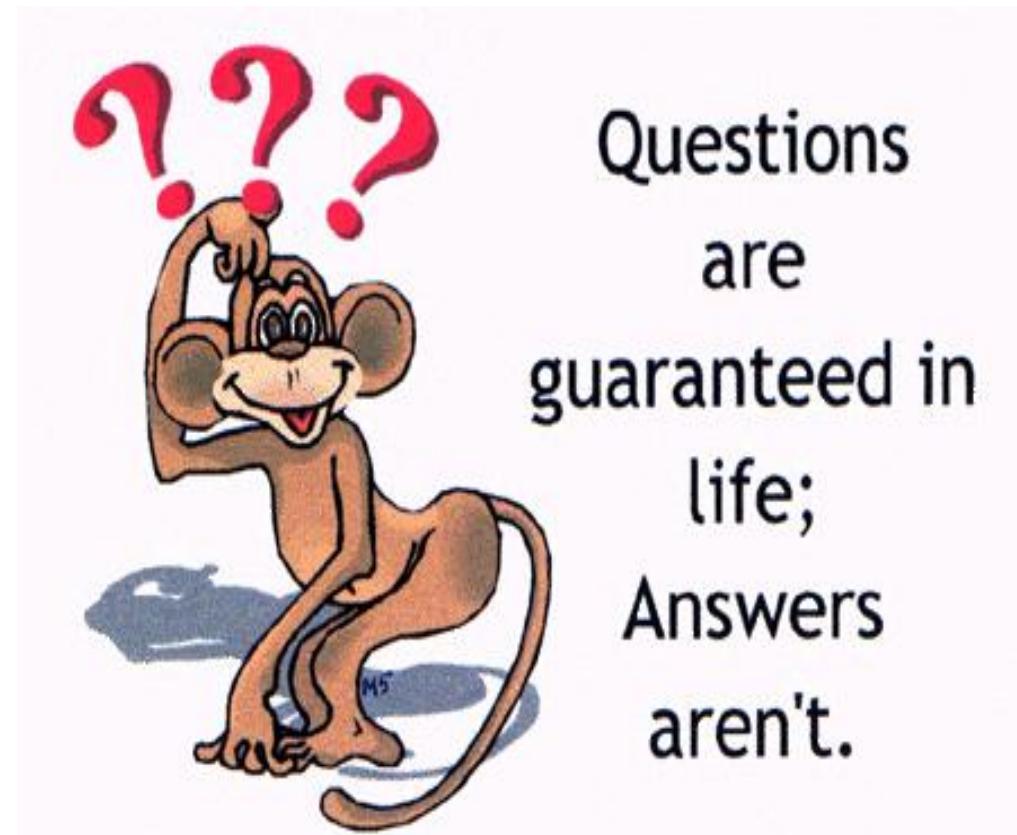
Summary of 4-year study

1. Requirements adapt to complex system
2. The differences between high school
and university
3. CDIO based learning
4. Establish a selfgoing lifestyle



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Questions
are
guaranteed in
life;
Answers
aren't.

To speak in real English, and manage intercultural impacts (Part 4 of the course)



One of the essential skill is.....



1. Internationalization needs your skills in English
2. If you want to go abroad, you have to speak in English
3. If you want to get a master degree, you have to write in English

通用就业能力 employ ability profile

1. Lifetime learning ability 学习能力
2. Discipline and skills 专业知识和技能
3. Knowledge coverage 知识面
- 4. English skills 外语水平**
5. Cooperative 合作精神
6. Responsibility 责任感
7. Managements 社会实践与管理能力
8. Innovative 科研创新能力
9. Attitude 工作态度

通用就业能力的要求程度从 7 到 1

就业能力	高新技术企业		中低技术企业	
	均值	标准差	均值	标准差
学习能力	5.8447	1.05213	4.2651	1.03963
专业知识和技能	5.4783	.87383	6.2229	.80436
知识面	5.7702	1.05622	2.7771	1.08643
合作精神	5.2360	1.02174	5.0602	1.13190
责任感	6.1988	.75680	6.3253	.75652
社会实践	3.9379	.82681	4.0602	.74426
科研创新能力	6.2547	.79278	4.0301	.86986
外语水平	5.1491	1.03206	2.7530	.94988
工作态度	5.6398	.84818	5.6024	.78532

对人的素质要求高，对实践能力要求不是最高
团队协作、沟通技巧、职业精神、职场礼仪

Intercultural communication

- Culture determines how individuals encode messages, and the way messages are interpreted (could be different)
- Aside from language, intercultural communication is on social attributes and different cultures of thinking
- In communication between people in the same culture, received messages are interpreted based on known values, beliefs, and expectations.
- When messages received from different culture, receiver uses his/her culture / information to interpret messages. The interpret results might be very different from what the speaker intended.

跨文化（共同语言）沟通

- 不同文化背景的人之间发生的沟通行为。因为地域不同、种族不同等因素导致文化差异，因此，跨文化沟通可能发生在国际间，也能发生在（国内的）不同的文化群体（比如老幼）之间。
- 一个文化包括：交流与语言、自我意识与空间、衣着与打扮、食品与饮食习惯、时间与时间意识、季节观念、人际关系、价值观、规范、信仰、态度、思维过程、工作习惯与实践等。
- 所谓跨文化沟通，发生在：信息的发出者是一种文化的成员，而接受者是另一种文化的成员。

职场英语能力 skills in English

- 英语进行交流的能力，可分为英语资料理解能力，英语e-mail阅读与回应能力，英语电话沟通能力，英语报告撰写能力，英语会议报告阐述能力，参与国际会议能力
- Your communication skill in English, including reading and reply emails, communications on phone, writing reports / specifications in English, presentation skills in English, and conference participation skills.
- **However, can you do it in Chinese !!!!!!!**

Skills using english language

- How to read in english for mathematical symbols, formulas, circuits, flowcharts, tables, and programs
- How to speak English
 - What are inter cultrual impacts (you both speak in english yet you do not understand each other)
 - Think in English (after much reading in English), not Chianglish
 - How to speak and write logically

Reading and reply emails in English

- Is that easy? I donnot think so!
- To build your skill by reading multiple times, making notes, and understand the real meaning behind the language in English
- Write reply in a draft buffer (text editor), do not press reply button until you are really sure that your reply is correct, accurate, and brief
- Your boss will know you through reading your emails.

Communications on Phone

- In a conference phone meeting, speakers on another side speak fast, with strong local accent
 - I1: I am dirty
 - I2: I am dirty-too
- You should realize that there are two Indians
 - I1: I am thirty
 - I2: I am thirty-two
- This is not a jock. Communication is not easy. The only way to survive is to get experienced!

Write report / specifications in English

- I will give you many examples to write in English
 - However, can you write in Chinese? Possibly not!
- Chinese understand your English and English do not! Why, intercultural impact! What is that?
 1. Chinese style: imply something, as you know.
 2. English style: logically illustration explicitly
 1. Chinese words: romantically
 2. English words: accurately
- You did not learn how to write logically report in highschool at all, that is true unfortunately!

Presentation skills in English

- Can you make yourself understood?
 - 把自己的意思表达清楚
 - Maybe, may be not
- In the following examples, I will offer some **Chinglish** examples.

Speak English not Chianglish

Do you speak English? Yes I do! Sometimes ...

• What blocks your communications – Think in Chinese and speak in English

- 我欲九死犹未悔 I would rather die than surrender
- The translator for the prime minister said: I would happy to die nine times..... (总理病的不轻)
- What is the problem here? What should we do!
- We need to know the real meaning behind roman 我绝不退缩. Remember: no roman, be accurate, and be mechanics

• How to translate a poem from Chinese to English: to write a poem under the local culture!

Speak in English

Do you speak English? Yes I do! Sometimes ...

- What blocks your communications – Wrong translation
 - 大学党委书记 Committee Secretary of CCP of the university
 - Chairman on board of the university 是老大, 不是一个社团秘书

汉语	误译	正译
温馨提示	Warm prompt	Please note
大雨	big rain	heavy rain
肤浅	skin shallow	superficial
黑啤酒	black beer	dark beer
眼红	be red-eyed	be green-eyed
领导水平	leadership level	art of leadership
交际花	social flower	social butterfly
红茶	Red tea	Black tea
这是我的书	The book is my book	The book is mine

Speak English

Do you speak English? Yes I do! Sometimes ...

- What blocks your communications – ambiguity
 - 二义性在英文是常见的问题，英国人常拿来开玩笑
 - A: How long it takes from Edinburgh to London, B: A secod, A: Thanks!
- Ambiguity happens rather often such as
 - Simulation results demonstrate that the proposed scheme outperforms its counterpart, and **it** can approach the performance bound. 这里 **it** 可以是 counterpart，也可以是scheme。
- It should be
 - Simulation results demonstrate that the proposed scheme outperforms its counterpart, and **the scheme** can approach the performance bound.

Speak English using right words

Do you speak English? Yes I do! Sometimes ...

•What blocks your communications – Wrong words

- It is uneasy (心神不安) for the children to do such a thing
- China policy 对华政策 (不是“中国政策”)
- Chinese dragon 麒麟 (不是“中国龙”)
- American beauty 一种玫瑰, 名为“美国丽人” (不是“美国美女”)
- English disease 软骨病 (不是“英国病”)
- Indian summer 愉快宁静的晚年 (不是“印度的夏日”)
- Greek gift 害人的礼品 (不是“希腊礼物”)
- Spanish athlete 吹牛的人 (不是“西班牙运动员”)
- pull one's leg 开玩笑 (不是“拉后腿”)
- in one's birthday suit 赤身裸体 (不是“穿着生日礼服”)
- eat one's words 收回前言 (不是“食言”)

Speak English using right words

Do you speak English? Yes I do! Sometimes ...

•What blocks your communications – Wrong words

- an apple of love 西红柿（不是“爱情之果”）
- handwriting on the wall 不祥之兆（不是“大字报”）
- bring down the house 博得全场喝彩（不是“推倒房子”）
- make one's hair stand on end 令人毛骨悚然—恐惧（不是“令人发指——气愤”）
- be taken in 受骗，上当（不是“被接纳”）
- think a great deal of oneself 高看或看重自己（不是“为自己想得很多”）
- pull up one's socks 鼓起勇气（不是“提上袜子”）
- have the heart to do （用于否定句）忍心做……不是“有心做”或“有意做”）
- What a shame! 多可惜！真遗憾！（不是“多可耻”）
- You don't say! 是吗！（不是“你别说”）
- You can say that again! 说得好！（不是“你可以再说一遍”）
- I haven't slept better. 我睡得好极了。（不是“我从未睡过好觉”）

Speak English logically

Do you speak English? Yes I do! Sometimes ...

- What blocks your communications – illogical
 - Robust performance – Robust 不能修饰 performance
 - Higher performance and robust design
 - Being qualified and to do the best 并列的词性不同
 - To be qualified and to do the best
 - Our result is much better than others 事和人在比较
 - Our measured performance is 20% better than the score of 2016[1]
 - Chinglish: remember you forever
 - Always remember you (语言不逻辑, 没有人能活到 forever)
 - Discussions between our group members (among)

Speak English logically

Do you speak English? Yes I do! Sometimes ...

- What blocks your communications – illogical
 - A subtitle: Existing schemes for inter-cell **interference** and mobility management 摘自清华大作：注意，中文本身的不严谨！
 - 至少应该是: Existing schemes for inter-cell **interference control** and mobility management
 - 最好是: Existing schemes **to against** inter-cell **interference** and **to promote** mobility management

Speak English logically

Do you speak English? Yes I do! Sometimes ...

• What blocks your communications – illogical

- *Abstract* As wireless communication standards are varied, baseband chips for base stations and mobile handsets have to support multiple standards (2G/3G/4G/WLAN/ WiMAX/5G) to realize seamless communication. Forward error correction (FEC) decoder is an important module of a baseband system, which takes up 40% of baseband computation load [o1] to improve communication reliability. FEC decoders must achieve 10-100 GOP/s [m1] within strict budgets for power/silicon area, and must support multiple FEC codes for different communication standards . These bring great challenges for designing FEC decoders 大家看看有多少个错？都是什么错？

Speak English logically

Do you speak English? Yes I do! Sometimes ...

• What blocks your communications – illogical

- *Abstract* As wireless communication standards are varied (一次性动做), (是递进还是并列, 逻辑混乱) baseband chips for base stations and mobile handsets have to support multiple standards (包括 2G/3G/4G/WLAN/WiMAX/5G) to realize seamless(错词) communication. Forward error correction (FEC) decoder is an important module of a baseband system, which (二义性, 可引FEC decoder也可引 baseband system) takes up 40% of baseband computation load [o1] to improve communication reliability(错词). FEC decoders must achieve 10-100 GOP/s [m1] within strict (错词) budgets for power/silicon area (并列表达错), and must support multiple FEC codes for different communication standards . These bring great challenges for designing FEC decoders.

Speak English logically

Do you speak English? Yes I do! Sometimes ...

• What blocks your communications – illogical

- *Abstract* As wireless communication standards **keep changing, and** baseband chips for base stations and mobile handsets have to support multiple standards (**including 2G/3G/ 4G/WLAN/WiMAX/5G**), **flexibility for a communication baseband processor is thus essential**. Forward error correction (FEC) decoder, as a part of a baseband processor, is an important module **taking** up 40% of baseband computation load [o1]. FEC decoders must achieve 10-100 GOP/s [m1] within **stringent budgets of power, silicon, and silicon area**, and must support multiple FEC **algorithms** for different communication standards . These bring great challenges for designing FEC decoders.

Speak English logically

Do you speak English? Yes I do! Sometimes ...

- What blocks your communications—Key word appear earlier
 - Enhancements to intra-cell and inter-cell interference mitigation 缓解 at the receiver side by increasing the degree of knowledge about interfering transmissions with possible coordination in the network have been studied in LTE Release 12
 - 此句话被我完全重写成: It has been studied in LTE Release 12, that the intra-cell and inter-cell interference can be mitigated at the receiver side thanks to the exposing of the interference transmission through possible network coordination
- 结论: 写完一句话, 仔细读一遍, 要保证逻辑顺序和准确性

Speak English logically

Do you speak English? Yes I do! Sometimes ...

