# Comprehensive Guide to the Curriculum

# Department of Computer Science & Information Engineering

# National Dong Hwa University

# 國立東華大學資訊工程學系

# 學程說明必讀手冊

**2014.03.28**

## Contents

# 1. Preface

For many years, Higher Education in Taiwan has been departmental-based; students enrolled in the university and followed the curriculum planned by the department to learn the required knowledge and skills. However, the fast changing world along with the knowledge-based economy has brought many new research fields within or across departments, which widens and deepens students' learning scopes, and catalyzes the demand for developing a second professional specialty and enhancing cross-field knowledge. Ideally, education should be "customized" to fit individual student's needs, and schools are supposed to provide a wide range of courses for study. Therefore, since the academic year of 2007, the university started to adopt the Structured Curriculum system, marking an important milestone toward the ideal way of learning. Structured Curriculum system offers students the flexibility to add a minor or second major, or to plan his/her own learning. All majors and minors completed will be listed on the graduation certification to manifest students' competency.

After holding numerous meetings and collecting opinions from different parties of the community, this department carefully rearranged courses for an up-to-date curriculum. Our Fundamental and Core Programs cover all the basic yet important theories in Computer Science. On top of core programs, there are four professional elective programs, including the Program of Multimedia Technologies and Applications, Program of Software Systems and Applications, Program of Network and Systems, and Program of Digital Life Technology. In addition to the major programs of this department, students can take a minor or another major within or across colleges.

To assist students in understanding this department's course programs and related career paths, and in choosing the courses that fit their interests best, we prepare this comprehensive guide to explain on the program-based structured curriculum system, study plan, roadmap for future careers, and relationship between study plans and careers. We also include detailed explanations and course selection examples in the four professional elective programs. Through this guide, we believe that all CSIE students will have a much clearer picture of their learning at school and future careers.

In the 21st century today, many new industries are burgeoning as the result of globalization and specialization. In order to adapt to this tough employment market and be a winner, our students must learn actively, think across disciplines, apply technologies and innovations to the daily life, and inject real passion into works and careers.

I wish you all the best with new life in here!

Professor Shiow-Yang Wu
Chairman of the Department of Computer Science & Information Engineering
National Dong Hwa University
2014.03.01

## 2. Structured Curriculum Programs

The concept of the Structured Curriculum system originates from the former President of the University, Dr. Huang, who proposed the system after surveying various curriculum systems around the world. The goal was to create a flexible system that was applicable under the current system in Taiwan, so that students could take an additional minor or major more easily. A well designed curriculum system not only enhances the teaching quality, but also increases students' motivation to learn, as well as their competency to compete in the employment market. This system also provides a feasible direction for the reformation of the higher education in Taiwan.

The basic concept of structured curriculum system is to modularize related courses into different sets, so that students can easily focus on sets of classes to build up related knowledge and skills. For a young college student who is still searching for the direction of study, these structured programs undoubtedly serve as a helpful guide and save lots of time. Also, teachers are able to focus on the core courses of the program and avoid being distracted by unrelated contents, which scatters and wastes the resources.

Our curriculum programs are structured as follows— firstly is the university-wide General Education Requirements (通識課程), also called the University Core Courses, where students can immerse themselves in knowledge, develop the ability of independent thinking and achieve mastery through comprehensive study. Come in the second is the Major Programs (主修學程) designed by the department. Take the Department of CSIE for example: the Major Programs consist of three programs--Fundamental Program of Electrical Engineering and Computer Science (電資基礎學程), and Core Programs of Computer Science I & II (資工核心一&二). **Fundamental Program of Electrical Engineering and Computer Science** covers the common knowledge base of the college. **Core Programs of Computer Science I & II** cover all primary knowledge on hardware, software, and theories. Furthermore, in order to graduate from the university, students also need to take a Professional Elective Program (專業學程) from our department (as a Declared Major) or any program set from another department (deemed as a Minor), and obtain at least 128 credits , which is required by the Ministry of Education of Taiwan.

Modularized programs are designed to help students cultivate the capabilities they look for. For instance, the Department of CSIE and the Department of EE share the same fundamental program, and many subjects appear in the Core Programs of both departments. Therefore students can declare a Double-Major in both CISE and EE by just making up the credits of the other required subjects. In addition, the university allows credits from the fundamental courses of a department to be counted as related General Education Requirements, so students can stand on an even more solid step stone for building up your professional knowledge and ability. With these advantages and flexibilities, students can develop study plans that best suit their own needs and enhance their competitiveness in

the future. All of these are not possible under the old curriculum system.

Our department offers a special **Five-Year** program for highly-motivated students. Approved applicants are granted the chance to acquire both bachelor and master degrees in a period of five years, allowing students an early start on their future careers.

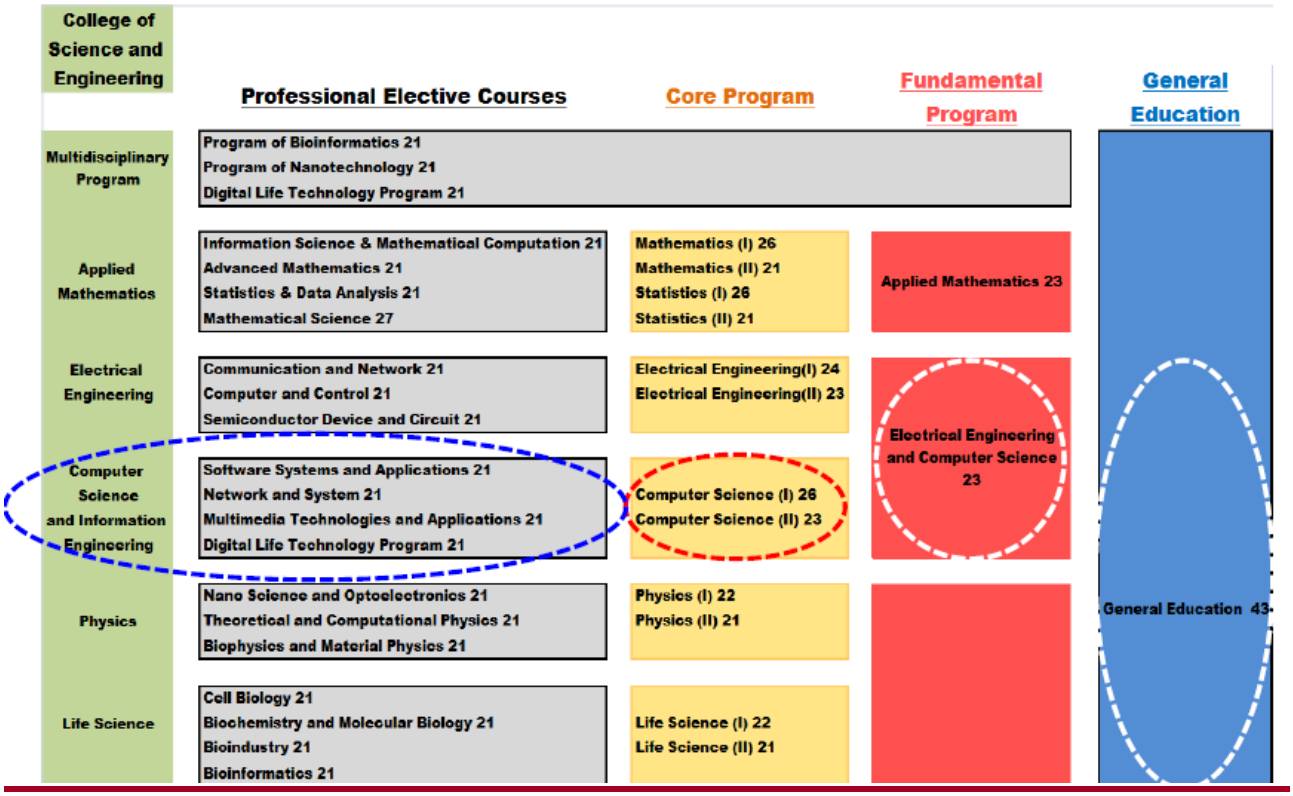
Here we would like to manifest that the success of the Structured Curriculum System and its Programs depends on both the design of programs and the participation and devotion of students. In addition to our teachers' elaboration, we need more feedback from academia, industries and our students to keep improving the whole system towards its perfection. We wish you to find out "who you are", "who you like to be in the future" early in your life and start to develop your proficiency. We also wish you a very fruitful and memorable time here with Department of CSIE as you build yourself up with profound professional abilities and life experience.

Engineering Building II (Department of Computer Science & Information Engineering)

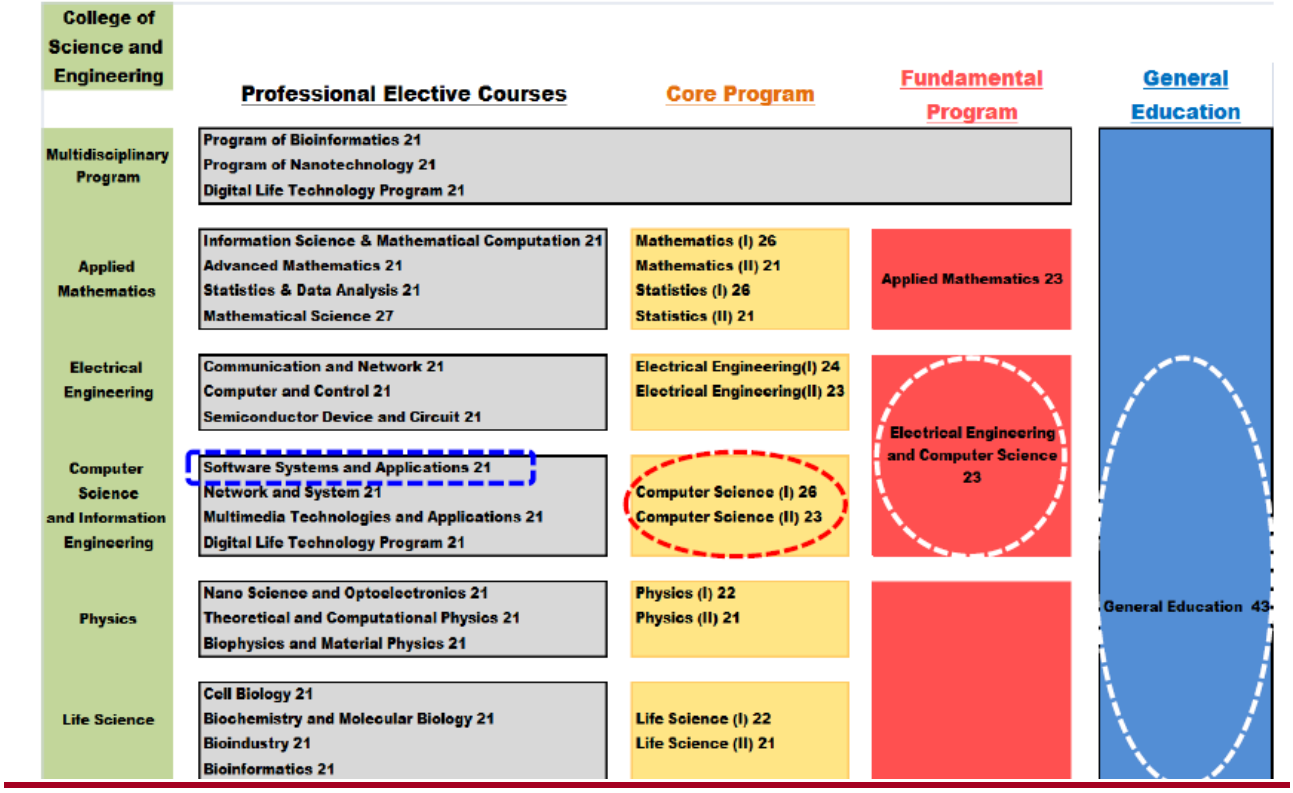
# Program System for the College of Science & Engineering

| College of Science and Engineering | Professional Elective Courses | Core Program | Fundamental Program | General Education |
|---|---|---|---|---|
| Multidisciplinary Program | Program of Bioinformatics 21<br>Program of Nanotechnology 21<br>Digital Life Technology Program 21 | | | General Education 43 |
| Applied Mathematics | Information Science & Mathematical Computation 21<br>Advanced Mathematics 21<br>Statistics & Data Analysis 21<br>Mathematical Science 27 | Mathematics (I) 26<br>Mathematics (II) 21<br>Statistics (I) 26<br>Statistics (II) 21 | Applied Mathematics 23 | |
| Electrical Engineering | Communication and Network 21<br>Computer and Control 21<br>Semiconductor Device and Circuit 21 | Electrical Engineering(I) 24<br>Electrical Engineering(II) 23 | Electrical Engineering and Computer Science 23 | |
| Computer Science and Information Engineering | Software Systems and Applications 21<br>Network and System 21<br>Multimedia Technologies and Applications 21<br>Digital Life Technology Program 21 | Computer Science (I) 26<br>Computer Science (II) 23 | | |
| Physics | Nano Science and Optoelectronics 21<br>Theoretical and Computational Physics 21<br>Biophysics and Material Physics 21 | Physics (I) 22<br>Physics (II) 21 | Program of Science 21 | |
| Life Science | Cell Biology 21<br>Biochemistry and Molecular Biology 21<br>Bioindustry 21<br>Bioinformatics 21 | Life Science (I) 22<br>Life Science (II) 21 | | |
| Chemistry | Organic Chemistry and Biochemistry 21<br>Physical and Analytical Chemistry 21<br>Inorganic Chemistry and Material Science 21 | Chemistry (I) 24<br>Chemistry (II) 22 | | |
| Materials Science and Engineering | Advanced Materials 21<br>Opto- Electronic Energy Material and Component 21<br>Nanotechnology 21 | Materials (I) 27<br>Materials (II) 21 | | |
| Opto-electronic Engineering | Opto- Electronic Energy Material and Component 21<br>Electro-Optical Technology 21<br>Lighting and Display 21 | Opto- Electronics 27 | | |