- What blocks your communications—Key word appear earlier
 - The handover performance in terms of the handover frequency and the handover failure rate for different RUs in case of one CRS port is shown in Fig.6 and Fig.7, respectively.
 - 我重写成： The handover performance is shown in Fig.6 and Fig.7, respectively. The performance is measured, for different RUs in case of one CRS port, based on the handover frequency and the handover failure rate.
- 注意我的断句、顺序的调节、和逗号的使用，用你的直觉和语感来体验。结论：越早在造句上花功夫，英语提升的就越快。

Please do not use funny English

- 1. we two who and who?
- 2. how are you ? how old are you ?
- 3. you don't bird me,I don't bird you
- 4. Government abuse chicken
- 5. You Give Me Stop! 你给我站住!
- 6. watch sister 表妹
- 7. take iron coffee 拿铁咖啡
- 8. American Chinese not enough
- 9. Where cool where you stay
- 10. heart flower angry open 心花怒放
- 11. want money no; want life one!
- 12. People mountain and people sea.
- 13. let the horse come on 放马过来
- 14. I give you face you don't wanna face
- 15. red face know me 红颜知己
- 16. seven up eight down 七上八下
- 17. no three no four 不三不四
- 18. you try try see ! 你试试看 !
- 19. love who who 爱谁谁
- 20. look through autumn water 望穿秋水
- 21. May I borrow your light? 借光
- 23. Handsome Year, Morning Die
- 24. king eight eggs 王八蛋
- 25. no care three seven twenty one
- 26. go and look 走着瞧
- 27. poor light egg 穷光蛋
- 28. ice snow clever 冰雪聪明
- 29. horse horse tiger tiger 马马虎虎
- 30. you me you me 彼此彼此
- 31. watch sisiter 表妹

Reading circuits, mathematical formulas, and tables in English

Do you speak English? Yes I do! Sometimes ...

- Read circuits, mathematical formulas, and tables in English is essential skill during discussions with international people (not with foreigners)
- Let us do it together

Mathematical symbols in English

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

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

Methematical symbols

Symbol	What it is	How it is read	Sample expression
+	Addition sign Logical OR symbol	... plus or ...	$3 + 5 = 8$ $\neg(A + B) = \neg A * \neg B$
*	Multiplication sign Logical AND symbol	... times and ...	$3 \times 5 = 15$ $\neg(A * B) = \neg A + \neg B$
x	Multiplication sign	... times ...	$3 \times 5 = 15$
·	Multiplication sign	... times ...	$3 \cdot 5 = 15$
Σ	summation sign	The summation of ...	$\sum_{n=1}^{\infty} \frac{1}{n}$

Methematical symbols

\int	Integral sign	The integral of ...	$\int x^2 dx = x^3/3 + c$
\iint	double integral sign	The double integral of ...	$\iint f(x,y) dx dy$
\iiint	Triple integral sign	The triple integral of ...	$\iiint f(x,y,z) dx dy dz$
\oint	Line integral sign	The line integral of ...	$\oint \mathbf{F} \cdot d\mathbf{x}$
\iint_s	Surface integral sign	The surface integral of ...	$\iint_s F(x,y,z) dx dy$
-	Subtraction sign Minus sign	... minus ... Negative...	$3 - 5 = -2$
\pm	Plus/minus sign	... plus or minus ...	$500 \text{ kbps} \pm 10\%$

Methematical symbols

-	Subtraction sign Minus sign	... minus ... Negative...	$3 - 5 = -2$
\pm	Plus/minus sign	... plus or minus ...	500 kbps \pm 10%
\cdot	dot product sign	... dot ...	$\mathbf{A} \cdot \mathbf{B} = \mathbf{B} \cdot \mathbf{A}$
\times	Cross product sign	... cross ...	$\mathbf{A} \times \mathbf{B} = -(\mathbf{B} \times \mathbf{A})$
\prod	Product sign	The product of ...	$\prod_{n=1}^{\infty} \frac{1}{n}$
\wedge	Carat	... to the power of ...	$2 \wedge 5 = 32$
!	Exclamation	... factorial, 阶乘	$5! = 120$

Methematical symbols

$\sqrt[n]{\cdot}$	surd	... root of ...	$z = \sqrt[n]{x + y}$
$\sqrt{\cdot}$	square root symbol	The square root of ...	$\sqrt{4} = \pm 2$
...	Continuation sign	... and so on up to and so on indefinitely	$S = \{1, 2, 3, \dots\}$
/	Slash	... divided by over ...	$3/4 = 0.75$
÷	Division sign	... divided by ...	$3 \div 4 = 0.75$
%	Percent symbol	... percent ...	$0.032 = 3.2\%$
$\%$	Per mil symbol	... per mil ...	$0.032 = 32\text{\textperthousand}$
::	Double colon	... averaged with ...	$3 :: 11 = 7$

Methematical symbols

∞	lemniscate 纽线	... infinity ... increases without limit	$\forall x : x < \infty$
()	Parentheses	... quantity... ... list... ... set of coordinates... ... open interval	$(x+y)+z$ (a_1, a_2, a_3, a_4) (x,y,z) $(3,5)$
[]	Square brackets	... the quantity the closed interval ...	$w + [(x+y)+z]$ $[3,5]$
(]	Hybrid brackets	... the half-open interval ...	$(3,5]$
[)	Hybrid brackets	... the half-open interval ...	$[3,5)$
{ }	Curly brackets	... the quantity the set ...	$E = \{2, 4, 6, 8, \dots\}$
=	Equal sign	... equals ...	$-(-5) = 5$ $2z^2 + 4z - 6 = 0$

Methematical symbols

\propto	proportionality sign	... is proportional to ...	$x \propto y$
\sim	Similarity sign	... is similar to ...	$\triangle ABC \sim \triangle DEF$
\approx	Approximate equal sign	... is approximately equal to ...	$x + y \approx z$
\neq	Inequality sign	... is not equal to ...	$x \neq y$
$<$	Inequality sign	... is less than ...	$3 < 5$ $x < y$
\leq	Inequality sign	... is less than or equal to is at most equal to ...	$x \leq y$

Methematical symbols

>	Inequality sign	... is greater than ...	$5 > 3$ $x > y$
\geq	Inequality sign	... is greater than or equal to ...	$x \geq y$
$ $	absolute value sign	The absolute value of ...	$ -3 = 3$
Δ	increment sign, Triangle symbol	the change in ... triangle ...	$m = \Delta y / \Delta x$ $\Delta ABC = \Delta DEF$
\perp	Perpendicularity symbol 垂直	... is perpendicular to ...	$L \perp M$
$//$	Parallel symbol	... is parallel to ...	$L // M$
\angle	angle symbol	Angle ...	$\angle ABC = \angle DEF$

Methematical symbols

\Rightarrow	logical implication symbol 逻辑蕴涵	... implies ... If ... then ...	$A \Rightarrow B$
\Leftrightarrow	logical equivalence symbol	... is logically equivalent to if and only if ...	$A \Leftrightarrow B$
\therefore	Three dots	... therefore it follows that ...	$x = y \text{ and } y = z$ $\therefore x = z$
\in	Element-of symbol	... is an element of a set ...	$a \in A$
\notin	Not-element-of symbol	... is not an element of a set ...	$b \notin A$

Methematical symbols

\subseteq	Subset symbol	... is a subset of ...	$A \subseteq B$
\subset	Proper subset symbol	... is a proper subset 真子集 of ...	$A \subset B$
\cup	Union symbol	联合, 或 ... union ...	$A \cup B = B \cup A$
\cap	Intersection symbol	相交, 交集 ... intersect intersected with ...	$A \cap B = B \cap A$
\emptyset	Null symbol	The null set The empty set	$\emptyset = \{ \}$
$^\circ$	Degree symbol	... degree(s)	$\theta = 45^\circ$ $T = +20^\circ C$

Methematical symbols

θ	Greek theta (lowercase)	... theta ...	$\theta = 90^\circ$
λ	Greek lambda (lowercase)	... lambda ...	$\lambda = 70 \text{ cm}$ $\lambda = 3:1$
μ	Greek mu (lowercase)	micro- (10^{-6})	$C = 0.001 \mu\text{F}$
π	Greek pi (lowercase)	... pi ...	$\pi \approx 3.14159$
Ω	Greek omega (uppercase)	... omega ...	$R_2 = 330 \Omega$
ω	Greek omega (lowercase)	... omega ...	$\omega = 36,000 \text{ rad/s}$ $\omega = 1/60 \text{ s}$

Circuit symbols in English

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

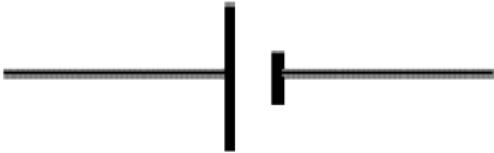
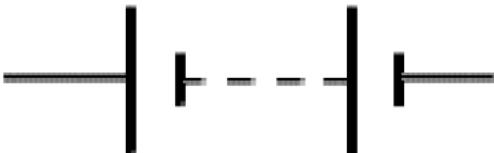


Circuit symbols

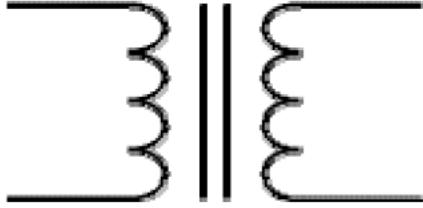
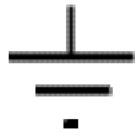
Wires and connections

Component	Circuit Symbol	Function of Component
Wire		To pass current very easily from one part of a circuit to another.
Wires joined		A 'blob' should be drawn where wires are connected (joined), but it is sometimes omitted. Wires connected at 'crossroads' should be staggered slightly to form two T-junctions, as shown on the right.
Wires not joined		In complex diagrams it is often necessary to draw wires crossing even though they are not connected. I prefer the 'bridge' symbol shown on the right because the simple crossing on the left may be misread as a join where you have forgotten to add a 'blob'!

Circuit symbols

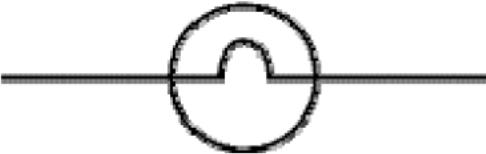
Power Supplies		
Component	Circuit Symbol	Function of Component
Cell		<p>Supplies electrical energy. The larger terminal (on the left) is positive (+). A single cell is often called a battery, but strictly a battery is two or more cells joined together.</p>
Battery		<p>Supplies electrical energy. A battery is more than one cell. The larger terminal (on the left) is positive (+).</p>
DC supply		<p>Supplies electrical energy. DC = Direct Current, always flowing in one direction.</p>

Circuit symbols

AC supply		Supplies electrical energy. AC = Alternating Current, continually changing direction.
Fuse		A safety device which will 'blow' (melt) if the current flowing through it exceeds a specified value.
<u>Transformer</u>		Two coils of wire linked by an iron core. Transformers are used to step up (increase) and step down (decrease) AC voltages. Energy is transferred between the coils by the magnetic field in the core. There is no electrical connection between the coils.
Earth (Ground)		A connection to earth. For many electronic circuits this is the 0V (zero volts) of the power supply, but for mains electricity and some radio circuits it really means the earth. It is also known as ground.

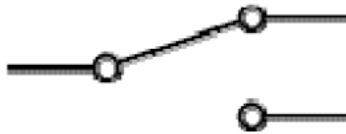
Circuit symbols

Output Devices: Lamps, Heater, Motor, etc.

Component	Circuit Symbol	Function of Component
Lamp <u>(lighting)</u>		A transducer which converts electrical energy to light. This symbol is used for a lamp providing illumination, for example a car headlamp or torch bulb.
Lamp <u>(indicator)</u>		A transducer which converts electrical energy to light. This symbol is used for a lamp which is an indicator, for example a warning light on a car dashboard.
Heater		A transducer which converts electrical energy to heat.
Motor		A transducer which converts electrical energy to kinetic energy (motion).

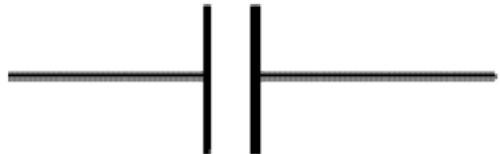
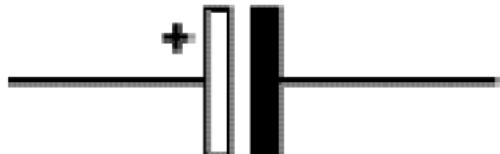
Circuit symbols

Switches

Component	Circuit Symbol	Function of Component
<u>Push Switch</u> (push-to-make)		A push switch allows current to flow only when the button is pressed. This is the switch used to operate a doorbell.
<u>Push-to-Break Switch</u>		This type of push switch is normally closed (on), it is open (off) only when the button is pressed.
<u>On-Off Switch</u> (SPST)		SPST = Single Pole, Single Throw. An on-off switch allows current to flow only when it is in the closed (on) position.
<u>2-way Switch</u> (SPDT)		SPDT = Single Pole, Double Throw. A 2-way changeover switch directs the flow of current to one of two routes according to its position. Some SPDT switches have a central off position and are described as 'on-off-on'.

Circuit symbols

Capacitors

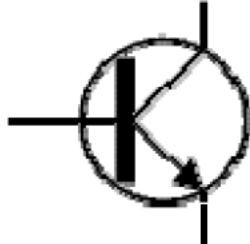
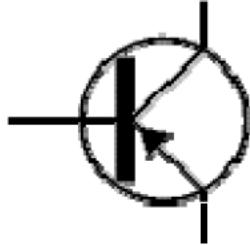
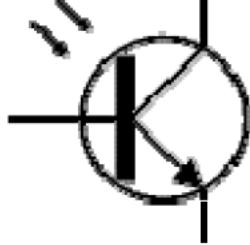
Component	Circuit Symbol	Function of Component
<u>Capacitor</u>		A capacitor stores electric charge. A capacitor is used with a resistor in a timing circuit. It can also be used as a filter, to block DC signals but pass AC signals.
<u>Capacitor, polarised</u>		A capacitor stores electric charge. This type must be connected the correct way round. A capacitor is used with a resistor in a timing circuit. It can also be used as a filter, to block DC signals but pass AC signals.
<u>Variable Capacitor</u>		A variable capacitor is used in a radio tuner.

Circuit symbols

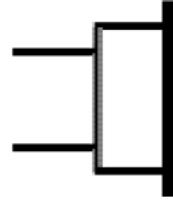
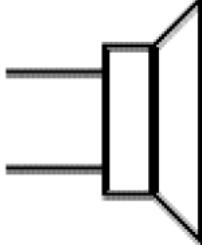
Diodes

Component	Circuit Symbol	Function of Component
<u>Diode</u>		A device which only allows current to flow in one direction.
<u>LED</u> Light Emitting Diode		A transducer which converts electrical energy to light.
<u>Zener Diode</u>		A special diode which is used to maintain a fixed voltage across its terminals.
Photodiode		A light-sensitive diode.

Circuit symbols

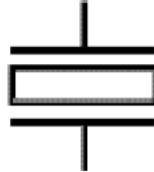
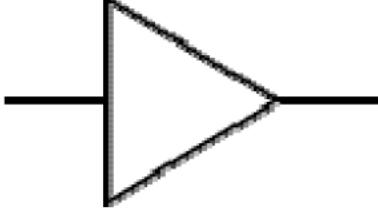
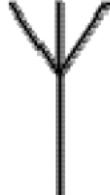
Transistors		
Component	Circuit Symbol	Function of Component
Transistor NPN		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit.
Transistor PNP		A transistor amplifies current. It can be used with other components to make an amplifier or switching circuit.
Phototransistor		A light-sensitive transistor.

Circuit symbols

Audio and Radio Devices		
Component	Circuit Symbol	Function of Component
Microphone		A transducer which converts sound to electrical energy.
Earphone		A transducer which converts electrical energy to sound.
<u>Loudspeaker</u>		A transducer which converts electrical energy to sound.

Circuit symbols

Audio and Radio Devices

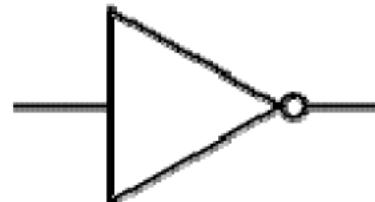
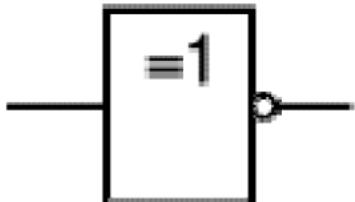
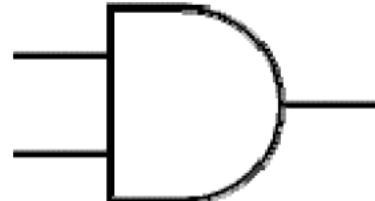
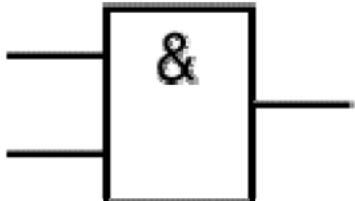
<u>Piezo Transducer</u>		A transducer which converts electrical energy to sound.
Amplifier (general symbol)		An amplifier circuit with one input. Really it is a block diagram symbol because it represents a circuit rather than just one component.
Aerial (Antenna)		A device which is designed to receive or transmit radio signals. It is also known as an antenna.

Circuit symbols

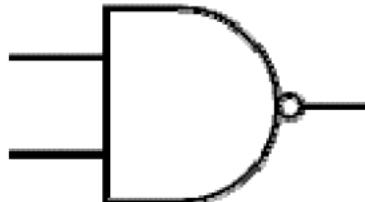
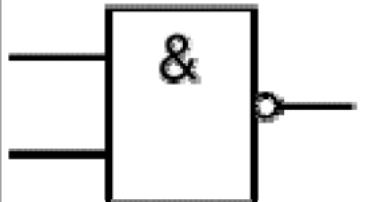
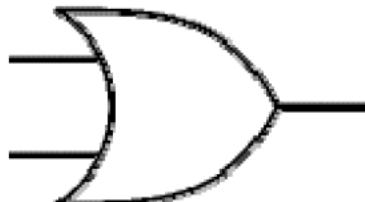
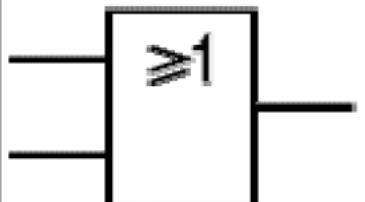
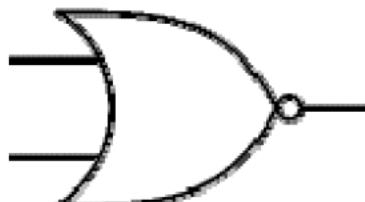
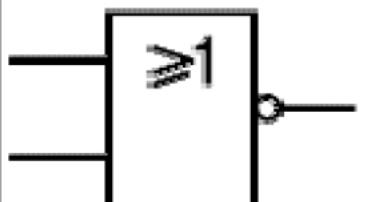
Meters and Oscilloscope

Component	Circuit Symbol	Function of Component
<u>Voltmeter</u>		A voltmeter is used to measure voltage. The proper name for voltage is 'potential difference', but most people prefer to say voltage!
<u>Ammeter</u>		An ammeter is used to measure current.
<u>Galvanometer</u>		A galvanometer is a very sensitive meter which is used to measure tiny currents, usually 1mA or less.
<u>Ohmmeter</u>		An ohmmeter is used to measure resistance. Most multimeters have an ohmmeter setting.
<u>Oscilloscope</u>		An oscilloscope is used to display the shape of electrical signals and it can be used to measure their voltage and time period.

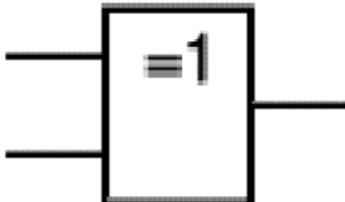
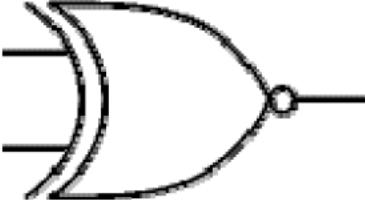
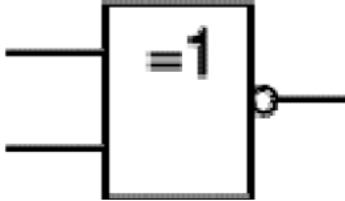
Logic circuit symbols

Gate Type	Traditional Symbol	IEC Symbol	Function of Gate
<u>NOT</u>			A NOT gate can only have one input. The 'o' on the output means 'not'. The output of a NOT gate is the inverse (opposite) of its input, so the output is true when the input is false. A NOT gate is also called an inverter.
<u>AND</u>			An AND gate can have two or more inputs. The output of an AND gate is true when all its inputs are true.

Logic circuit symbols

<u>NAND</u>			A NAND gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a <u>Not AND</u> gate. The output of a NAND gate is true unless all its inputs are true.
<u>OR</u>			An OR gate can have two or more inputs. The output of an OR gate is true when at least one of its inputs is true.
<u>NOR</u>			A NOR gate can have two or more inputs. The 'o' on the output means 'not' showing that it is a <u>Not OR</u> gate. The output of a NOR gate is true when none of its inputs are true.

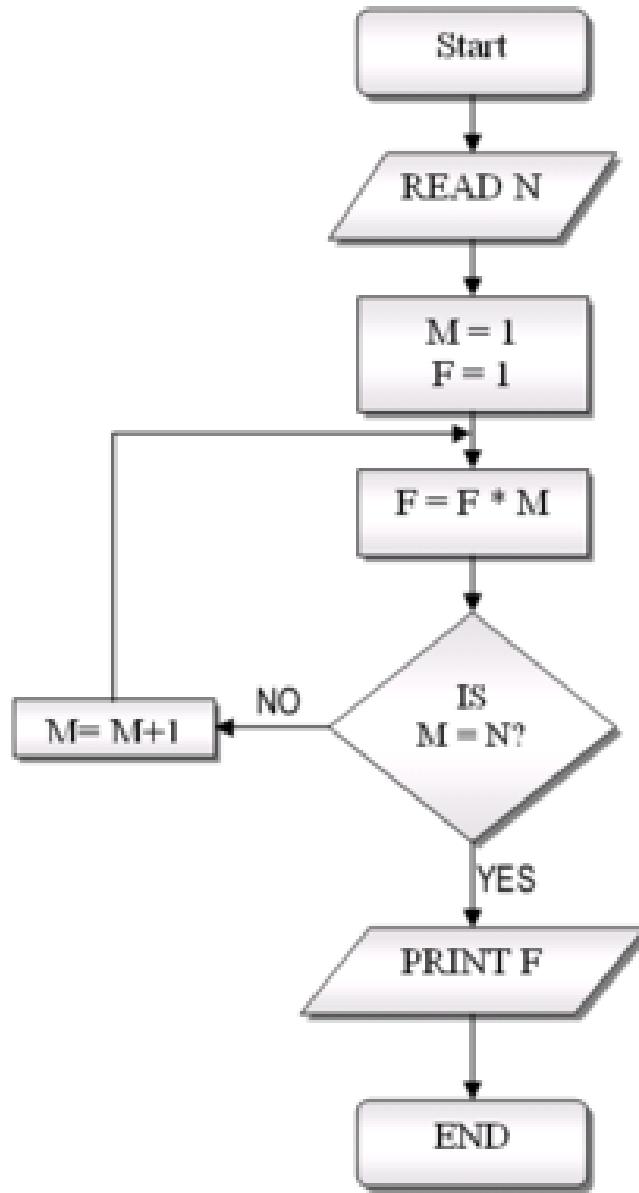
Logic circuit symbols

<u>EX-OR</u>			An EX-OR gate can only have two inputs. The output of an EX-OR gate is true when its inputs are different (one true, one false).
<u>EX-NOR</u>			An EX-NOR gate can only have two inputs. The 'o' on the output means 'not' showing that it is a <u>Not EX-OR</u> gate. The output of an EX-NOR gate
			is true when its inputs are the same (both true or both false).

System level symbols in English

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





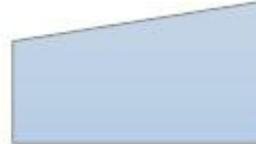
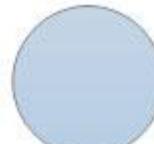
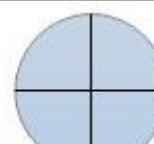
Flowchart

- Start and end symbols
- Generic processing steps
- Subroutines
- Input/Output
- Conditional or decision
- Concurrency symbol

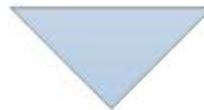
Flowchart symbols

	Terminator symbol Start/End Symbol
	Action or Process Symbol
	Document Symbol
	Multiple Documents Symbol
	Decision Symbol or branching point

Flowchart symbols

	Input/Output Symbol
	Manual Input Symbol
	Preparation Symbol
	Connector Symbol
	Or Symbol: Indicating the process flow continues in more than two branches

Flowchart symbols

	Summoning Junction Symbol: a point multiple branches converge back into a single process
	Merge Symbol: two or more sub-lists or sub-processes become one
	Subroutine Symbol
	Data Storage or Stored Data Symbol: a step where data gets stored
	Database Symbol: data allows for searching and sorting

Let us go through math together

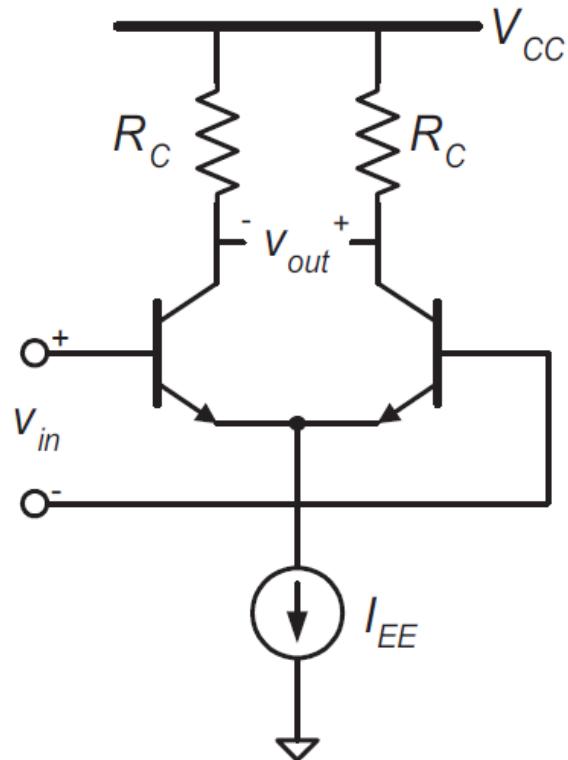
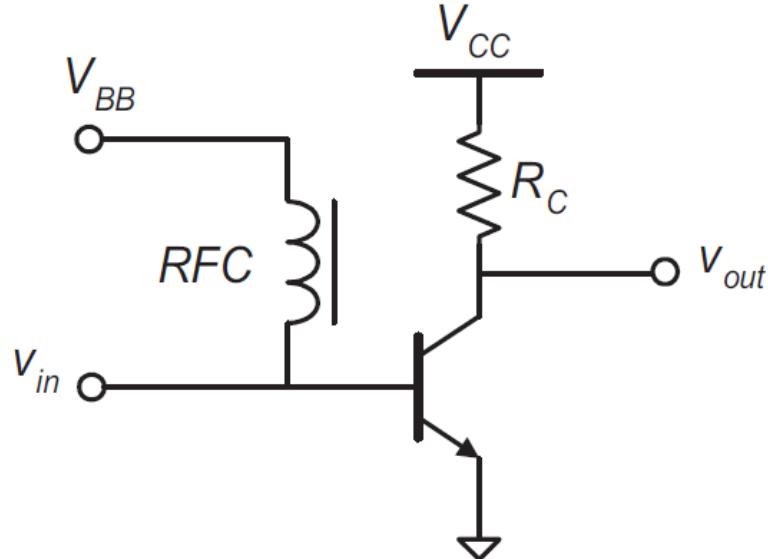
$$\frac{4096}{2^d \times r} \times \left\lceil \frac{\log_2^{4096}}{\log_2^r} \right\rceil \leq \frac{4096}{\frac{\text{Throughput}_{8 \times 4096}}{R}} \quad \lceil \text{ is round up operation}$$