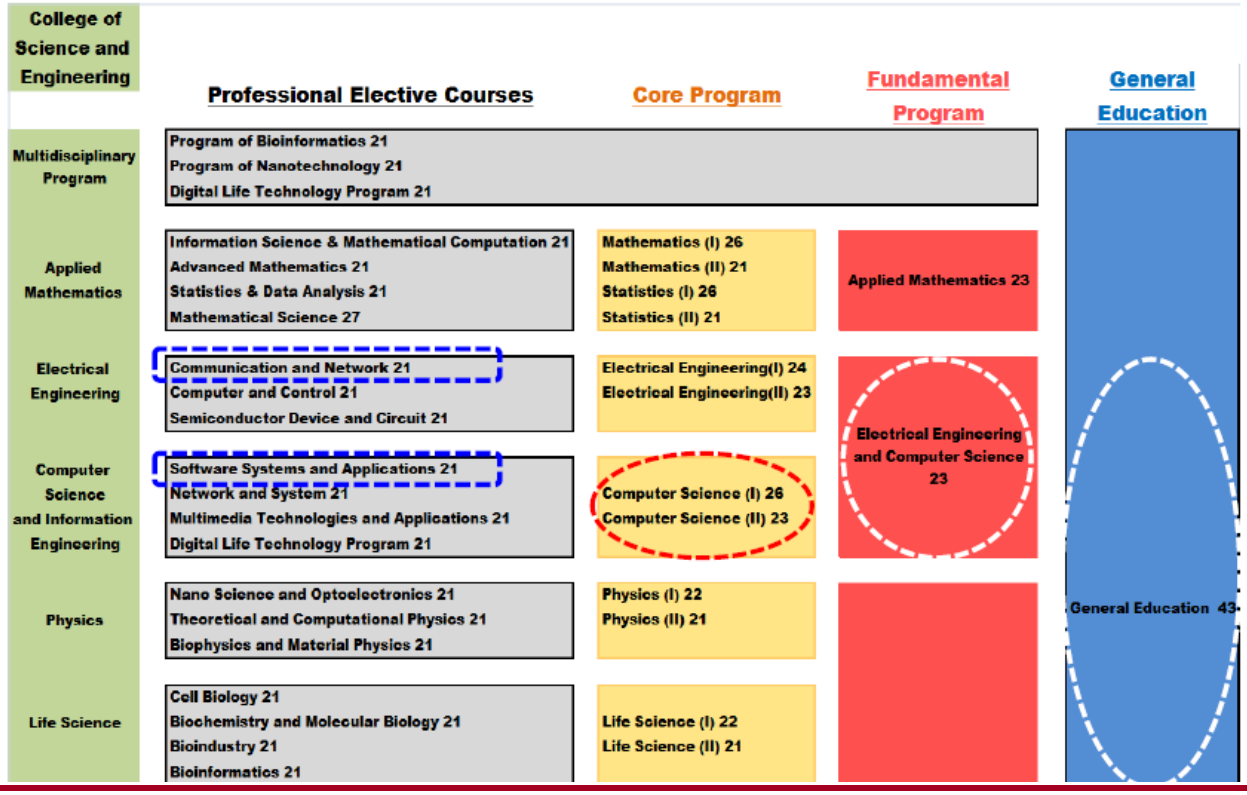
# Structured Curriculum Programs



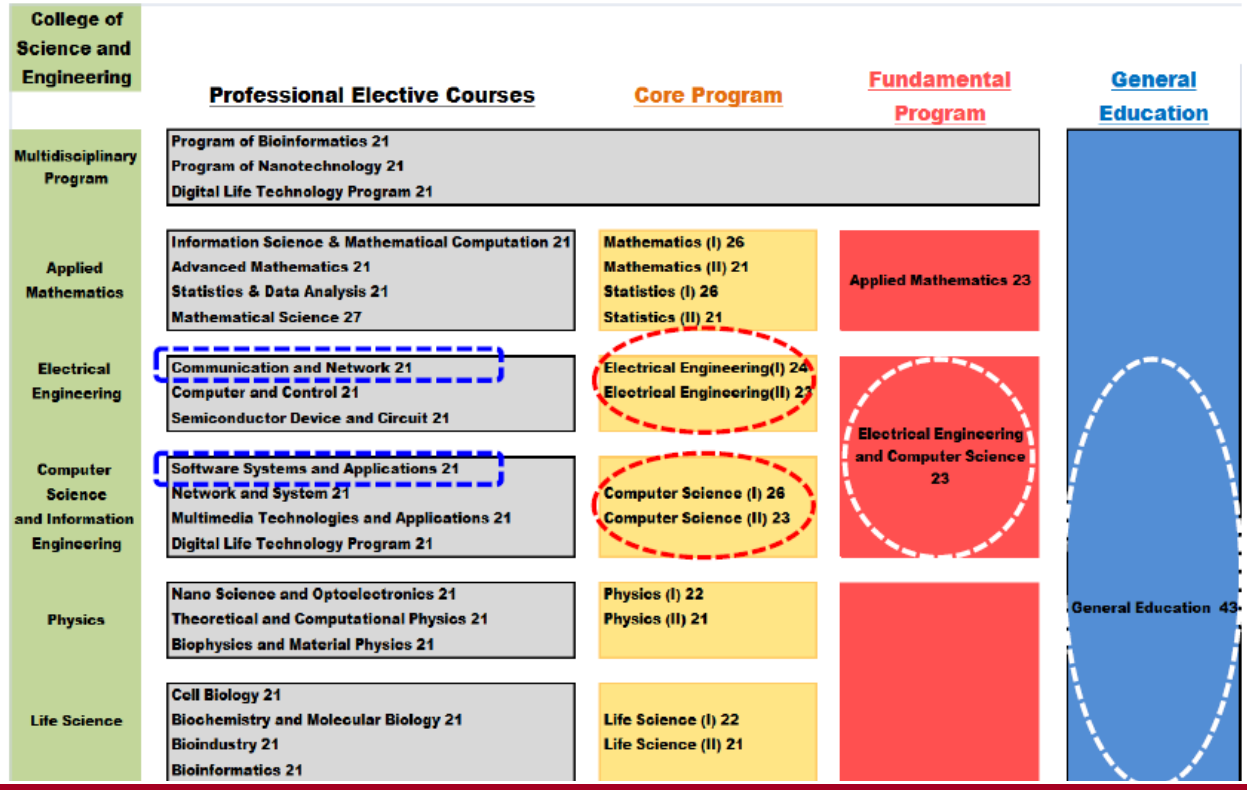

# One Major



# One Major & One Minor

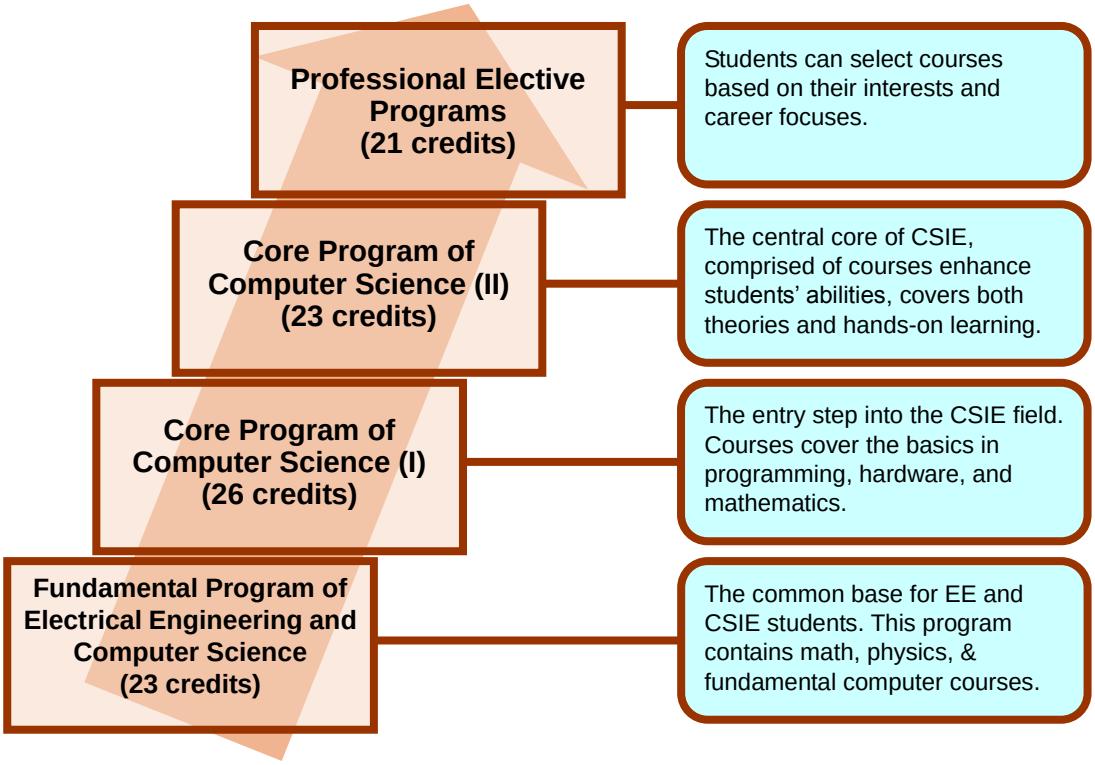



# Double Major



## 3. Program Planning

Based on the expertise of our faculty and the latest development trends of industries and research, we group our courses into different programs that cover various fields of computer science and information engineering.




These programs are:

1. Fundamental Program of Electrical Engineering and Computer Science
2. Core Program of Computer Science (I)
3. Core Program of Computer Science (II)
4. Program of Multimedia Technologies and Applications
5. Program of Software Systems and Applications
6. Program of Network and Systems
7. Program of Digital Life Technology
8. Program of Cloud Computing and Management of Big Data Systems (in coming future)

**The first three are the required programs** and the others are professional elective programs. To graduate from the Department of CSIE, students must complete all the required programs and one elective program of the department or a program of any other department of the university, and also fulfill the requirements from the University, which is part of the criteria of graduation.

The courses in the Fundamental Program of Electrical Engineering and Computer Science are listed in Table 1. These courses worth a total of 23 credits and are expected to be completed in the first

school year. This program aims at building up students' capabilities on logical thinking, programming, and basic knowledge in the field of computer science and information engineering.

**Table 1. Fundamental Program of Electrical Engineering and Computer Science**

| Fundamental Program of Electrical Engineering and Computer Science | Credit | Year | Semester | Requested /Elective | Remark |
|---|---|---|---|---|---|
| Calculus ( I ) | 3 | 1 | 1 | R | |
| Calculus ( II ) | 3 | 1 | 2 | R | |
| General Physics ( I ) | 3 | 1 | 1 | R | |
| General Physics ( II ) | 3 | 1 | 2 | R | |
| General Physics Lab. ( I ) | 1 | 1 | 1 | R | |
| General Physics Lab. ( II ) | 1 | 1 | 2 | R | |
| Introduction to Computer Programming ( I ) | 3 | 1 | 1 | R | |
| Linear Algebra | 3 | 1 | 2 | R | |
| Introduction to Computer Science | 3 | 1 | 1 | R | |
| Important Notifications:<br>None. | | | | | |

The courses in the Core Program of Computer Science ( I ) are listed in Table 2. These courses worth 26 credits and most of them are for students in their second year. This program covers the basics in mathematics, hardware, and programming. Experimental laboratories are connected with most of the classes in this program where theories are really brought into practice.