$$\begin{cases} N = \prod_{j=1}^S N_j \\ n = \sum_{m=1}^{S-1} \left(\prod_{n=m+1}^S (N_n) n_m \right) + n_S \\ k = k_1 + \sum_{m=2}^S \left(\prod_{n=1}^{m-1} (N_n) k_m \right) \end{cases}$$

$$X[k] = \sum_{n=0}^{N-1} x[n] W_N^{nk}$$

$$W_N^{nk} = \exp \left(-j2\pi nk/N \right)$$

Let us go through analog circuits together



Let us go through digital circuits together

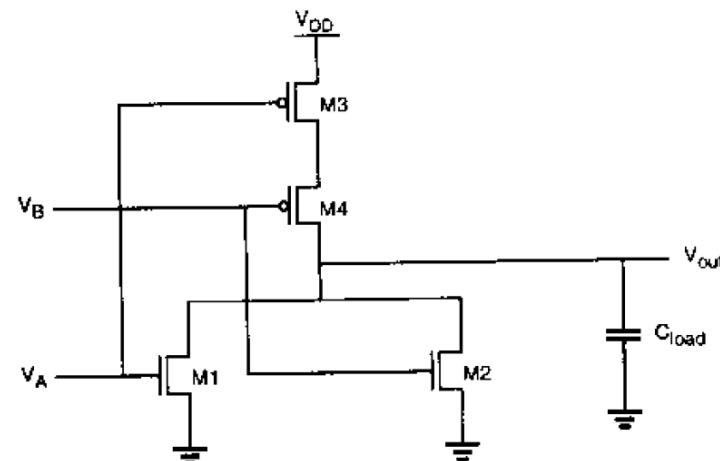
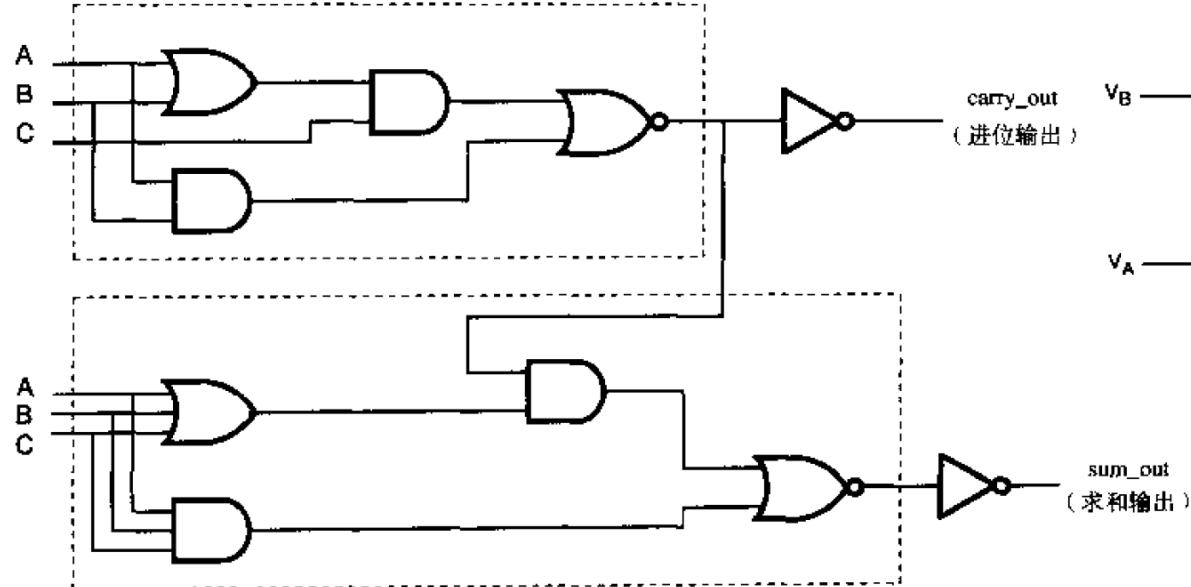
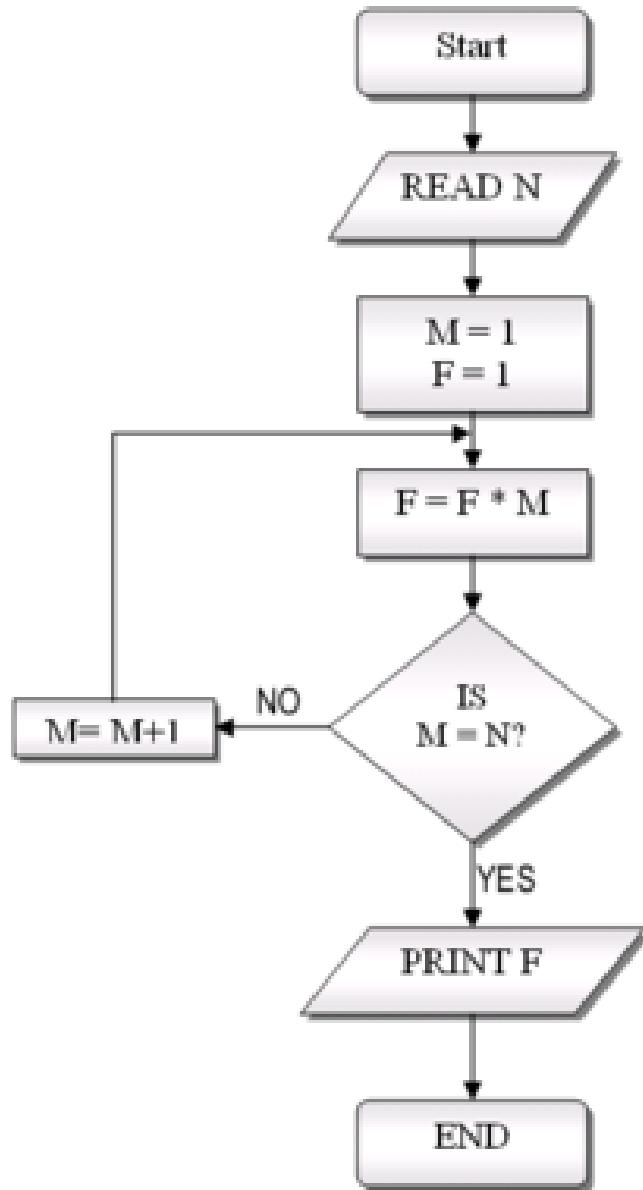
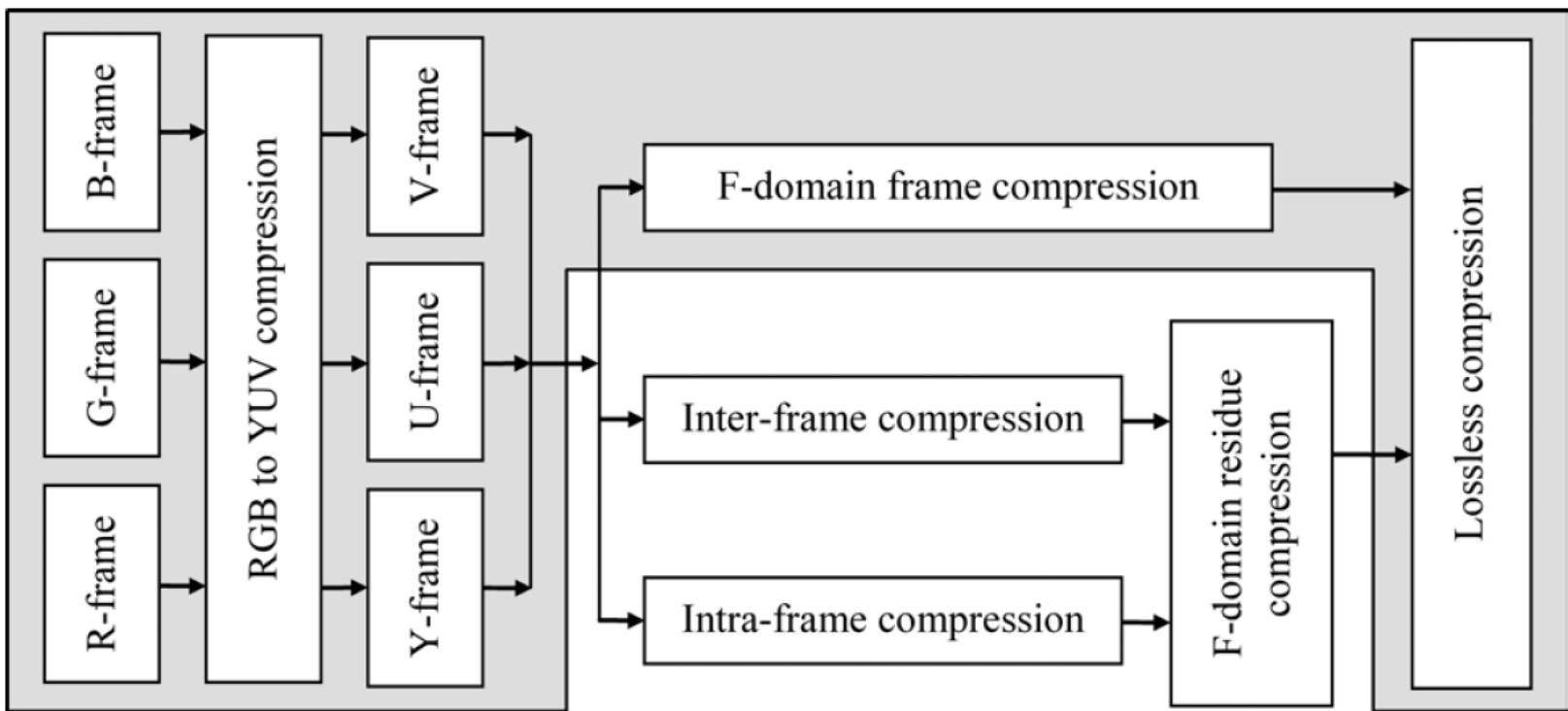


图 1.7 一位全加器电路的门级示意图



Let us go through
flowchart together

Let us go through block diagram together



Let us go through a table together

Table 2.8 IEEE Standard 754.1985 Format Parameters.

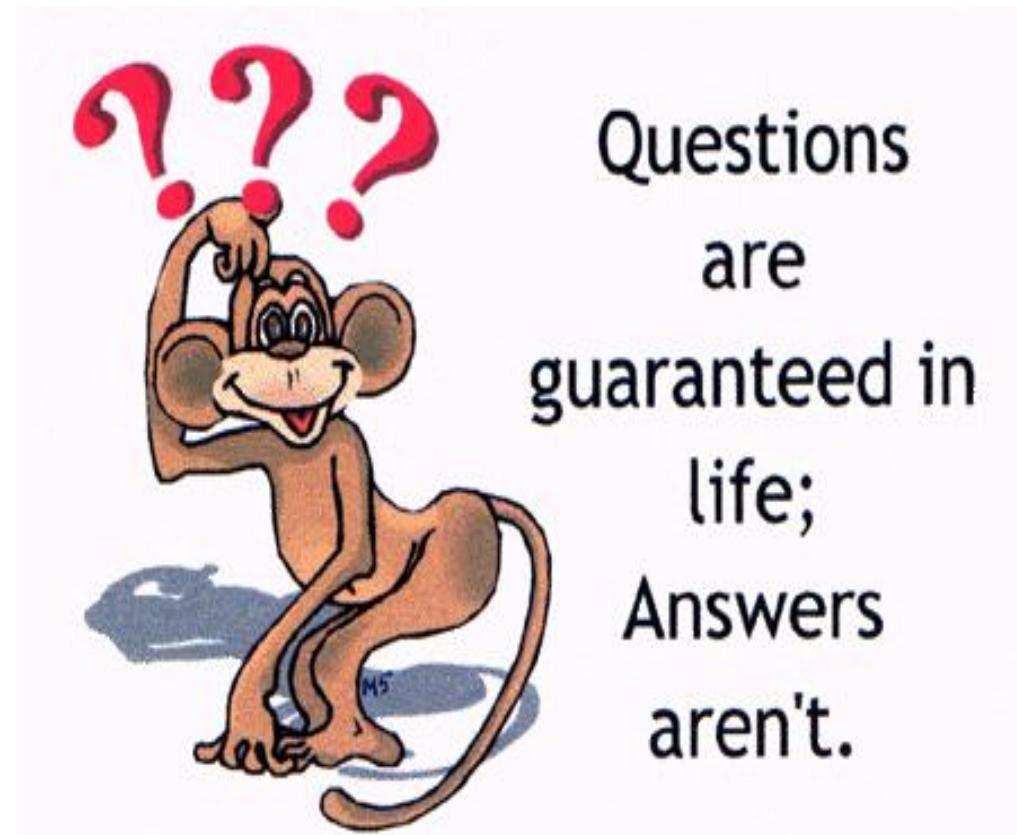
Parameter	Basic single	Extended single	Basic double	Extended double
Format width in bits	32	43	64	79
Width of Mantissa p	24	32	53	64
Exponent width in bits	8	11	11	15
MAX Exponent E_{\max}	+127	+1023	+1023	+16383
MIN Exponent E_{\min}	-126	-1022	-1022	-16382

Seems that you can
read in English now!
Good luck!



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Questions
are
guaranteed in
life;
Answers
aren't.

To know yourself and plan for your life

(Part 5 of the course)



Du you really know yourself?

Actually, many of us do not know whom we are

- Everyone is suitable for EE!
- What do I really want to do as my career in EE?
- What will be my future if I take it as my career?

Many materials available on web, and there are many soother (心灵鸡汤) to enjoy, yet there are useful things from psychologist.

Du you really know yourself?

Actually, many of us do not know whom we are

- It is hard to change your peronality as it is the person's nature
 - Therefore, what is your personality? I donn't know. Yuo have to diagnose it by yourself.
- You need to plan for yourself by adapting the society around you and your personality
- To find a job you really like, and to build a happy and exciting life by yourself.

是什么同时导致了成功和热情？北大史蛟

- 那么如何产生爱呢？我们的梦想教父乔布斯说过：绝对不要屈就于一个你不热爱的工作。问题是：我们中有多少人，知道自己全心热爱、心所向往的职业是什么吗？
- 当前一碗最流行的鸡汤是“热情理论”。根据“热情理论”，年轻人只该去做自己全心热爱、心所向往的工作。为什么呢？因为热爱带来全情投入，全情投入带来成功，即使不成功，至少是快乐的。是不是很美妙？无懈可击。
- 但热情理论需要一个前提：你要有一种天赋的热情，你得知道自己具有这种热情。因此要找到这个热情。在谷歌搜索“找到热情”(Find passion)，的结果有七亿多条。所以，找不到热情是世界性难题。在欧美只有4%的大学生具有职业相关的热情。
- 但是有个事实不容忽视：就是成功人士往往确实对自己的事业抱有莫大的热情，这又如何解释？是热情导致了成功？还是成功导致了热情？
- MIT 的 Carl Newport 博士认为这是一个遗漏变量问题。其实是有第三方因素同时导致了成功和热情。这个因素是什么呢？是精通，是你对自己职业技能的精通。你达到大师级的水准，就会有信心和成就感，成功和热情也就随之而来。
- 从今天做起，好好学习，天天向上！你精通了，你就爱了！

Society around you

Actually, many of us do not know whom we are

- Opportunities and challenges
- Conditions and constraints

Your personality

Actually, many of us do not know whom we are

- Extrovert and introvert (外向或内向)
- Imaginal thinking and/or abstract thinking
- Challenge oriented and/or easy type
- Cooperative and/or self going type
- Perceptual and/or rational (感性或理性)

Find a job adapt to your personality

- 有人选择了教师的职业，可是性情暴烈缺乏耐心；
- 有人选择了记者的职业，但生性沉稳、反应迟缓。
- 理智型性格喜欢周密思考，善于权衡利弊得失，适合于选择管理性、研究性和教育性的职业；
- 情绪型性格表现为情感反应强烈丰富，行为方式带有浓厚的情绪色彩，适于艺术、服务性的职业；
- 意志型性格表现为行为目标明确，行为方式积极主动，坚决果断，适应于经营性或决策性的职业

Find a job adapt to your personality

To know your personality and find a job suitable to it

- Principle Engineer: Very broad + cooperative
- Engineering expert: In a specific domain (e.g. DFT)
- Product manager: Strategic visioner + coordinator
- Project manager: Driver + expert + coordinator
- Line manager or higher: HR + Money + chain + all
- Researcher & professor: Lifetime focus on a small thing

你很幸运，选择了信息与电子，你更幸运，你选择了全英文信息与电子。你的再造机会几乎是无限的，专家、总师、经理、教授、作家、记者、翻译、党务。到企业、事业、国防、大学

To promote your personality

- If you really want a job, yet your personality is not suitable for it now, you still have a chance to promote it
- Personality 人格:
 - 思维能力、认识能力、行为能力、情绪反应、人际关系、态度、信仰、道德价值观念等方面
- 人格即性格与气质:
 - 性格: 人的性格不仅表现在做什么, 而且表现在怎么做
 - 气质: 人的心理活动和行为模式方面的特点, 赋予性格光泽

To promote your personality

良好的人格有几个特点：

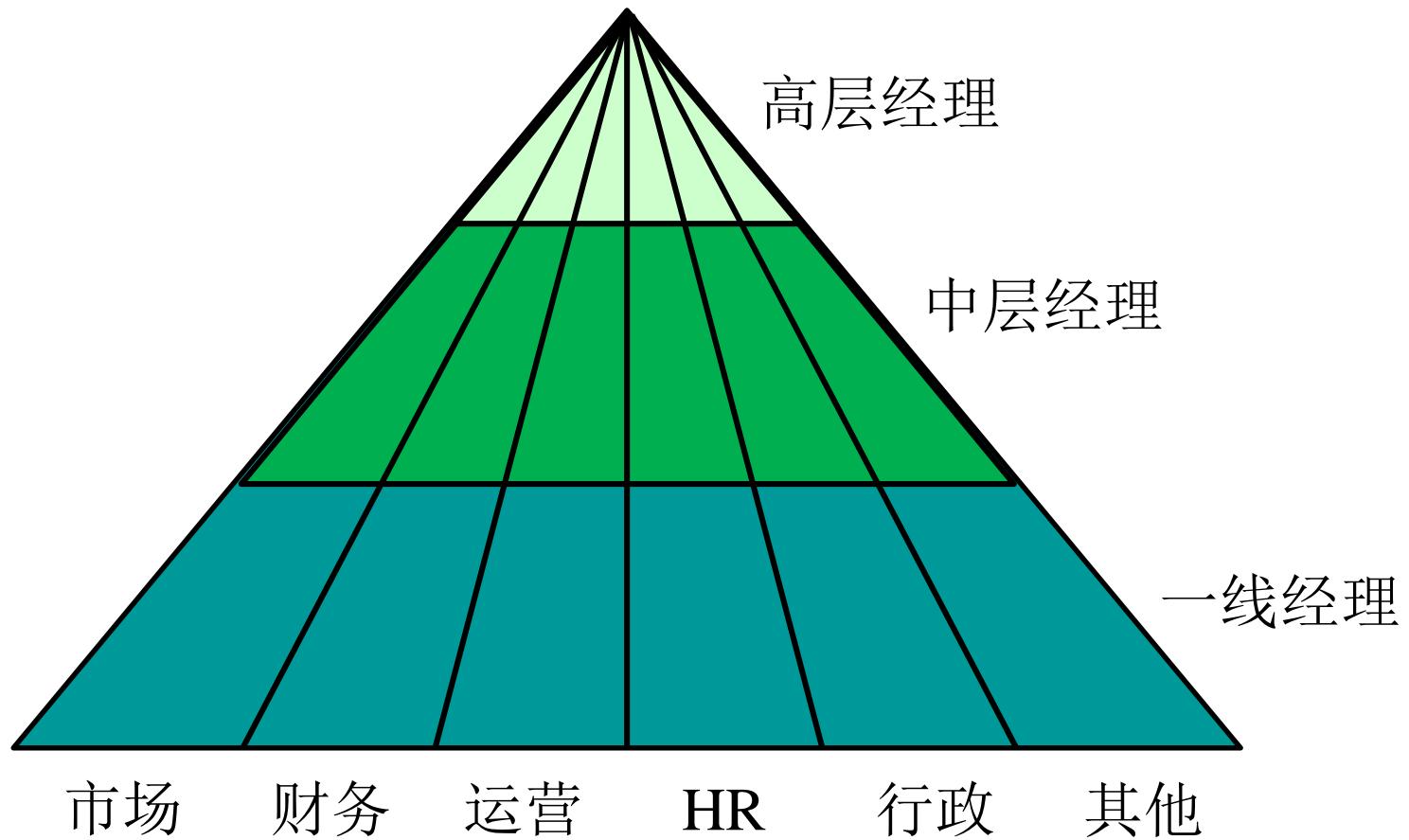
- ✓ 一是应该有良好的道德品质，正确的人生观；
- ✓ 二是在日常生活中热爱生活、热爱集体、热爱劳动，能够经常保持愉快的情绪、广阔的胸怀，不以自我为中心；
- ✓ 三是富有同情心，能经常想到别人，不一时冲动感情用事；
- ✓ 四是遇事能客观冷静地分析，正确理智地进行处理和判断，不固执己见，不主观；
- ✓ 五是有坚强的意志和毅力，没有依赖性，勇于克服困难，善于解决矛盾

To promote your personality

如何塑造自己的性格

1. 控制自己的情绪。冲动是魔鬼，凡事要三思后行。任何决定都放在冷静之后再做决断
2. 注意检点自己的行为举止。养成一个良好的行为举止，给形成属于自己的完美性格
3. 理性或感性的调控。理智人具有独立，敏捷，分析和综合等表现形式。不易发怒，心平气和，有安全感，做事周密，成功率高。
4. 坚强的人。坚强来源于对自己的意志调节：善于主动去控制自己的言行；紧急情况下及时采取正确而坚定的决定；失败后的百折不挠。
5. 性格稳健。任何一个性格一旦形成，就比较稳定，不论何时，何地，何种情况下，都用自己的形为惯性与方式去做事。

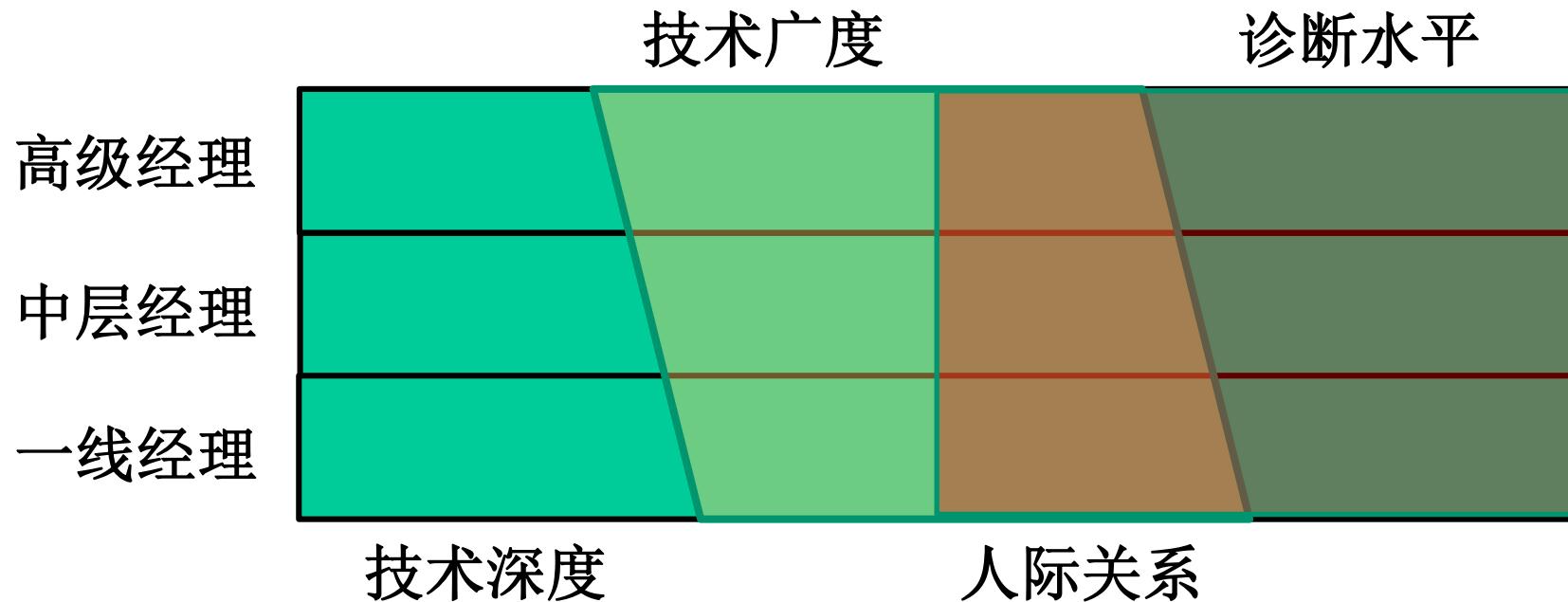
管理的层次和领域



管理的分层

级别	工作类型
一线经理	<ul style="list-style-type: none">• 不完全是经理，更是直接导师和师傅，• 使用获取的人力和其他资源完成高层经理的计划和目标，• 将任务分配给项目执行人，并监督指导他们所完成的工作，完成短期，明天或一周的计划。同时对执行人进行评估。
中层经理	<ul style="list-style-type: none">• 通过其他经理完成管理，• 管理实施中长期计划，实现由最高管理层设定的长期目标，制定部门政策，评价工作的下属单位及其管理人员的业绩• 提供并整合和协调功能，保证短程决策和一线经理的活动能够实现企业的长远目标。
高层经理	<ul style="list-style-type: none">• 负责定义角色，使命和企业的目标，• 建立评价准则，审查长期计划，• 评估各主要部门的表现，评估中层领导管理人员，并决定中层领导的升降。

三类经理的定义与分类



杰出校友共性的东西

- 会思考
 - 网络和微信及时的带给人爆炸的信息，使人变傻。新时代的教学法亟待提升。教人思考是很危险的☺。但为适应全球竞争，我们必须学会思考。
 - 学生具有自己悟出结论的方法。
- 勤奋
 - 来自兴趣。我们的报考制度和社会压力阻碍了学生寻找自我。教会学生先结婚后恋爱，如何一步步的产生爱，爱自己的专业。
 - 目标导向的125%原则，一步步的脚踏实地的进步。

做一个快乐的工程师

1. 热爱创造。你愿意弄脏手，搭出个什么，并引以为豪。
2. 爱你的工具。工具是工程师的命根子。不管是扳手，还是软件，还是报表。它们的祖先，是人类的那根木棒。
3. 永不满足。总有可以改进的地方，总有可以优化的地方，总有可以完善的地方。
4. 理性思维。不做无用之事。明白实验与犯傻之间的区别。
5. 好奇。对自己专业的好奇，对不同专业的好奇，对生活的好奇，对世界的好奇，对宇宙的好奇。
6. 热爱自己的专业，并一直向下挖。疯狂到相信自己能够改变世界。工程师，确实是这么一群人。他们在改变世界。

To be a happy Engineer

Scientists study the world as it is;

Engineers create the world that has never been.