**Table 2. Core Program of Computer Science ( I )**

| Core Program of Computer Science ( I ) | Credit | Year | Semester | Requested /Elective | Remark |
|---|---|---|---|---|---|
| Introduction to Computer Programming ( I ) | 3 | 1 | 1 | R | |
| Lab of Programming ( I ) | 1 | 1 | 1 | R | |
| Introduction to Computer Programming ( II ) | 3 | 1 | 2 | R | |
| Lab of Programming ( II ) | 1 | 1 | 2 | R | |
| Digital Logic Design | 3 | 2 | 1 | R | |
| Digital Systems Laboratory | 1 | 2 | 2 | R | |
| Data Structures | 3 | 2 | 1 | R | |
| Lab of Data Structures | 1 | 2 | 1 | R | |
| Algorithm Design and Analysis | 3 | 2 | 2 | R | ** |

| | | | | | |
|---|---|---|---|---|---|
| Lab of Algorithm Design | 1 | 2 | 2 | R | |
| Operating Systems | 3 | 3 | 1 | R | |
| Discrete Mathematics | 3 | 2 | 1 | R | |

Important Notifications:

1. Students must pass both Introduction to Computer Programming (I) &(II) to proceed to Data Structures and/or Algorithm Design and Analysis classes.
2. Computer Programming (I) and (II) must be offered by Dept of CSIE, unless approved by Departmental Education Committee.
3. ** Must pass Data Structures class in order to continue to Algorithm Design and Analysis class.

The courses in the Core Program of Computer Science ( II ) are listed in Table 3. These courses worth 23 credits and will be in the second and the third school year. Again, in the second year, 3 areas are equally covered—Probability for **mathematics**, Computer Organization and Electric and Electronic Circuits for **hardware**, and Programming Languages for **software**. Courses in the third year are more advanced—e.g. Formal Languages and Automata, Compiler Design and Implementation. Also in the third year, a yearlong Independent Study is required for all students to apply theories into real situations. For this Independent Study class, students need to choose their own professors, join research labs, work under the advisors' direct supervisions, design and develop projects, and present the final results in an exhibition. Through this process, students will learn how to research for solutions as well as deepen and widen their abilities and knowledge in the field of CSIE.

**Table 3. Core Program of Computer Science ( II )**

| Core Program of Computer Science ( II ) | Credit | Year | Semester | Requested /Elective | Remark |
|---|---|---|---|---|---|
| Probability | 3 | 2 | 2 | R | |
| Computer Organization | 3 | 2 | 2 | R | |
| Programming Languages | 3 | 2 | 2 | R | |
| Computer Architecture | 3 | 3 | 1 | R | |
| Formal Languages and Automata | 3 | 3 | 2 | R | |
| Compiler Design and Implementation | 3 | 3 | 2 | R | |
| Independent Study ( I ) | 1 | 3 | 1 | R | * |
| Independent Study ( II ) | 1 | 3 | 2 | R | * |
| At least 1 course from below: | | | | | |
| Electronics ( I ) | 3 | 2 | 1 | E | |
| Electric Circuit Analysis ( I ) | 3 | 2 | 1 | E | |

| | | | | | |
|---|---|---|---|---|---|
| Electric and Electronic Circuits | 3 | 2 | 1 | E | |
| Important Notifications:<br>* All CSIE students must complete a 1-year long Independent Study to finish a graduate project, and then perform a stand-up presentation and exhibition demonstration at the end of the year. | | | | | |

In addition to the three required programs above, four advanced professional programs are provided by the department, as listed from Table 4 through Table 7. They are the Program of **Multimedia Technologies and Applications**, Program of **Software Systems and Applications**, Program of **Network and Systems**, and Program of **Digital Life Technology**. All these elective programs cover the current development directions in CSIE fields. Further details on enrollment in these programs will be elaborated in Section 4 to 7 of this guide. Students must complete 21 credits to fulfill the requirements of one program.

Starting from the school year of 2012, the department introduced the concept of "class groups **課組**"— by placing both undergraduate introduction-level and graduate advanced-level classes of same professional areas in the program. This concept provides advantages and flexibilities for teachers to plan the courses, and for students to choose the subjects. If a freshman student plans to get his/her master degree in five year, this "class group" concept provides even more benefits.

Taking the Multimedia Program for example: an undergraduate student now has the option to choose either "Introduction to Image Processing" or the graduate-level "Image Processing" to fulfill the bachelor degree requirement. For a student who wants to advance into the master degree, he/she can take the advantage of paying less for costly graduate-level courses. Furthermore, if the course credits are not counted into the bachelor degree requirement, they can be applied to master degree requirement.

**Table 4. Program of Multimedia Technologies and Applications**

| Course | Credit | Year | Semester | Remark |
|---|---|---|---|---|
| Introduction to Image Processing | 3 | 3 | 1 | Image Processing Group |
| Image Processing | 3 | 4 | 2 | Image Processing Group-Graduate Level |
| Introduction to Digital Signal Processing | 3 | 3 | 2 | Digital Signal Processing Group |
| Digital Signal Processing | 3 | 4 | 2 | Digital Signal Processing Group-Graduate Level |
| Computer Vision | 3 | 3 | 1 | Computer Vision Group |
| Advanced Computer Vision | 3 | 4 | 2 | Computer Vision Group-Graduate Level |
| Introduction to Virtual Reality | 3 | 3rd | 1 | Virtual Reality Group |

| | | | | |
|---|---|---|---|---|
| Virtual Reality | 3 | 4th | 1 | Virtual Reality Group-Graduate Level |
| 3D Computer Graphics on Game Development | 3 | 3rd | 1 | Computer Graphics Group |
| Advanced Computer Graphics | 3 | 4th | 1 | Computer Graphics Group-Graduate Level |
| 3D Game Engine Programming | 3 | 3rd | 2 | Graphics System Group |
| Advanced Computer Graphics System Design | 3 | 4th | 2 | Graphics System Group-Graduate Level |
| Multimedia Systems | 3 | 4th | 2 | |
| Computer Game Architecture and Design | 3 | 3rd | 2 | |
| Pattern Recognition | 3 | 4th | 2 | Graduate Level Course |
| Speech Processing and Recognition | 3 | 4th | 1 | Graduate Level Course |
| Advanced Multimedia Interaction Technologies | 3 | 4th | 1 | Graduate Level Course |

Important Notifications:

1. Up to 6 credits are transferrable into this program.
   For CSIE students: Information Security and Advanced Computer Programming classes are allowed to transfer into this program.
   For students of other departments: any courses offered by the CSIE elective programs, Introduction to Computer Programming (I), and Data Structures classes are allowed to transfer into this program.
   Courses of the same names but intended for non-major students are not allowed to transfer.

2. Only 1 course from the same course group can be counted as the required credits of the program, although all credits are counted for graduation. Students must decide where the course credits will be counted. If graduate-level courses are counted for undergraduate programs or for graduation, they cannot be counted again for the master's programs.

3. For undergraduate students—when studying a graduate-level course with the same name, even though it is offered in different graduate programs (e.g. master's, executive-master's, doctoral), is deemed as the same-name course of this program.

## Table 5. Program of Software Systems and Applications

| Course | Credit | Year | Semester | Remark |
|---|---|---|---|---|
| Introduction to Artificial Intelligence | 3 | 3 | 1 | Artificial Intelligence Group |
| Artificial Intelligence | 3 | 4 | 2 | Artificial Intelligence Group-Graduate Level |
| Introduction to Bioinformatics | 3 | 3 | 2 | Bioinformatics Group |
| Computational Biology | 3 | 4 | 2 | Bioinformatics Group-Graduate Level |

| | | | | |
|---|---|---|---|---|
| Introduction to Soft Computing | 3 | 3 | 1 | Soft Computing Group |
| Realization of Soft Computing Systems | 3 | 4 | 1 | Soft Computing Group-Graduate Level |
| Programming Multimedia APPs for Mobile Platforms | 3 | 3 | 1 | Mobile Applications Group |
| Context aware navigation technologies | 3 | 4 | 1 | Mobile Applications Group--Graduate Level |
| Advanced Computer Programming | 3 | 3 | 2 | |
| System Programming | 3 | 3 | 1 | |
| Information Retrieval | 3 | 3 | 1 | |
| Algorithms for Bioinformatics | 3 | 3 | 1 | |
| Software Engineering | 3 | 3 | 2 | |
| Database Systems | 3 | 3 | 2 | |
| XML Design and Applications | 3 | 3 | 2 | |
| Internet System Design | 3 | 3 | 1 | |
| Internet System Practice | 3 | 3 | 2 | |
| Data Mining and Applications | 3 | 3 | 1 | |
| Machine Learning | 3 | 4 | 2 | Graduate level |
| Intelligent System Design | 3 | 4 | 2 | Graduate level |

Important Notifications:

1. Up to 6 credits are transferrable into this program.
   For CSIE students: Multimedia Systems and Network Programming Design classes are allowed to transfer into this program.
   For students of other departments: any courses offered by the CSIE elective programs, Introduction to Computer Programming (I), and Data Structures classes are allowed to transfer into this program.
   Courses of the same names but intended for non-major students are not allowed to transfer.

2. Only 1 course from the same course group can be counted as the required credits of the program, although all credits are counted for graduation. Students must decide where the course credits will be counted. If graduate-level courses are counted for undergraduate programs or for graduation, they cannot be counted again for the master's programs.

3. For undergraduate students—when studying a graduate-level course with the same name, even though it is offered in different graduate programs (e.g. master's, executive-master's, doctoral), is deemed as the same-name course of this program.

## Table 6. Program of Network and Systems

| Course | Credit | Year | Semester | Remark |
|---|---|---|---|---|
| Introductory to VLSI Design | 3 | 3 | 1 | VLSI Design Group |
| Application-Specific Integrated Circuits Design | 3 | 4 | 1 | VLSI Design Group-Graduate Level |
| Introduction to Embedded System Design | 3 | 3 | 2 | Embedded System Design Group |
| Software Development for Embedded Systems | 3 | 4 | 1 | Embedded System Design Group-Graduate Level |
| Wireless Networks | 3 | 3 | 2 | Wireless Networks Group |
| Wireless Internet | 3 | 4 | 2 | Wireless Networks Group-Graduate Level |
| Computer Networks | 3 | 3 | 1 | Computer Networks Group |
| Computer Networks and Communications | 3 | 4 | 1 | Computer Networks Group-Graduate Level |
| Graph Theory | 3 | 3 | 2 | Graph Theory Group |
| Advanced Graph Theory | 3 | 4 | 2 | Graph Theory Group-Graduate Level |
| Introduction to Information Security Management System | 3 | 3 | 1 | Information Security Management Group |
| Information Security Management System | 3 | 4 | 2 | Information Security Management Group-Graduate Level |
| Introduction to Parallel Computing | 3 | 3 | 1 | Parallel Computing Group |
| Parallel Computing | 3 | 4 | 1 | Parallel Computing Group Group-Graduate Level |
| Introduction to Cloud Computing | 3 | 4 | 1 | Cloud Computing Group |
| Cloud Computing | 3 | 4 | 2 | Cloud Computing Group-Graduate Level |
| Information Security | 3 | 3 | 1 | |
| Computer Network Practice | 3 | 3 | 2 | |
| Network Programming Design | 3 | 3 | 2 | |
| Internet Protocols | 3 | 3 | 2 | |

Important Notifications:

1. Up to 6 credits are transferrable into this program.
   For CSIE students: Introduction to Digital Signal Processing and System Programming classes are allowed to transfer into this program.
   For students of other departments: any courses offered by the CSIE elective programs, Introduction to Computer Programming (I), and Digital Logic Design classes are allowed to transfer into this program. Courses of the same names but intended for non-major students are not allowed to transfer.

2. Only 1 course from the same course group can be counted as the required credits of the program,

although all credits are counted for graduation. Students must decide where the course credits will be counted. If graduate-level courses are counted for undergraduate programs or for graduation, they cannot be counted again for the master's programs.

3. For undergraduate students—when studying a graduate-level course with the same name, even though it is offered in different graduate programs (e.g. master's, executive-master's, doctoral), is deemed as the same-name course of this program.