—西奥多 冯 卡曼 Theodore von Kármán

- There is no Number one in Engineering
- There is no Number two in Science

Samuel Chao Chung Ting 丁肇中

To be an honest Engineer

We, the members of the IEEE (You can be a IEEE member after graduation), in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. To accept responsibility in making decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment;
2. To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
3. To be honest and realistic in stating claims or estimates based on available data;
4. To reject bribery in all its forms;
5. To improve the understanding of technology; its appropriate application, and potential consequences;
6. To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
7. To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. To treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. To avoid injuring others, their property, reputation, or employment by false or malicious action;
10. To assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

Honest and Logical

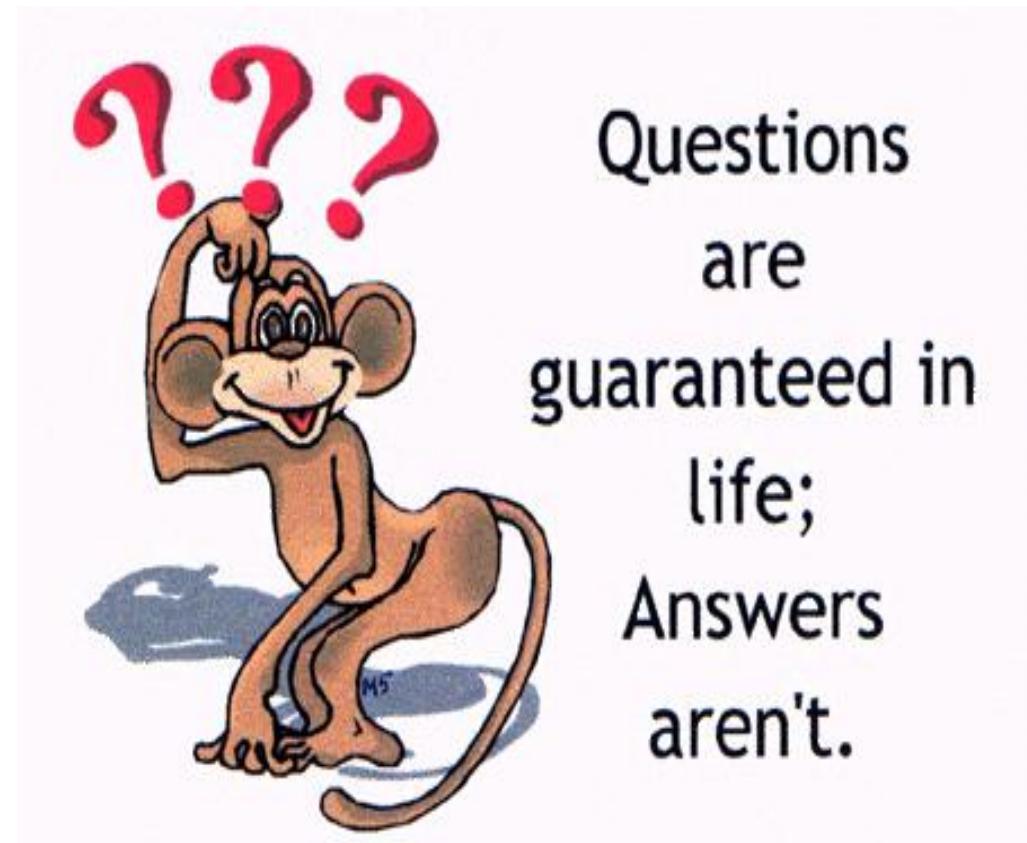
- Honest is the base of creativity
- Logical is the source of creativity
- Mechanical materialism 机械唯物论
- Be realistic is our dialectics 辩证法
- Working hard is essential path to success

It is really difficult
to understand
oneself. Let us try!



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Questions
are
guaranteed in
life;
Answers
aren't.

Survive: To build lifetime learning skill and lifestyle (part 6 of the course)



What is lifetime learning skill

A lifetime (lifelong) learning skill is not unique

- You build yourself a sucessful way
- However, the personality in general gives you a sucessful story

What is a lifetime learning skill

1. 把学习当成自己的事情。这主要体现在处理好学习的每个细节，不需要别人提醒，做好自我管理。当然，努力改造自己成为天生的“爱”学习者。
2. 养成主动学习习惯，对学习有如饥似渴的需要，随时随地利用零散的时间学习。
3. 对自己的学习及时有效地进行评价。一个人在学习过程中，不仅学习水平在不断变化，其兴趣和爱好也在不断地变化。对这些方面进行评价和审视，不仅有利于保证学习的速度和质量，更重要的是能保证学习方向的正确。
4. 主动调节自己的学习行为，以适应不同的环境和需要。我们不能决定我们身边的环境和人。别抱怨，适应环境，不仅是主动学习的表现，也是锻炼多种能力和丰富人格力量的机会。
5. 学习不会一帆风顺，遇到困难能够坚持下去，是主动学习的重要内容。
6. 要正确对待别人的帮助。学习好的学生，有思想的人，对别人帮助的需求相对少，能更多地自己埋头钻研。但同时会利用不同信息，不断拓展自己的视野。

Self orientation and self going!

- 意义: Why do we want to do it
- 目的: What is the goal
- 范围: What is the scope
- 输入: What are inputs and conditions
- 自识: Self evaluation: find your drawbacks
- 方法: The conducting/executing method
- 输出: Is the result you really want
- 总结: Are you satisfied with what you did?

Quantitative approach

- Do nothing before documentation!
 - Goal and objectives; plan step by step
 - Based on paper document, not on talk
- Strong modeling knowledge
 - Skills of HW system modeling
 - Skills of using available models
 - Pipeline, cycle, bit, pin accurate;
 - Specify what to expose and what to hide.
 - Self evaluation of modeling
- Quantitative approach, 1克盐、50毫克胡椒

Try to approach to a limit

- What is physical limitation and what limits are not physical
 - Do not try to break a physical limitation
 - Work on other (instead of physical) limitations
- What are “other limitations”:
 - Limited by technology, limit of knowledge, price, complexity, human resources
- How to use limiting parameters during designs
- How to use limiting parameters for research
- How to make self evaluation based on limits

Think the future

- **Design methods:**
 - 市场、参数、限定条件、场景的预测技术
 - 超前参数设定方法：外推法、建模法。
 - 超前参数设合理使用方法、自我评价方法
- **Decide your research:**
 - 如何确定当你毕业时，你是最火的(先驱)：
既不太超前(先烈)也不落后。恰到好处。

自我完善 Self promotion!

- 我做我感兴趣的事、兴趣是成功的基础
- 我按照我的兴趣找工作
- 我按照我的兴趣发展自我
- 静下心来做一件事，我不是最快的，但我是最好的！
- 做适合我做的事、打擦边球、我不人云亦云
something different.
- 机会在于知识融合与跨学科

华盛顿协议教学体系 助你实现自我

Summary of Washington accord

编号	能力 / 素质	类型
WA1	多学科知识应用能力	专业能力
WA2	复杂工程问题分析能力	
WA3	复杂工程系统设计与开发能力	
WA4	文献研究与实验分析能力	
WA5	现代工具使用能力	
WA6	工程师的社会责任意识	综合素质
WA7	环境与可持续发展意识	
WA10	沟通交流能力	社会能力

An example: NSFC approach

- Who is the best
- What is the weakness
- What is my way to do it better
- How much is the improvement of my research

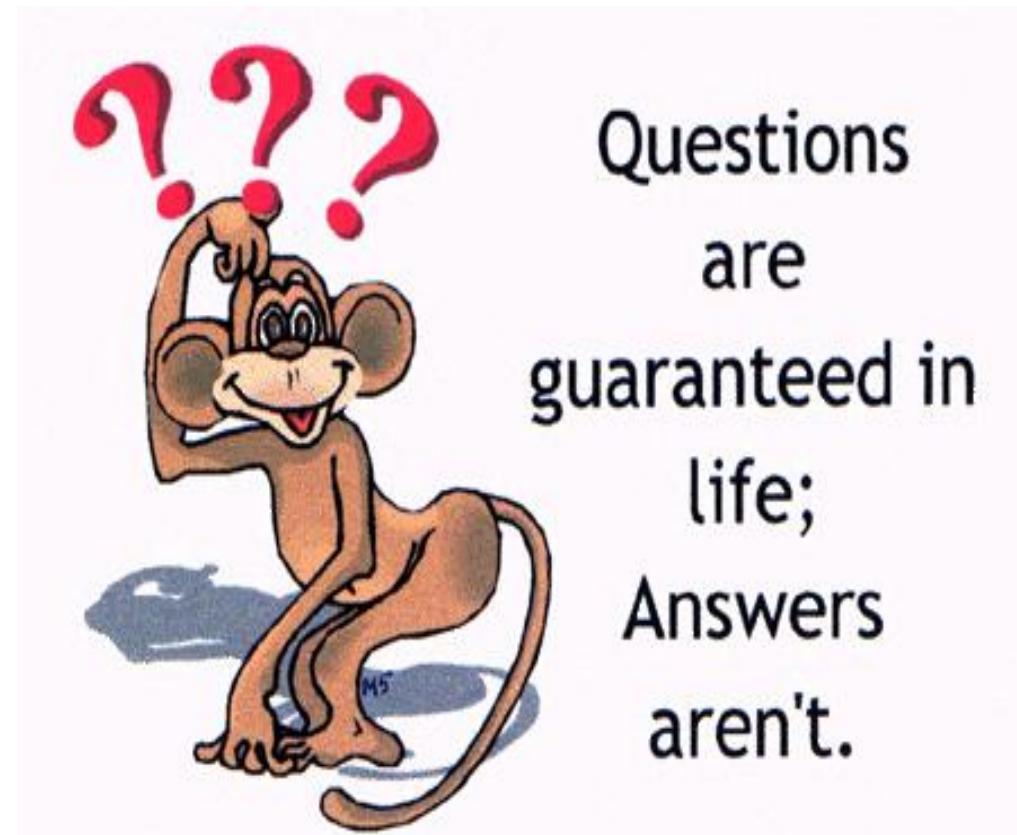
An example: my approach

- What is the future opportunity
- What is the limit set
- What is physical limitation to approach
- My way to approach
- The distance to the limit



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Questions
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Answers
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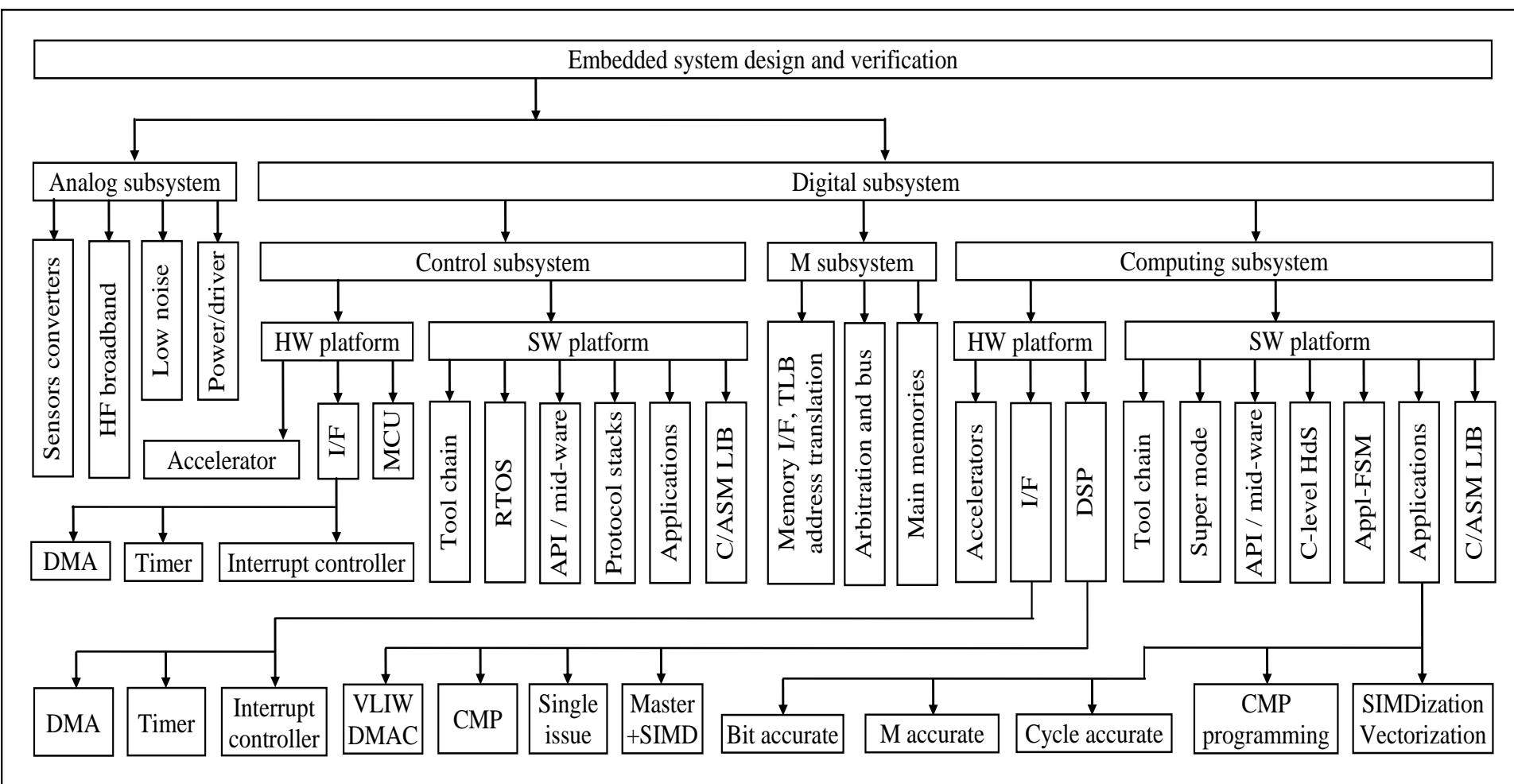
What will you do after graduation

(Part 7 of the course)