**Table 7. Program of Digital Life Technology**

| Course | Credit | Year | Semester | Remark |
|---|---|---|---|---|
| Introduction to Image Processing | 3 | 3rd | 2 | Taught in English |
| Computer Networks | 3 | 3rd | 1 | Taught in English |
| Introduction to Embedded System Design | 3 | 3rd | 2 | Taught in English |
| 3D Computer Graphics on Game Development | 3 | 3rd | 1 | Taught in English |
| Database Systems | 3 | 3rd | 2 | Taught in English |
| Multimedia Systems | 3 | 3rd | 1 | Taught in English |
| Data Mining and Applications | 3 | 4th | 1 | Taught in English |
| Wireless Networks | 3 | 3rd | 2 | Taught in English |
| Introduction to Optimization Methods | 3 | 4th | 1 | Taught in English |
| Mobile Device Programming Design | 3 | 2nd | 1 | Taught in English |
| Principles of Communications | 3 | 3rd | 1 | Taught in English |
| Introduction to Computer Networks | 3 | 3rd | 1 | Taught in English |

Important Notes:

Any classes with the same name from all other CSIE Programs are substitutable.

# 4. Program of Multimedia Technologies & Applications

## About this program


If there were no more audio and video resources online, would it still be interesting to surf the internet? If it went backwards to the days when you need to interact with computers by typing in commands instead of through a graphic interface, would computers still be a part of your daily life? Do you know how the mesmerizing League of Legends (LoL) was designed and presented to us? There is no doubt that computers and all sorts of consumer electronics have become so attractive to people with their dazzling sound and light, being the main source of fun for users of multimedia devices.


Multimedia has broadened the consumer base of the information and communications technology (ICT) industry and further diversified the products on the market. Multimedia technologies and applications is the key in the field of digital contents, which has been promoted all around the world by governments; Digital Archives of History, e-Learning, and Digital Leisure, …, etc. are all part of the Nation's Digital Engineering Project and are all closely related to multimedia technologies. Our multimedia program aims to enable our students to bring the feast of light and sound to our daily life, and bring the abilities of senses to machine through computers. The saying "Multimedia Technology is the best way to transform the Arts" absolutely makes the point. We invite you to join this program and join us to bring to people an even more convenient and quality life through this digital power.



Various professional elective courses are offered in this program—**Introduction to Image Processing, Introduction to Digital Signal Processing, Computer Vision, Multimedia Systems, Intoduction to Virtural Reality, 3D Computer Graphics on Game Development, 3D Game Engine Programming, Computer Game Arcchitecture and Design, Programming Multimedia APPs for Mobile Platforms, Pattern Recognition, Speech Processing and Recognition, Advanced Multimedia Interaction Technologies, Intelligent digital learning system.** These courses are presented by our Multimedia

faculty members, including Prof. Shin-Feng Lin, Prof. Ching-Nung Yang, Prof. Wen-Kai Tai, Prof. Cheng-Chin Chiang, Prof. Mau-Tsuen Yang, Prof. I-Cheng Chang, and Prof. Chih-Hung Lai. At least 21 credits are needed to complete this program and up to 6 credits from other elective courses can be counted as credits of this program.


It takes solid programming skills to complete this program. It is strongly suggested that you learn and develop required capabilities through **Introduction to Computer Programming I & II, Data Structures, and Algorithm Design and Analysis in Core Program (I)** in the first year. Furthermore, your performances in **Linear Algebra and Probability** are also critical. In this Elective Program, the **Information to Image Processing** will help you build up the fundamental knowledge base of image processing and related skills. **Introduction to Digital Signal Processing** will present you the Concepts of Digital Signals—including the theories on signal processing and various methods of signal transferring. **Multimedia Systems** is a comprehensive and important course that integrates all sorts of multimedia technologies and applications. **3D Computer Graphics on Game Development** is a highly recommended course that cannot be missed for those who intend to pursue a career in game design or 3D graphics. **Introduction to Virtual Reality** is an educative and entertaining course, which gives an introduction on how to integrate 3D graphics techniques and interactive input/output technologies in game design. **Computer Vision** is based on image processing techniques, teaches on how computers can perform intelligent analyses on images and videos and provide useful services to us. **Pattern Recognition** will build up your basic knowledge of this field both theoretically and pragmatically; you will be able to recognize data in various format, such as text, sound, image etc., with computer aid. Speech Processing and Recognition will teach you the technologies of speech signal processing and the abilities to design speech recognition system, allow people to control machine by voice and enjoy a smoother and more convenient user experience. **Advanced Multimedia Interaction Technologies** helps you integrate video, voice, and human body posture in running machine and device, and brings in more fun to our life. **Programming Multimedia APPs for Mobile Platforms** familiarizes you with the principles of APP design and allows you to exert your creativity and implements it on mobile devices. **Computer Game Architecture and Design** introduces you the planning and designing of interactive computer games both theoretically and pragmatically and helps you master the key knowledge of game development. **3D Game Engine Programming** focuses on the back-end engine


design of computer graphics. And Intelligent Digital Learning System emphasizes on uplifting students' learning results through the applications of information and communications technologies, which at the same time makes learning more fun and effective.

Students have a wide range of choices for further studies after the completion of this program. In addition to the master programs in the Department of CSIE, programs for multimedia-related degrees are also offered in National Taiwan University, National Tsing Hua University, National Chiao Tung University, etc. For those who also have talents or interests in the Arts, the Institute of Applied Arts at National Chiao Tung University or the Department of New Media Art at Taipei National University of the Arts (國立臺北藝術大學) can also be an option. Multimedia are widely applied to various fields; therefore, there are many interesting and challenging research topics on multimedia processing, multimedia compression, multimedia watermarking, human machine interaction, 3D graphics and animation, medical imaging, video surveillance, pattern recognition, image rendering techniques, multimedia communication, ...etc., making it a field worth exploring.

For those looking to enter the employment market, there are three major directions in multimedia application:

1. **Multimedia Network:** Combining two mainstreams of technologies—Multimedia and Network, this field is where various applications for high definition and high speed are developed. Examples include the software and hardware designs for Movie on Demand (MOD), Voice over IP(VoIP), next-generation mobile communication, video conference,…etc. These applications allow us to break the limitations of time and space, enjoy quality videos and audios online, and the convenience of digital video and audio communication.

2. **Digital Content Design:** Combining video and audio synthesis techniques and game design, digital archives, e-learning, and digital audio and video, …etc., this field is where creativity and innovation can be explored and where techniques meet the Arts. All advanced countries around the world are injecting talents and capitals into this field, and career prospects are promising .

3. **Intelligent Multimedia Systems:** Combining advanced audiovisual techniques and Artificial Intelligence techniques to increase computer systems' senses, recongiztions, and learning abilities, the intelligent multimedia system allows computers to be our smartest partner of life. This field covers human-machine interaction systems (e.g. voice-, gesture-, or movement-control systems), machine guards, video survelliance, bio-feature recognition, remote image analysis, medical image analysis, intelligent transportation systems, industrial automated inspection, automated military target tracking and recognition, …etc.

## Examples of Course Enrollment

| Career Focus | Math courses | Suggested courses from this program | Suggested courses from other programs |
|---|---|---|---|
| Multimedia Network | Linear Algebra, & Probability | ■ Multimedia Systems<br>■ Introduction to Image Processing<br>■ Introduction to Digital Signal Processing<br>■ Programming Multimedia APPs for Mobile Platforms | ■ Computer Networks,<br>■ Internet Protocols,<br>■ Network Programming Design,<br>■ Introduction to Embedded System Design |
| Digital Content Design | | ■ Multimedia Systems<br>■ Introduction to Image Processing<br>■ Computer Graphics on Game Development,<br>■ Computer Game Architecture and Design<br>■ Introduction to Virtual Reality<br>■ Intelligent Digital Learning System | ■ Advanced Computer Programming,<br>■ Database Systems,<br>■ Information Security,<br>■ Software Engineering |
| Intelligent Multimedia System | | ■ Introduction to Image Processing,<br>■ Computer Vision,<br>■ Speech Processing and Recognition<br>■ Pattern Recognition<br>■ Advanced Multimedia Interaction Technologies | ■ Advanced Computer Programming,<br>■ Introduction to Artificial Intelligence,<br>■ Data Mining and Application |

# Program of Multimedia Technologies and Applications

- **Offered by: Department of CSIE**
- **At least 21 credits are required to complete this program.**
- **Course list:**

| Course | Course code | Credit | Year | Semester | Remarks |
|---|---|---|---|---|---|
| Introduction to Image Processing | CSIE30700 | 3 | 3 | 1 | Image Processing course group |
| Image Processing | CSIE52100 | 3 | 3 | 2 | Image Processing course group (Graduate level) |
| Introduction to Digital Signal Processing | CSIE34200 | 3 | 3 | 2 | Digital Signal Processing course group |
| Digital Signal Processing | CSIE57500 | 3 | 4 | 2 | Digital Signal Processing course group(Graduate level) |
| Computer Vision | CSIE32400 | 3 | 3 | 1 | Computer Vision course group |
| Advanced Computer Vision | CSIE54400 | 3 | 3 | 2 | Computer Vision course group (Graduate level) |
| Introduction to Virtual Reality | CSIE34300 | 3 | 3 | 1 | Virtual Reality course group |
| Virtual Reality | CSIE56000 | 3 | 4 | 1 | Virtual Reality course group (Graduate level) |
| 3D Computer Graphics on Game Development | CSIE34800 | 3 | 3 | 1 | Computer Graphics course group |
| Advanced Computer Graphics | CSIE53300 | 3 | 4 | 1 | Computer Graphics course group(Graduate level) |
| 3D Game Engine Programming | CSIE@0150 | 3 | 3 | 2 | Computer Graphics system course group |
| Advanced Computer Graphics System Design | CSIE55400 | 3 | 4 | 2 | Computer Graphics system course group (Graduate level) |
| Multimedia Systems | CSIE32100 | 3 | 4 | 1 | |
| Computer Game Architecture and Design | CSIE33800 | 3 | 3 | 2 | |

| | | | | | |
|---|---|---|---|---|---|
| Pattern Recognition | CSIE55000 | 3 | 4 | 2 | Graduate level |
| Speech Processing and Recognition | CSIE58900 | 3 | 4 | 2 | Graduate level |
| Advanced Multimedia Interaction Technologies | CSIE@0170 | 3 | 3 | 1 | Graduate level |

Important Notes:

1. Up to 6 credits are transferrable into this program.
   For CSIE students: Information Security and Advanced Computer Programming classes are allowed to transfer into this program.
   For students of other departments: any courses offered by the CSIE elective programs, Introduction to Computer Programming (I), and Data Structures classes are allowed to transfer into this program.
   Courses of the same names but intended for non-major students are not allowed to transfer.

2. Only 1 course from the same course group can be counted as the required credits of the program, although all credits are counted for graduation. Students must decide where the course credits will be counted. If graduate-level courses are counted for undergraduate programs or for graduation, they cannot be counted again for the master's programs.

3. For undergraduate students—when studying a graduate-level course with the same name, even though it is offered in different graduate programs (e.g. master's, executive-master's, doctoral), is deemed as the same-name course of this program.

# 5. Program of Software Systems and Applications

## About the program


Software is the soul of computer, and finding practical solution is the core value for most computer systems. Since the computer is the common main theme for all fields of CSIE, this program is the core and soul of the department. Through a well-rounded combination of courses and trainings, our students develop skills in software systems and applications and are able to explore various fields.

Most of CSIE students' jobs are related to software and its applications; some of them are about software and system, some are about application development, and even more are about designing and constructing the costumed Enterprise Resource Planning System through system analyzing. While we have come to the age of mobile and cloud computing, industries' demands for all sorts of innovative services are becoming even more urgent. Solid abilities on software development and system application have been deemed the promise for your dream job. Even Obama, the President of the USA, encourages young people to learn programming and software development but not just use it. The purpose of this program is to help you build a strong foundation in this field and enhance your competitiveness in the job market.



The first part of the program helps develop your software abilities; courses include: **Advanced Computer Programming, System Programming, Software Engineering, Database Systems, Information Retrieval, Data Mining and Applications, XML Design and Applications, Internet System Design, Internet System Practice**, **Machine Learning**, and **Intelligent System Design**. The second part is the course groups for different application fields; these fields are: artificial intelligence, bioinformatics, soft computing, and mobile application. Courses are presented by our software systems and applications faculty members including Prof. Shiow-Yang Wu, Prof. Shih-Chien Chou, Prof. Shi-Jim Yen, Prof. Guan-Ling Lee, Prof. Sheng-Lung Peng, Prof. Han-Ying Kao, and Prof. Tao-Ku Chang. At least 21 credits are needed to complete this program and up to 6 credits from other elective courses can be counted as credits of this program. Please refer to the Notifications part of the course list table.

Following the fundamental courses such as **Introduction to Computer Programming I & II, Data Structures, and Algorithm Design and Analysis**, this program involves more advanced courses like **Advanced Computer Programming, System Programming, and Software Engineering** to progressively develop students' abilities from small procedural design projects to large object-oriented ones.


Data management and application courses include **Database Systems, Information Retrieval, Data Mining and Application, Internet System Design, Internet System Practice, and XML Design and Applications**. These courses take you from the basic database theories and applications, to the hottest topics such as information retrieval, search engines, data mining and applications, all will help you fully understand the core role that databases play in all applications and how to apply related theories and techniques to implement them. For all sorts of solutions to problems, databases are the foundation for the software development in today's applications.


As for the courses for applications, **Artificial Intelligence** course group opens the gate for you to intelligent software development. **Bioinformatics** course group and **Algorithms for Bioinformatics** ushers you into the wonderland of biology and information. **Soft Computing** course group takes unconventional ways to find the best solutions, like evolutionary computation, fuzzy logic, genetic algorithms, and neural network etc., whereas Mobile Application course group provides you the required knowledge and capabilities to develop multimedia applications and services for mobile devices and wireless environment.



This program is invaluable to your further studies and employment. You can choose to study any field related to software systems and applications. Courses in this program are the base of all these research fields. The research areas of our professors of software systems and applications research group are all based on the courses of this program. The completion of this program will greatly help with your transit to the research life in graduate school; students of our 5-year special program can also greatly benefit from this. In addition, students with good command in software desiging and system developing are always very welcome by professors from other research groups and even other deparments and colleges.

Software development and maintenance experts are consistently sought in information-related industries regarding firmware, system program, software driver, middleware, wireless applications for mobiles, commerce, medical software, office automation, recreational software, multimedia system, communications protocal implementation, ...etc. In the foreseeable future, there will only be more employment opportunities in this field. Our faculty members constantly receive requests for talents from industry and alumni as well.

## Examples of Course Enrollment

Students should follow their own interests and career plans when complete this program. Students focus on software development are seggested to take **Advanced Computer Programming**, **System Programming**, and **Software Engineering**. Students focus on database are suggested to take **Database Systems, Internet System Design, Internet System Practice, XML Design and Applications, Information Retrieval, and Data Mining and Application**, along with selective courses from the Program of Network and System. Courses, such as **Network Programming Design, Internet Protocols,** and **Information Security** etc. And then, based on your personal interest, advance with the courses from the course group of Artificial Intelligence, Bioinformatics, Soft Computing,, and Mobile Applications. Students interested in business software development should consider taking related programs in the Department of Information Management.


Chinese Chess Artificial Intelligent Software—NDHU 7, successfully challenged human brain for the **World Record, on June, 30, 2013.**

# Program of Software Systems and Applications

- **Offered by: Department of CSIE**
- **At least 21 credits are required to complete this program.**
- **Course list:**

| Course | Course code | Credit | Year | Semester | Remarks |
|---|---|---|---|---|---|
| Introduction to Artificial Intelligence | CSIE31500 | 3 | 4 | 1 | Artificial intelligence course group |
| Artificial Intelligence | CSIE51600 | 3 | 4 | 2 | Artificial intelligence course group (Graduate level) |
| Introduction to Bioinformatics | CSIE21400 | 3 | 2 | 2 | Bioinformatics course group |
| Computational Biology | CSIE56200 | 3 | 4 | 2 | Bioinformatics course group (Graduate level) |
| Introduction to Soft Computing | CSIE34400 | 3 | 3 | 1 | |
| Realization of Soft Computing Systems | LT__52800 | 3 | 4 | 1 | |
| Programming Multimedia APPs for Mobile Platforms | CSIE41020 | 3 | 3 | 1 | |
| Context aware navigation technologies | CSIE@A020 | 3 | 4 | 1 | |
| Advanced Computer Programming | CSIE34000 | 3 | 2 | 2 | |
| System Programming | CSIE32300 | 3 | 3 | 1 | |
| Information Retrieval | CSIE33700 | 3 | 3 | 1 | |
| Algorithms for Bioinformatics | CSIE33300 | 3 | 3 | 1 | |
| Software Engineering | CSIE31300 | 3 | 3 | 2 | |
| Database Systems | CSIE30600 | 3 | 3 | 2 | |

| | | | | | |
|---|---|---|---|---|---|
| XML Design and Applications | CSIE35300 | 3 | 3 | 2 | |
| Internet System Design | CSIE40020 | 3 | 4 | 1 | |
| Internet System Practice | CSIE41010 | 3 | 4 | 2 | |
| Data Mining and Applications | CSIE34500 | 3 | 4 | 2 | |
| Machine Learning | CSIE@A030 | 3 | 4 | 1 | Graduate level |
| Intelligent System Design | CSIE56900 | 3 | 4 | 1 | Graduate level |

Important Notes:

1. Up to 6 credits are transferrable into this program.
   For CSIE students: Multimedia Systems and Network Programming Design classes are allowed to transfer into this program.
   For students of other departments: any courses offered by the CSIE elective programs, Introduction to Computer Programming (I), and Data Structures classes are allowed to transfer into this program.
   Courses of the same names but intended for non-major students are not allowed to transfer.

2. Only 1 course from the same course group can be counted as the required credits of the program, although all credits are counted for graduation. Students must decide where the course credits will be counted. If graduate-level courses are counted for undergraduate programs or for graduation, they cannot be counted again for the master's programs.

3. For undergraduate students—when studying a graduate-level course with the same name, even though it is offered in different graduate programs (e.g. master's, executive-master's, doctoral), is deemed as the same-name course of this program.

# 6. Program of Network and Systems

## About this program

Networks not only enhance relationships among people, but also improve the economy as the most successful product of information technology. On the other hand, hardware is the media that displays the magic power of the information technology. Networks and Systems engineers are always the most wanted in the job market. This program aims to cultivate talents of these fields through solid studies and trainings, and also to prepare students for further opportunties.


There are 20 professional elective courses offered in this program, 12 of them are undergraduate level: **Introductory VLSI Design, Introduction to Embedded System Design, Introduction to Parallel Computing, Introduction to Cloud Computing, Graph Theory, Wireless Networks, Computer Networks, Computer Network Practice, Network Programming Design, Internet Protocols, Information Security, and Introduction to Information Security Management System**.


The other 8 are graduate level but open for undergraduate students to enroll in; credits are counted based on course group. There 8 courses are **Application-Specific Integrated Circuits Design**, **Software Development for Embedded Systems**, **Parallel Computing**, **Cloud Computing**, **Advanced Graph Theory**, **Wireless Internet**, **Computer Networks and Communications**, and **Information Security Management System**. Courses are presented by our network and system research group, which includes Prof. Ruay-Shiung Chang, Prof. Chenn-Jung Huang, Prof. Chang-Hsiung Tsai, Prof. Hsin-Chou Chi, Prof. Shou-Chih Lo, Prof. Pao-Lien Lai, Prof. Min-Xiou Chen, and Prof. Chung Yung. At least 21 credits are needed to ccomplete this program and up to 6 credits from other elective courses are transferrable.


Network-related courses in the program include **Wireless Networks, Computer Networks, Computer Network Practice, Network Programming Design, Internet Protocols, Information Security, Introduction to Information Security Management System, and Graph Theory**. And among the courses of this program, **Computer Networks** and **Computer Networks and Communications** are introductory courses that emphasize the structure, composition, and operation of computer networks; they also give clear explanation on internet communication protocols. **Computer Network Practice** will let you know how to

sub-divide and track the info-packet, and provide network management practice. **Wireless Networks** and **Wireless Internet** are the extensive courses of Computer Networks; focusing on the data communications of wireless networks(e.g. Wi-Fi, WiMAX, an 3G/4G). Through these courses you can learn the designs and the principles of communications methods. Furthermore, teachers can arrange visits to the telecommunication control rooms of Chunghwa Telecom, Taiwan Mobile, and the Computer Center in NDHU campus to gain the firsthand experience in system's setups and operations.


**Internet Protocols** gives more details on the operations of network protocols; **Network Programming Design** teaches sockets and inter-process communication programming; **Information Security** introduces the fundamental concepts of computer systems and the internet security techniques; **Introduction to Information Security Management System** introduces the system and the mechanism to manage information control; **Graph Theory** shows various issues on graphics and related algorithms, as well as the solutions.

System-related courses are **Introductory VLSI Design, Introduction to Embedded System Design, Introduction to Parallel Computing, and Introduction to Cloud Computing.** After years of booming, the computer industry has become mature in terms of designing and manufacturing on both software and hardware techniques. Through the demand for 3Cs, humans are creating a better lifestyle than one can image. The techniques of VLSI design and embedded systems are the bridges between the electronic information and the 3C industries, and are the next major power that sustains the continuous growth of electronics-related industries. Such techniques can be applied to machinery, medical engineering, electrical engineering, aerospace, automotive, control, etc., and more. The course of **Introductory VLSI Design** elaborates on the basic concepts, methods, and future trends in VLSI design. **Introduction to Embedded System Design** integrates all focal techniques on software and hardware, and helps students to develop the whole picture of the embedded system. In-class practices on building a complete embedded system allow students to integrate software and hardware knowledge. **Introduction of Parallel Computing** presents an evolution of serial computing that attempts to emulate what has always been the state of affairs in the natural world: many complex, interrelated events happening at the same time, yet within a temporal sequence. **Introduction to Cloud Computing** will present the concepts of cloud computing, allowing students to become familiar with the cloud platforms, services, infrastructures, and associated programming tools, and ultimately practice on building a cloud service.

The completion of this program is beneficial whether you choose to go for further studies or enter employment market. When entering graduate studies, students can choose to conduct research on any topics related to networks, chip design, or embedded systems, such as mobile computing, pervasive computung, cloud computing, network security, wireless network, system-on-a-chip, internet, computer structures, ...etc. Our department offers the following related research topics: RFID/sensor technology and its applications, architecture for Digital Home Platforms, technologies and applications of Vehicular Ad hoc Networks (VANET), wireless broadband services and applications, open architecture for multimedia networks, technology and applications of Grid Computing, technology and applications of P2P networks, next generation networks(IPv6), the fourth generation mobile communication network, technologies of parallel and distributed compuing, interconnection networks, fault-tolerant computing, VLSI design and software design for embedded systems, ...etc.

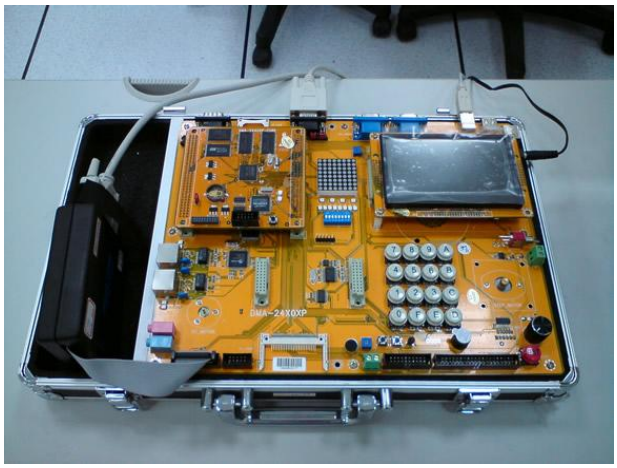


When entering the job market, students can choose to join telecom, communication, IC design, semiconductor or software development companies and engage in communications equipment maintenance and testing, internet protocols implementation, management and maintenance of information systems, wireless applications for mobiles, and driver programming. In Taiwan, there are so many companies related to semiconductors, memory devices, IC design, network equipment, mainboard, mobile, etc. and they have been offering promising employment opportunities.