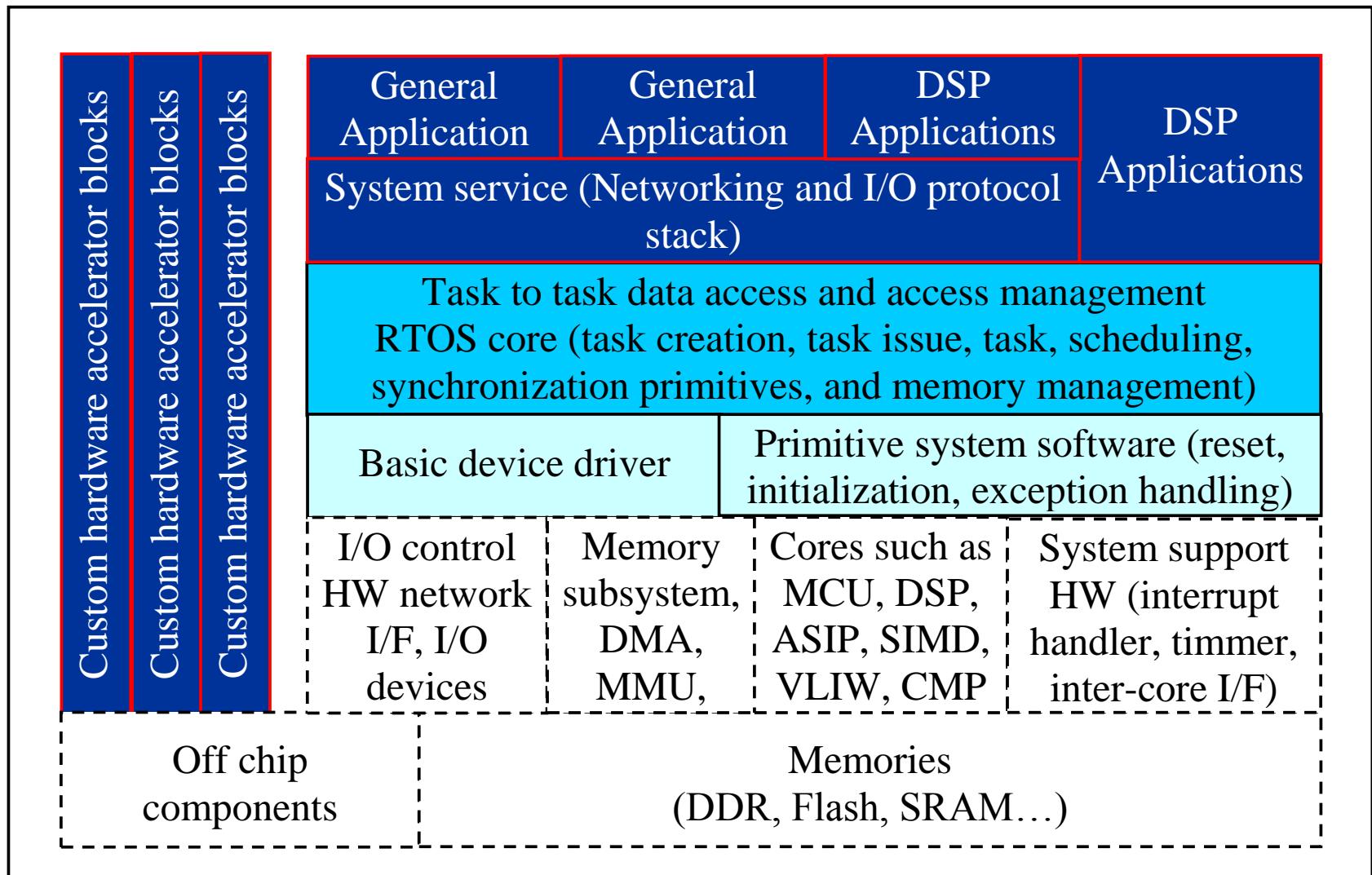


都有啥可做

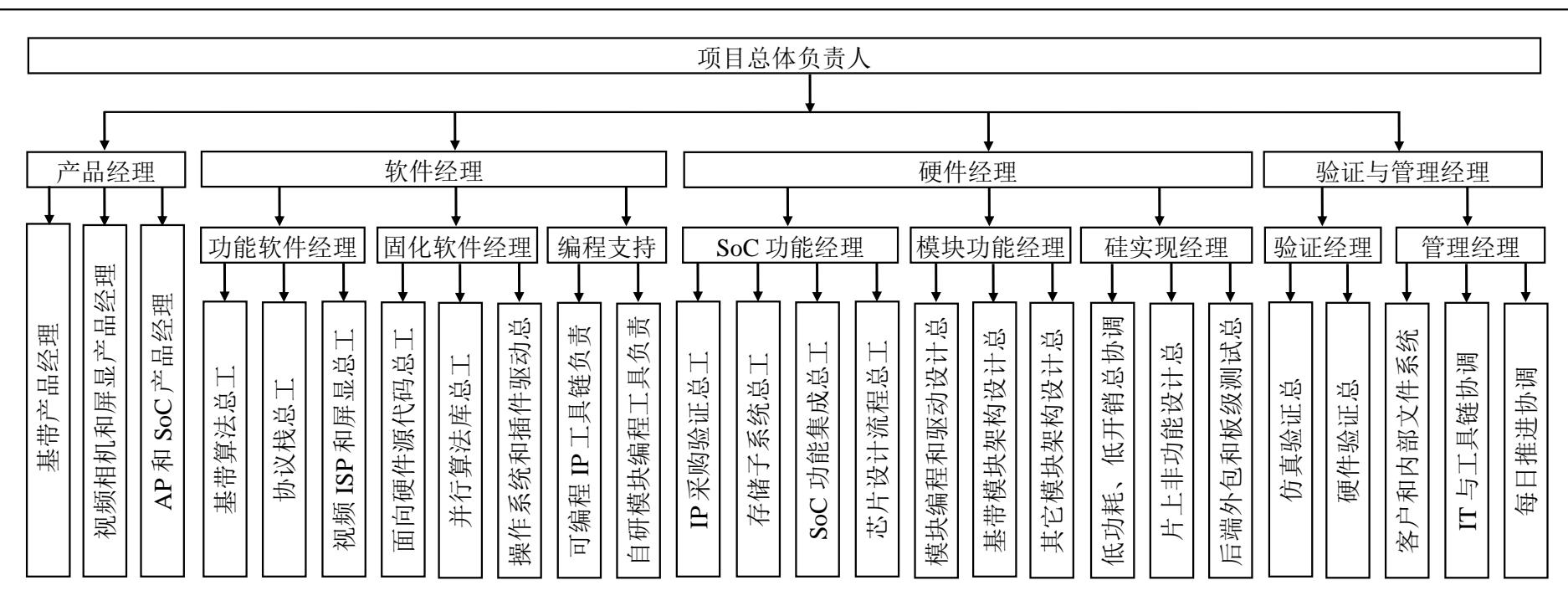
Embedded system in general



Embedded software system



一个SoC集成的知识结构



So what will you do after graduation

- Got scared and want to escape from our EE
- Got excited and want to do something

What will you do V.S. what shall you learn

1. Continue for your master and PhD study
 - ① Go abroad to study in a world ranking university
 - ② Get a master position in a top China university
2. Eventually to find a job of your EE career
 - ① Engineer of (device, OEM, operator, OTT, gov)
 - ② Manager for product, project, cooperative, monitoring
 - ③ Researcher for discovery, new product, standards
 - ④ Teacher in university and school

So, what shall you learn during the four years study?

I want to go abroad

To apply for a master student position

- Do I really want to go abroad? Am I prepared?
 - Lots uncertainties, US may not be a paradise
- Do I really want to learn something or I am just afraid of leaving from school 就业恐惧症
 - Most want to have a master degree, yet not everyone

To get master degree

You will know more than what a bachelor knew

- You may know what do you really want and to find a master position fit for you
- Prepare differently towards a PhD candidate or to find a job when you are a master
- You may thus to find a suitable professor and a suitable research opportunity

社会是个啥样子

Soon or later, you will leave us you need to know 就业市场

- **设备商**: 基础设施、终端、客户、其他
- **器件商**: IC、分立器件、缆板、其他
- **运营商/OTT**: 采购构建、运营、其他
- **政府**: 监管、协调、标准、领导(中国)
- **大学**: 人才、科研、社会未来
- **研究机构**: 大学与企业的桥梁 (link)
- **国防**: 采购构建、使用、科研、其他
- **行业联盟**: 标准、协调、分享

工学学生毕业以后干什么、怎么干？

- **设备商:** 市场战略、研究、规划、设计、验证、生产、系统调试、器件甲方、管理、采购、标准、市场销售、售后服务、**training**
- **运营商和OTT:** 市场、销售、技术甲方、规划与设计、安装调试、验证、维护、采购、研发、运营、客服、更新、换代、**training**
- **器件商:** 市场、研发、规划、设计、验证、生产、销售（设备商、分销商）、支持维护、企业运行管理、标准、**training**
- **软件商:** 市场、研发、规划、设计、验证、销售、支持维护、企业运行管理、标准、**training**
- **政府与行业协会:** 监管、协调、分享、标准、采购、运营、维护、研发、领导(中国)、**training**
- **国防(不按市场规律办事):** 战略、研发、规划设计、安装调试、验证、维护、标准、协调、采购、使用、维护、**training**
- **大学:** 教学、研究、咨询、标准、社会未来
- **研究所:** 研发、**training**、企业桥梁、设计、咨询、标准

你们毕业后可能就业的机会比例

中国仅有一个华大九天，占比不到百分之一

各层的设计加工验证软件

系统应用

行业软件机会 30%，通用软件机会 0%

基础软件

OS 0%、库 10%、编程支撑软件 0%

设计

模拟模块 10%、数字模块 10%、片上系统 30%

工艺

3%

封装

5%

设备

2%

材料

0%

总结：我们就业机会主要在电路设计和行业软件

Febless 集成电路设计的六大分块

设计分解	Febless 集成电路的设计工作描述
SoC片上系统设计	是啥: 现代芯片, 例如服务器主片、手机主片、定制芯片 干啥: 系统定义, 硬件软件分解, 系统构成, 功能流程
数字功能模块设计	是啥: 自主逻辑电路: 例如arm、视频模块、ISP、基带 干啥: 所需数字功能模块的设计验证或IP购买选型验证
模拟功能模块设计	是啥: 自主模拟电路: 例如数模转换、射频收发、放大器 干啥: 所需模拟功能模块的设计验证或IP购买选型验证
非功能模块设计	是啥: 非应用: 例如产率测试电路、频率源、电源、PMU 干啥: 系统所需非功能模块的设计验证或IP购买选型验证
SoC片上系统集成	是啥: 硅集成: 在功能、性能、功耗、开销的需求下完成 干啥: 用片上总线连起来模块, 跑起系统, 灌入验证软件
后端设计和流片	是啥: MPW: 多项目硅圆, 工业坯: 咱自家的全硅圆模板 干啥: 将已经设计的功能变成版图、送到Fab、然后封测

想创业吗

什么是创新

- 创新：符合自然规律的，基于异于常规常人思路之见解。利用现有知识和条件，为满足社会需求，改进或创造新事物、方法、元素、路径、环境，并获得有益结果的行为。
- 其结果应是**更**：更难竞争、更贴近用户、更先进、更低价、更短开发时间、更环保、更大量、更赚钱

IET 领域的六个技术创新层次

1. 颠覆性理论突破引出新的应用领域
2. 革命性材料 (构成及过程) 突破制出的新器件
3. 概念的突破创造出的一个新市场
4. 设计的突破 (例如多学科融合) 获得的新产品
5. 更好的实施 (低价、低功耗、适于用户...)
6. 不对称资源利用 (法律、规定、天、地、人)

什么是社会创新

- 社会创新是创造满足各种社会需求的新战略，新观念，新思想和新组织
 - 从社会发展、健康、安全、方便等角度来提高生活水平，工作条件和教育水准等。
 - 例如：BAT、新的公共服务方式、社会机会、老人社会自组合作、新幼儿照看教育模式、MOOC等新知识传播方式。
 - 社会创新可进一步衍生服务业和技术创新的机会。

基于颠覆性技术的创新创业

- 不一定是好事，人是保守的。颠覆性技术是很难被相信的
 - 颠覆性技术不是目的，要让投资人相信的是：它可以排他的长期垄断一个海量利润市场
- 技术越高风险越大，风险应对能力重要
 - 对投资人和自己解释：如何应对未知风险(不可预知预算、额外的研发时间)、多个 backup
- 高处不胜寒

(我)逼近预期的极限去创新创业

我导师的箴言：我从不去找竞争对手，我找物理极限，我逼近的是物理极限，自然是最好的

1. 定义产品，预测产品的市场需求
2. 预期并逼近投放到市场时的物理极限
3. 超前设计，当投放到市场时，自然最强悍

我在瑞典受到的教育是：不要和已知的对手较劲，这种较劲真的没劲！

基于知识与经验融合的创新创业

- 通过融合和系统优化提升并发现新机会
 - 多种信息源（获取途径）的融合
 - 算法和建模（传统、现代、突变）的融合
 - 多种工艺、方法、和实现流程的融合
 - **Systematical design, total optimum solution**
- 通过各种优化提升客户体验，降低价格
 - 工科没有最，只有更：更好，更适合市场

基于新概念的创新创业

- 可形成知识产权并受到保护的新概念：容易被模仿、当大腕模仿你时，你哭的很惨
 - 你飞速的进入市场，时间差给你短时的机会
 - 如只是个新概念，没有不对称的杀手锏技术，电子行业尽量别创业
 - 被大腕收购也是一个好的结局
- 潜在对手：静静的等你开始销售时告你侵权

基于不对称资源的创新创业

- 不对称资源都有哪些?
 - 政府指令性、市场不开放、地域倾斜性、原材料垄断、关税、不对称税收、采购链垄断、语言和文化、老爸很有权（纪检严格，正在消亡）
- 资源的唯一性？(A省上马，B省抄袭亦上马)
- 拥有不对称资源的持续时间 (期间内做强)？

用政府不对称资源创业的案例

- 1998年，新浪模仿雅虎。
- 1998年，QQ 模仿MSN。
- 2000年，百度模仿谷歌。
- 2003年，淘宝模仿易趣。
- 2009年，微博模仿Twitter。
- 2012年，滴滴模仿Uber。
- 2015年，共享单车的出现，标志着中国互联网企业创新的开始，不幸的是不是很成功.....