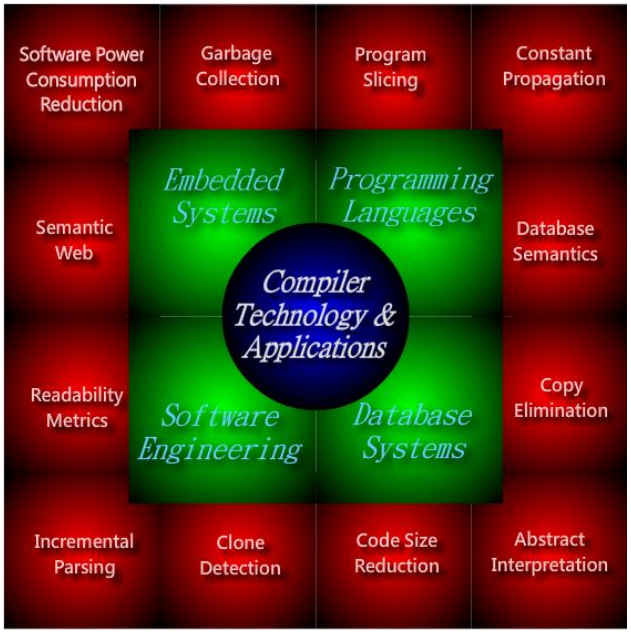
## Examples of Course Enrollment

You can choose courses in this program based on your own interests and career goals. Those who want to focus on Networks are suggested to enroll in **Computer Networks, Wireless Networks** and **Information Security**. Also, extra programming-oriented courses like **Network Programming** and **Internet Protocols**, and **Advanced Computer Programming** and **Software Engineering** from the Program of of Software Systems and Applications can be included to sharpen your programing ability. More pragmatical courses like **Introduction to Information Security Management System** and **Computer Network Practice** and, from the Program of of Software Systems and Applications, **Internet System Design**, **Internet System Practice**, and **Database Systems** courses can also be considered. For students plan to go for master degree, courses focus more on theories concepts can also be good options, such as **Graph Theory**, **Introduction to Parallel Computing**, **Introduction to Cloud Computing**. To further understand the the multimedia applications on the networks, **Multimedia Systems** from the Program of Multimedia

Technologies and Applications can be included onto your list. Students focus on systems are suggested to take **Introductory to VLSI Design** and Introduction to **Embedded System Design**, and also hardware design related cources from the Department of Electrical Engineering.



Embedded Systems




Intergration of Complier Technology

# Program of Network and System

- **Offered by: Department of CSIE**
- **A least 21 credits are required to complete this program.**
- **Course list:**

| Course | Course code | Credit | Year | Semester | Remarks |
|---|---|---|---|---|---|
| Introductory to VLSI Design | CSIE32900 | 3 | 3 | 1 | VLSI design course group |
| Application-Specific Integrated Circuits Design | CSIE56700 | 3 | 4 | 1 | VLSI design course group (Graduate level) |
| Introduction to Embedded System Design | CSIE34600 | 3 | 3 | 2 | Embedded system design course group |
| Software Development for Embedded Systems | CSIE58100 | 3 | 4 | 2 | Embedded system design course group(Graduate level) |
| Wireless Networks | CSIE33200 | 3 | 3 | 2 | Wireless networks course group |
| Wireless Internet | CSIE58400 | 3 | 4 | 2 | Wireless networks course group (Graduate level) |
| Computer Networks | CSIE33600 | 3 | 3 | 1 | Computer networks course group |
| Computer Networks and Communications | CSIE52500 | 3 | 4 | 1 | Computer networks course group (Graduate level) |
| Graph Theory | CSIE32500 | 3 | 3 | 2 | Graph theory course group |
| Advanced Graph Theory | CSIE54800 | 3 | 4 | 2 | Graph theory course group (Graduate level) |
| Introduction to Information Security Management System | CSIE@0120 | 3 | 4 | 1 | Information security management system course group |
| Information Security Management System | LT__51600 | 3 | 4 | 2 | Information security management system course group (Graduate level) |
| Introduction to Parallel Computing | CSIE35200 | 3 | 3 | 1 | Parallel computing course group |

| | | | | | |
|---|---|---|---|---|---|
| Parallel Computing | CSIE61600 | 3 | 4 | 1 | Parallel computing course group (Graduate level) |
| Introduction to Cloud Computing | CSIE40010 | 3 | 4 | 1 | Cloud computing course group |
| Cloud Computing | CSIE@0160 | 3 | 4 | 2 | Cloud computing course group (Graduate level) |
| Information Security | CSIE32000 | 3 | 3 | 1 | |
| Computer Network Practice | CSIE41000 | 3 | 3 | 2 | |
| Network Programming Design | CSIE33000 | 3 | 3 | 2 | |
| Internet Protocols | CSIE33100 | 3 | 4 | 1 | |

Important Notes:

1. Up to 6 credits are transferrable into this program.
   For CSIE students: Introduction to Digital Signal Processing and System Programming classes are allowed to transfer into this program.
   For students of other departments: any courses offered by the CSIE elective programs, Introduction to Computer Programming (I), and Digital Logic Design classes are allowed to transfer into this program.
   Courses of the same names but intended for non-major students are not allowed to transfer.

2. Only 1 course from the same course group can be counted as the required credits of the program, although all credits are counted for graduation. Students must decide where the course credits will be counted. If graduate-level courses are counted for undergraduate programs or for graduation, they cannot be counted again for the master's programs.

3. For undergraduate students—when studying a graduate-level course with the same name, even though it is offered in different graduate programs (e.g. master's, executive-master's, doctoral), is deemed as the same-name course of this program.

# 7. Program of Digital Life Technology

## About this program

Since year of 2011, the Department of CSIE started the “All-English-Taught International Program”, recruiting international elite students. To meet the need for the flexibility in learning and need for the infrastructure developments of students’ home countries, our department planned this Digital Life Technology Program, and all classes are taught in English.

Digital Life Technologies encompass many aspects of life, for instance, care systems for the elderly, distance medical consultation and execution, next-generation mobile communication, intelligent multimedia systems, combining advanced audiovisual techniques and Artificial Intelligence techniques to enhance computer systems’ senses, recongiztions, and learning abilities, human-machine interaction systems (e.g. voice-, gesture- or movement-control systems), machine guards, video survelliance, bio-feature recognition, remote image analysis, medical image analysis, intelligent transportation system, industrial automated inspection, automated military target tracking and recognition, …etc. All these systems require the ability to integrate and apply the knowledge from database, multimedia, network, software, hardware, and many other fields.

Courses of this program can be divided into several groups that relaed to database, multimedia, networks, software, and hardware, repectively, which allow students to have comprehensive understanding on how information techlonogies are applied to out digital life.

Another distinsuishing feature of this program is that all courses are taught in English, classmates will be from various countries. In addtion to the professional learning, students can also emjoy the chance of cultural exchange while enhance English ability from all aspects of liestening, speaking, reading and writing. With active participation, stduents can expect to feel the great difference on how you see the terms of cultural diversity and international perspective. In all, it is just like “one arrow kills two vultures”.

One point to be manifested here is that our goal is to provide a pragram that has courses in both English and Chinese, and our international students can have their professional elective courses taught in Chinese in the third and forth school year. Therefore, students’ choices may decide if the courses will still be in English or be changed to Chinese.

## Examples of Course Enrollment

Digital life technologies requires lots of integration and application of knowledge. Therefore, when you decide to take this program, it is better that you have a more comprehensive understanding on

various fields of information knowledge. You could firstly take courses like Database Systems, Multimedia Systems, Computer Networks, Introduction to Optimization Methods, and Introduction to Embedded System Design etc., and go further to the field that interests you most. It is also suggested that you choose a digital-life related topic to work on in your Independent Study course, and apply what learn to bring up a solution to our daily life; this will surely deepen and broaden your learning here.

## Program of Digital Life Technology

- **Offered by: Department of CSIE**
- **A least 21 credits are required to complete this program.**
- **Course list:**

| Course | Course code | Credit | Year | Semester | Remarks |
|---|---|---|---|---|---|
| Introduction to Image Processing | CSIE@1810 | 3 | 3 | 2 | All-English-Taught |
| Computer Networks | CSIE@1820 | 3 | 3 | 1 | All-English-Taught |
| Introduction to Embedded System Design | CSIE@1830 | 3 | 3 | 2 | All-English-Taught |
| 3D Computer Graphics on Game Development | CSIE@1840 | 3 | 3 | 1 | All-English-Taught |
| Database Systems | CSIE35000 | 3 | 3 | 2 | All-English-Taught |
| Multimedia Systems | CSIE@1850 | 3 | 3 | 2 | All-English-Taught |
| Data Mining and Applications | CSIE@1860 | 3 | 4 | 1 | All-English-Taught |
| Wireless Networks | CSIE@1870 | 3 | 3 | 2 | All-English-Taught |
| Introduction to Optimization Methods | CSIE@1880 | 3 | 4 | 1 | All-English-Taught |
| Mobile Device Programming Design | CSIE@1890 | 3 | 2 | 1 | All-English-Taught |
| Principles of Communications | CSIE@1900 | 3 | 3 | 1 | All-English-Taught |
| Introduction to Computer Networks | CSIE35100 | 3 | 3 | 1 | All-English-Taught |

Important Notes:

Any classes with the same name from all other CSIE Programs are substitutable.

# 8. CSIE Bachelor Degree Requirements

In order to obtain the Bachelor Degree from Department of Computer Science & Information Engineering, each undergraduate student must fulfill the following requirements

## 國立東華大學資訊工程學系國際學士班 102 學年課規

**International Bachelor Program, Course Requirements**

**Department of Computer Science & Information Engineering (CSIE)**

**(Academic Year 2013)**

■ **University Requirements: See Academic Regulations (學則) and General Education Requirements of NDHU**

■ **General Education Requirements: (including Language 9 credits, Physical Education 4 credits, Service Learning 2 credits, Core Fundamental Course 28 credits …etc) must study at least 43 credits), and at least 128 credits to graduate. See Full List of General Education Requirements**

■ **College Requirements: None.**

■ **Departmental Requirements:**

**I.** In addition to the General Education Requirements from the University, students are required to take Major Programs and at least one of four Professional Elective Programs (as a declared major) from the Department of CSIE, or any program set from any department (deemed as a minor), and study at least 132 total credits in order to graduate.

**II. Important Rules and Regulations:**

**A.** To graduate with a Bachelor Degree in Computer Science and Information Engineering, all students must fulfill the General Education Requirements, complete 4 curriculum programs (Fundamental Program of Electrical Engineering and Computer, Core Program of Computer Science (I), Core Program of Computer Science (II), and one Professional Elective Program) and study a minimum of 132 credits. At least **half of the 132** credits must be taught in English. The elective programs can be any curriculum module offered by the CSIE or other departments.

**B.** Students must take **6** compulsory credits in English and fulfill the **English**

**Proficiency Requirements** set by the University--LTTC-GEPT (Intermediate or above), TOEFL iBT (above 61), TOEFL ITP (above 500), TOEIC (above 600) or equivalent criteria listed on the Language Center website, **as the NDHU Graduation Requirement**. Students who pass the exams have to confirm their scores with the NDHU Language Center.

**C.** Students who fail the **English Proficiency Requirements** have to study 2 additional English courses (about 4~6 credits) from General Education courses, the English department, or any department offers the English-Taught courses. The courses must be approved by the Language Center. Those additional credits cannot be counted into the **9** credits in the Language field, but can be counted toward the total graduation credits.

**D.** Credits earned in courses of the same name offered by other departments or institutes may be counted toward degree requirements with the approval of the Departmental Education Committee.

**E.** The maximum credit load per semester is 24 credits with the exception of Physical Education and Military Training. All other exceptions must receive prior approval by the Departmental Education Committee.

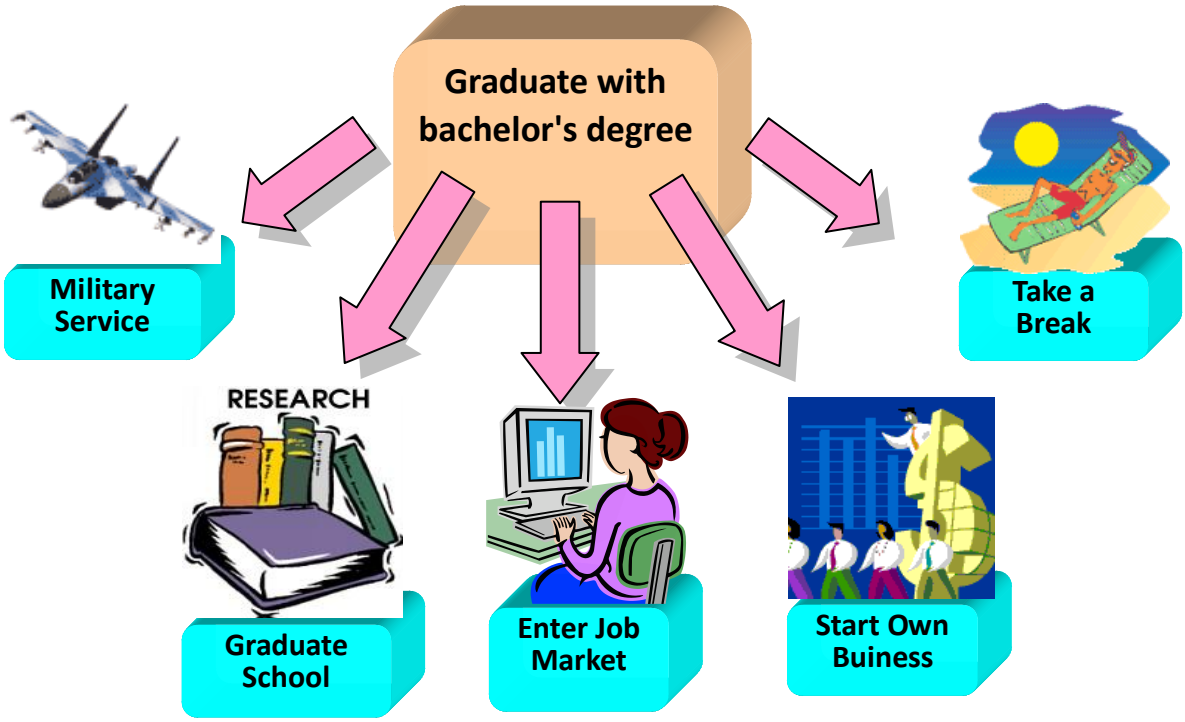
**F.** All Students must successfully complete Service Learning (I) and (II) before graduation.

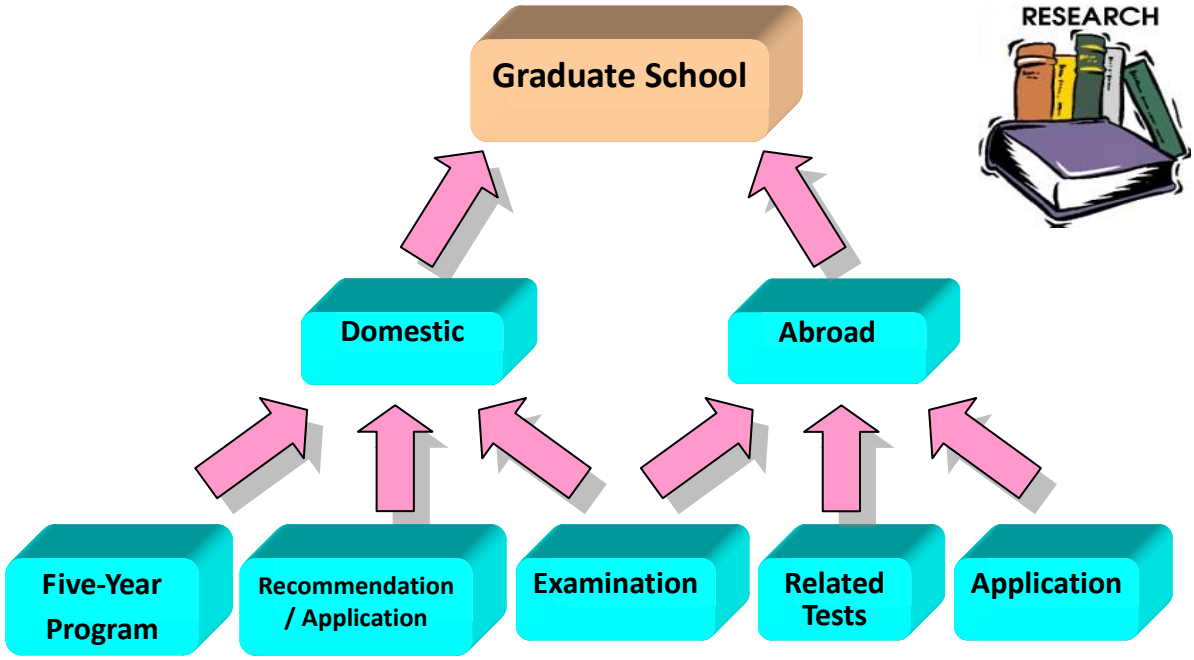
**G.** All Students must **successfully complete and pass** Introduction to Computer Programming (I) and (II), Lab of Programming (I) and (II), Data Structure, Lab of Data Structure, Algorithm Design and Analysis, and Lab of Algorithm classes before graduation.

**H.** All students must pass the Primary Programming Proficiency Exam in order to graduate. **NDHU CSIE Regulation of the Primary Programming Proficiency (PPP) Certification** : http://english.csie.ndhu.edu.tw/csieweb/en/node/946

**I.** For any students come from 5-year Middle School(Junior High)/High School education system, must take an **additional 6 credits** to graduate. These 6 credits can be from any departments.