创业基于创新

- **创新的定义:** 知识变成商品。用商业手段产生、引进、改进、生产和传播有经济价值的技术
- **演进过程:** 从个体为主的创新(20世纪以前), 到集体为主的创新(20世纪), 到多学科融合的创新(21世纪)
- **创新的根本:** *something really different from others*。从异化中得到市场和核心竞争力(性能、吸引力、价格、时间差)。

拿什么创业--- IET核心技术

- 一是你能不能搞，二是国人认不认（被忽悠的太多了，不敢认了）
- 投入大、周期长、竞争力和认可度难建立
- 例如核心器件（CPU）
- 例如基础软件（库、OS）
- 我认为不要一开始就搞大的。要一步步的渐进，不要一开始就搞核心技术

拿什么创业 --- 擦边球

- 这个可以有，是多数初创的原则
- 是指大公司尚未意识到，或船大难掉头的擦边球机会。
- IET新技术的配套小件，一个不起眼但是四两拨千斤的东西。
- 留意大的IET公司历来都在收购什么样的公司、技术、团队、和市场。

拿什么创业 --- 设备

- 现代大型IET设备利润空间越来越小。没有历史积淀，很难挤入IET设备行当
- 白壳机的概念（为大OEM企业补短板）
- 子系统的概念(把大企业非核心或懒得去做的一个步骤、板卡、或一个软件做精做强)
- 搞好和OEM大企业的关系，随时准备被并购

拿什么创业 --- 电子器件

- 核心器件（功能性能）：集成电路、无源器件、传感器、驱动器
- 通用器件要么被垄断（电阻电容），要么利润越来越小（插接件）
- 规律：找一个专用器件作突破口，悄悄的启动，足够的积累之后突然进入通用领域

拿什么创业 --- IET知识产权

- 我的强项，做IP，卖 license 收取 royalty fee
- IP 可以是集成电路的一个功能模块，一个核心基础软件
- 例：我的第一家公司、我的第二家公司
- 避免对工艺的依赖性，避免低门槛的抄袭，避免进入无法起诉抄袭者的业务区域。

拿什么创业 --- 设计与服务

- 建立一个开源的IET核心技术体系，鼓励大家免费用。然后你收取高额设计服务费。
- 拥有一个多家IET公司都需要，又不是天天需要，不值得养HR，又不易被抄袭（需 fine tune）的核心特种技术。收取高额设计服务费
- 合力机会：国企引进设备不完善不配套没合力
- 借鸡生蛋：大学仪器极浪费，私企租借获双赢

信息与电子创业机会的汇总

	创新创业机会	超前度	产业规模	利润	风险
1	颠覆性模块	~ 8年	中小	超大	超大
2	IC功能模块	~ 6年	中小	中小	中小
3	SoC系统芯片	~ 4年	大	大	大
4	设备	~ 3年	大	大	大
5	软件	~ 2年	中小	中小	中小
6	应用AP, APP	~ 1年	小	短期	大
7	设计与服务	~ 0年	小	小	小

To conclude: creativity discipline

- Through market prediction to identify and achieve imbalance opportunities
- To specify a product from market concept
- To decompose and refine a product spec
- To plan and execute a project under budget
- To do the best through approaching limits
- Be cooperative, be tough, be realistic

爸爸， 我要创业！



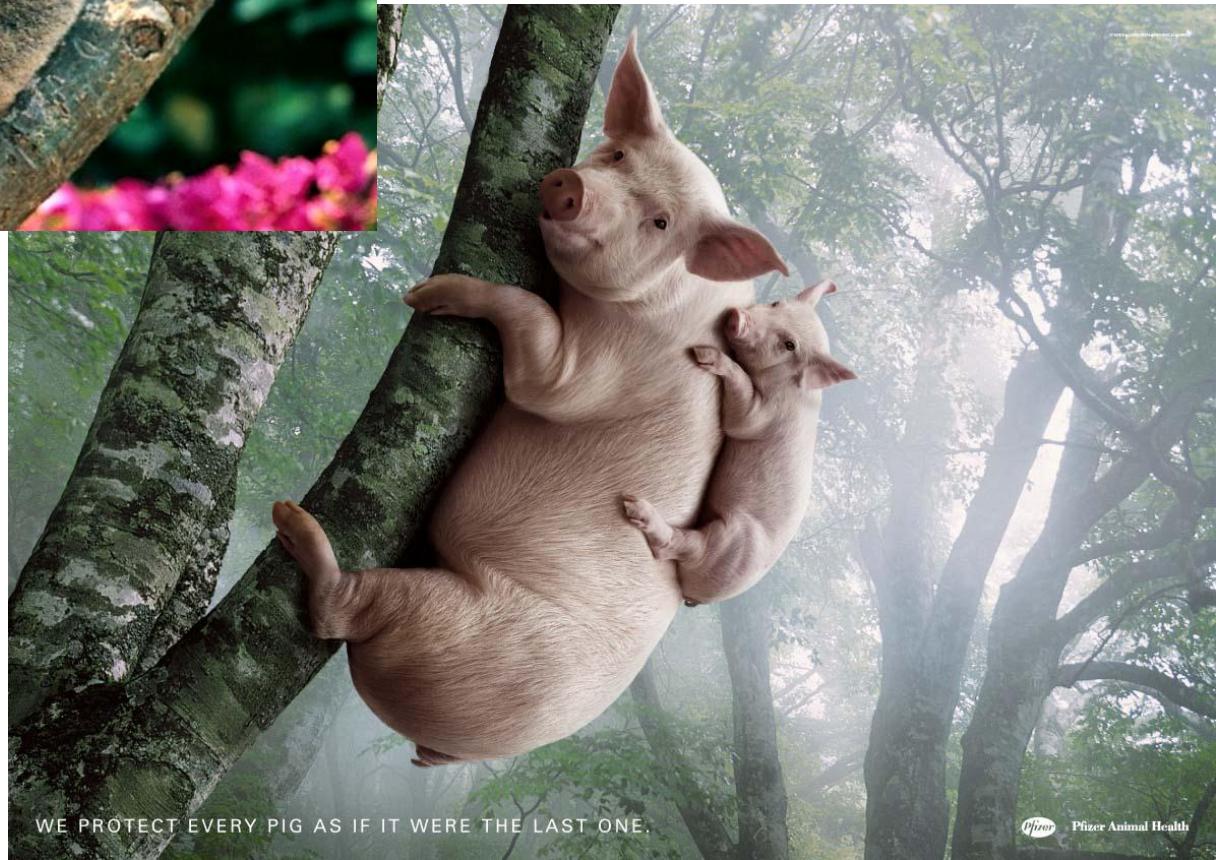
妈妈， 创业失败了！





有些事
你我不合适

走自己的路
不要盲目跟随



【別把觀念弄反了】

- 
1. 不是因为有了希望才坚持，
而是因为坚持才有了希望；
2. 不是因为有了机会才争取，
而是因为争取了才有机会；
3. 不是因为会了才去做，
而是因为做了才会；
4. 不是因为成长了才去承担，
而是因为承担了才会成长；
5. 不是因为拥有了才付出，
而是因为付出了才拥有；

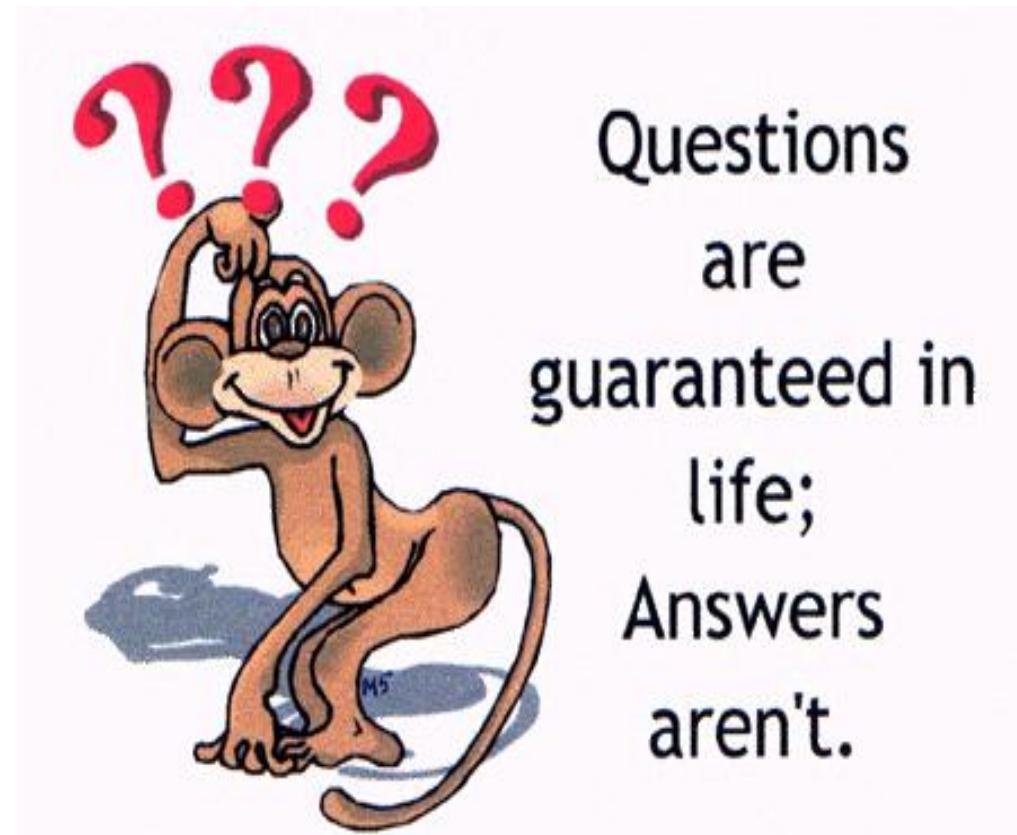
**Wow! You can manage
your life by youself now.**

Congratulations



Welcome to ask any questions you want to

- I can answer
- Or discuss together
- I want to know what you want



Questions
are
guaranteed in
life;
Answers
aren't.

Discussions and reviews

(Part 8 of the course)



What to prepare

- Everyone prepare a PPT for a 5minut talk
- It can be from the list assigned by me
- Or you can decide what to talk
- After the talk, you write a report according to your talk and discussions.
- Send your report + PPT to liu.dake@outlook.com
- Your score will be the score of the report + the score of duscussions during my teaching

What to discuss today

- The topic, the scope, and the goal
 - 确定你讲话的主题。选择一个单一而集中的主题而不是试图涵盖多个主题。写一个简洁的单句声明你的主题。
 - 确定你讲话的范围：千万不要开口千言离题万里。为话题选择3到5个支持的论点。确保你的论点简洁直接。
 - 考虑你的动机。一个好的演讲可以满足观众的需求。你想让你的观众笑？你想鼓舞他们的斗志，或者你想通过清楚直接的信息传达，从而改变他们的行为？

How to discuss today

- The art of brainstorm
- 口头报告需要计划再计划。
- 一个“三步曲”的老套套是管用的。
 1. 先是告诉大家自己今天要讲的是什么。
 2. 再把它讲出来。
 3. 最终告诉大家自己今天讲了什么

How to discuss today

- Presentation skill

- 不要让一张幻灯片停留太长时间——不要要求听众很长时间看一张幻灯片。
- 不要让一张幻灯片停留太短时间——太短还不如没有。
- 不不要求听众在现场阅读太长的文字。密密麻麻的字大家读起来是没有反应的。

How to discuss today

- Presentation skill

- 经常犯的另一个“雄心壮志”式的错误是，期望自己能在10分钟内讲完100张幻灯片的内容。6秒钟换一张幻灯片，转换太快？这不可能。
- 一个经过专业训练的电视/广播播音员，1分钟以正常速度只能读160~170个字。
- 也不要寄希望在作报告时完成从100张中挑选10多张的任务，这应该在准备时完成。

How to discuss today

- Presentation skill

- 做口头报告之前练一练，勇敢点，声音要大。
- 说得缓慢，发音清楚。演讲的部分之间要停顿，使听众能消化信息
- 不断的重复你的提纲，确保听众能够跟上你的思路
- 经常移动目光扫视听众，保证同步和互动
- 在你认为满意的 PowerPoint 幻灯片内容的基础上，用自己的话讲解它，不重复说投影出来的文字
- 掌握速度，不要太快也不要太慢

Review on the introduction

- Your view on the course so far

Review on the curriculum

- Try to remember what will be the EEinE Curriculum
 - Grouping
 - Ways to learn

A seminar to discuss going abroad

- The purpose, the destination university, the program to join, the way to learn, the challenges

A seminar to discuss continuation

- How many of you want to have master study opportunity in BIT or other universities in China
- What do you really want to learn

A seminar to discuss finding a job

- If you want to find a job after 4-year study, what do you want to do.
- How to prepare yourself

A seminar to discuss a spin off

- What will be the opportunity, what do you want to do, what is the goal and the expectation

A seminar to discuss preview a class

- What is your experiences to prepare for a lecture
- What are the main problems
- If I understand most of the contents, how can I keep my concentration during the lecture time

A seminar to discuss writing notes

- Why should I write notes
- What are benefits in writing notes
- What are my experiences in writing notes

A seminar to discuss time plan

- How should I plan my four-year time, should I have a achademical goal? Or should I find a boy / girl friend?
- How can I divide time slotes and achieve step goals
- Others

A seminar to discuss enjoying

- Except for busy time slots, how should I enjoy the four-year time

A seminar to dream your job

- Many of you can talk on it. You select one of
 - Which job do you really suitable 专家、总师、经理、教授、作家、记者、翻译、党务。
 - As your job
 - Where will be your dreaming destination 到企业、事业、国防、大学
 - What shall we do to realize my dream
- Which part in my course can be your reference

A seminar to discuss the missing in the course

- I cannot understand something because of.....
- I missed something you did not mention.....
- I have different opinions with you such as.....

Thanks ! Questions ?

!



?



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- I can answer
- Or discuss together
- I want to know what you want