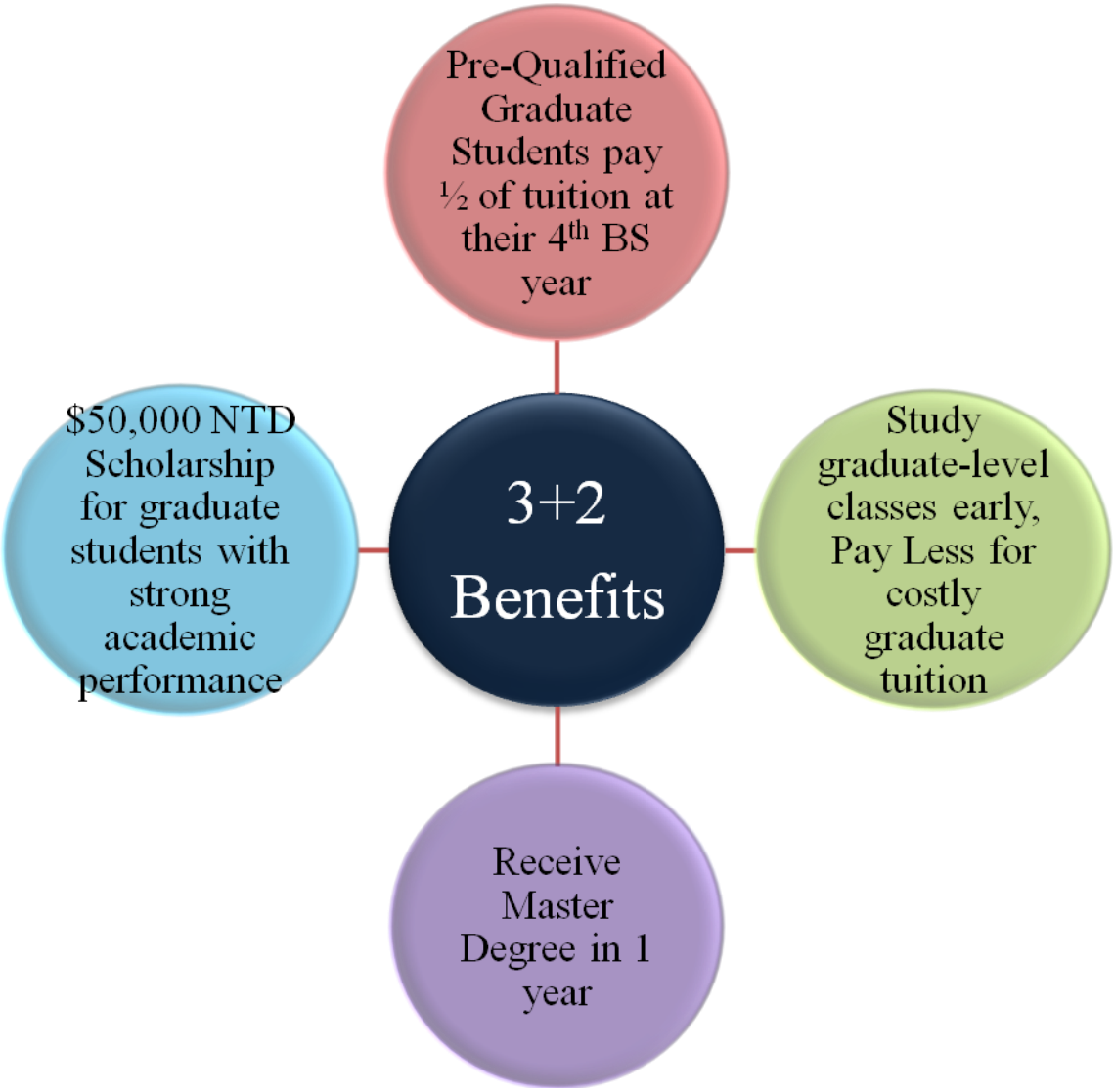
# 9. CSIE Careers & Prospects

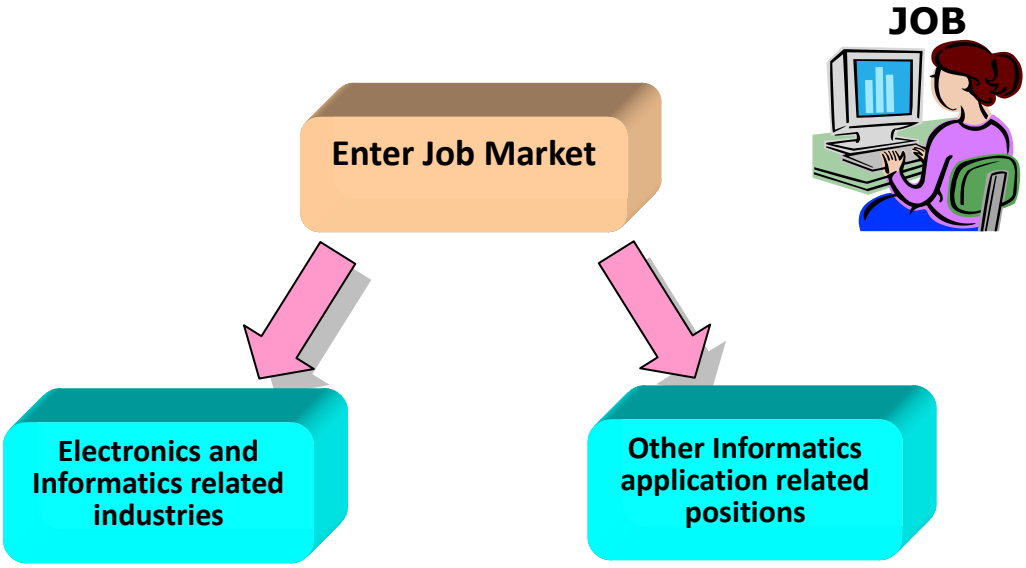


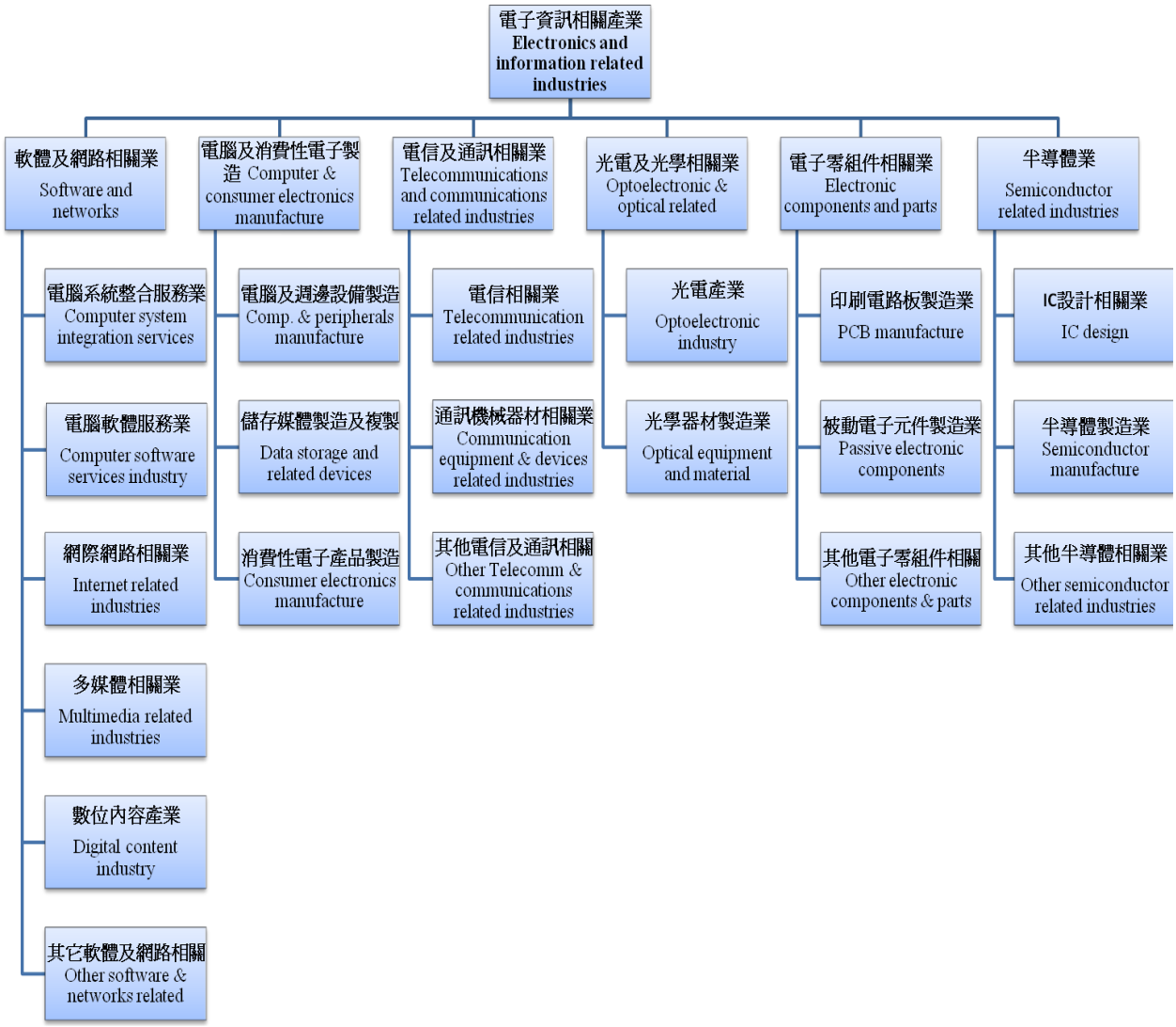



# NDHU CSIE—5 Year BS & MS option

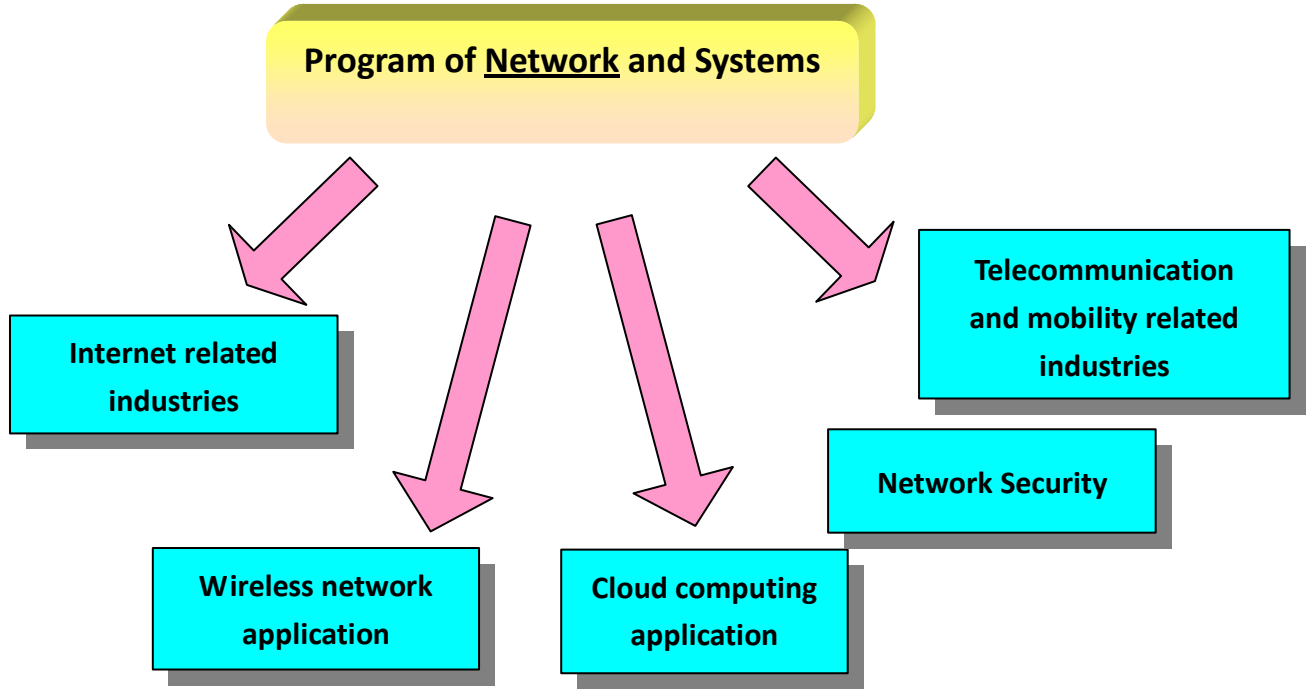
- Beginning from the 2nd semester of the 3rd school year, undergraduate students can apply for the permission to enroll in graduate-level courses. Once approved, such students become "**pre-qualified graduate students**".
- The pre-qualified graduate students should receive their bachelor degrees on or before the 2nd semester of the 4th year (or the 8th semesters in total), and participate in the examination or the application selection to enter the master program. Once approved, such students become **true graduate students of CSIE**.

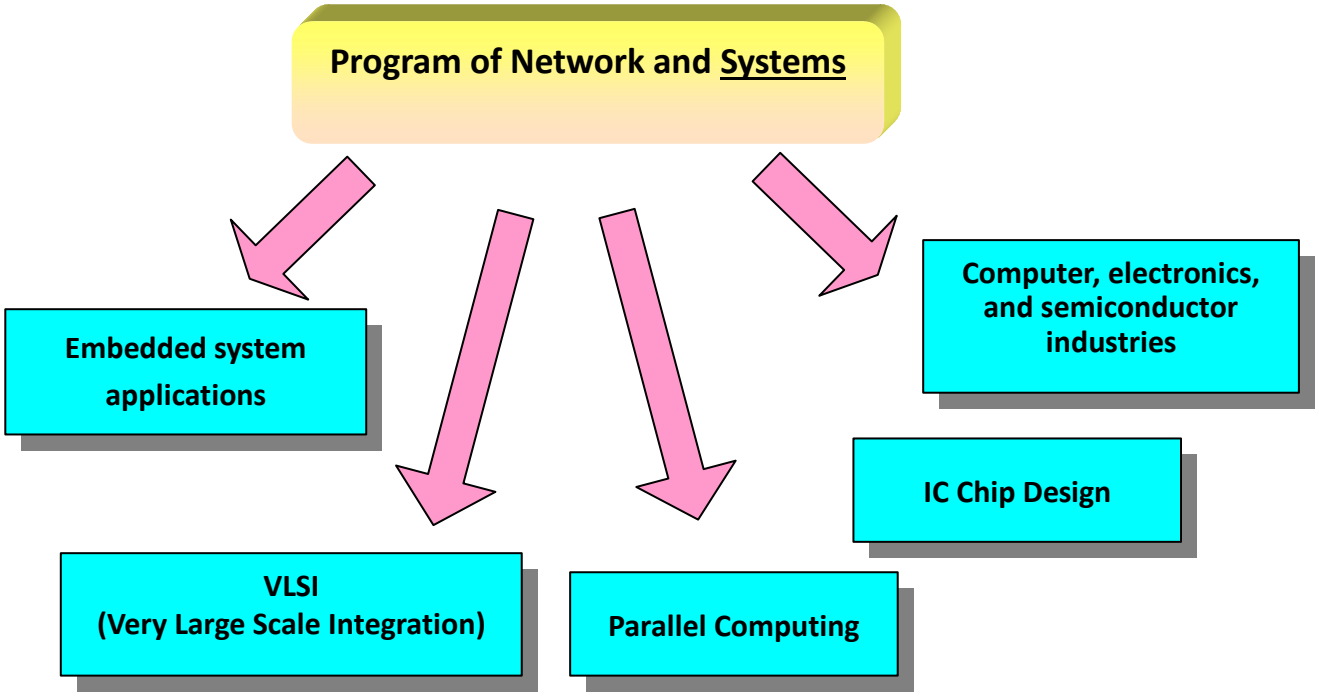



JOB
Enter Job Market
Electronics and Informatics related industries
Other Informatics application related positions

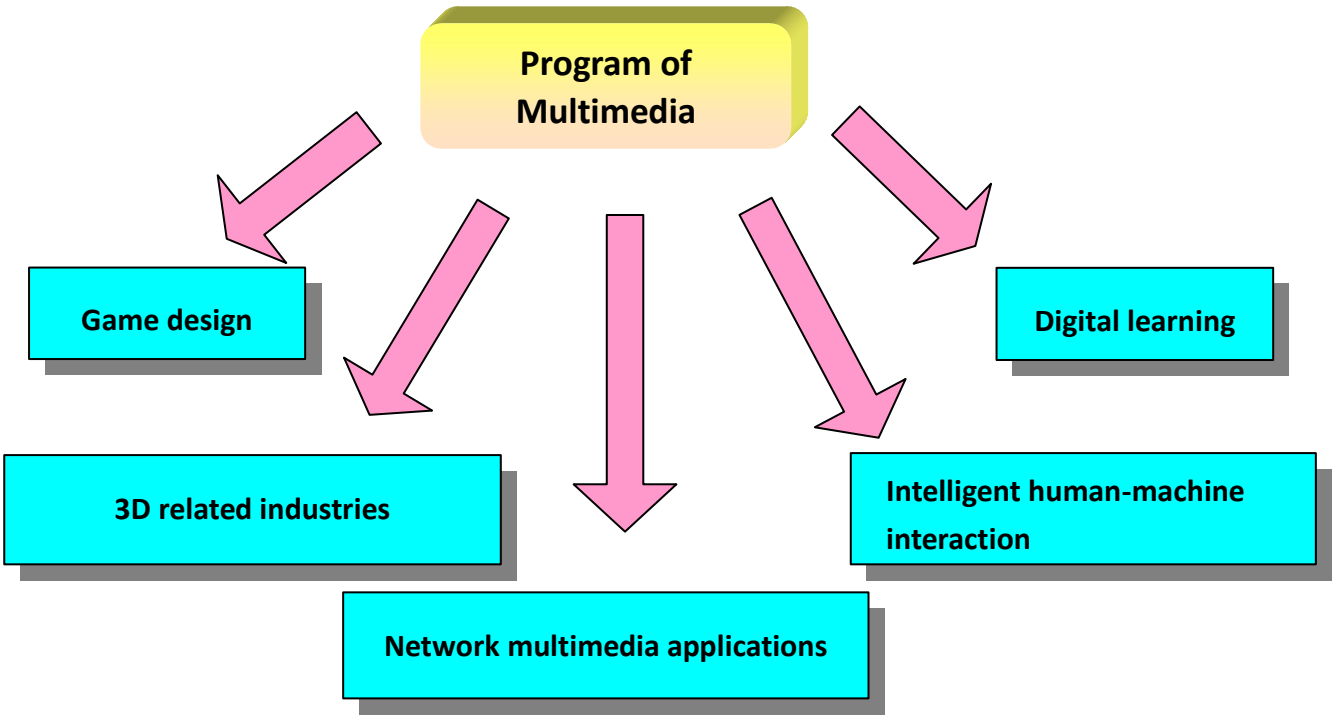

電子資訊相關產業 Electronics and information related industries
軟體及網路相關業 Software and networks
電腦及消費性電子製造 Computer & consumer electronics manufacture
電信及通訊相關業 Telecommunications and communications related industries
光電及光學相關業 Optoelectronic & optical related
電子零組件相關業 Electronic components and parts
半導體業 Semiconductor related industries
電腦系統整合服務業 Computer system integration services
電腦軟體服務業 Computer software services industry
網際網路相關業 Internet related industries
多媒體相關業 Multimedia related industries
數位內容產業 Digital content industry
其它軟體及網路相關 Other software & networks related
電腦及週邊設備製造 Comp. & peripherals manufacture
儲存媒體製造及複製 Data storage and related devices
消費性電子產品製造 Consumer electronics manufacture
電信相關業 Telecommunication related industries
通訊機械器材相關業 Communication equipment & devices related industries
其他電信及通訊相關 Other Telecomm & communications related industries
光電產業 Optoelectronic industry
光學器材製造業 Optical equipment and material
印刷電路板製造業 PCB manufacture
被動電子元件製造業 Passive electronic components
其他電子零組件相關 Other electronic components & parts
IC設計相關業 IC design
半導體製造業 Semiconductor manufacture
其他半導體相關業 Other semiconductor related industries

## Careers in Network and Systems

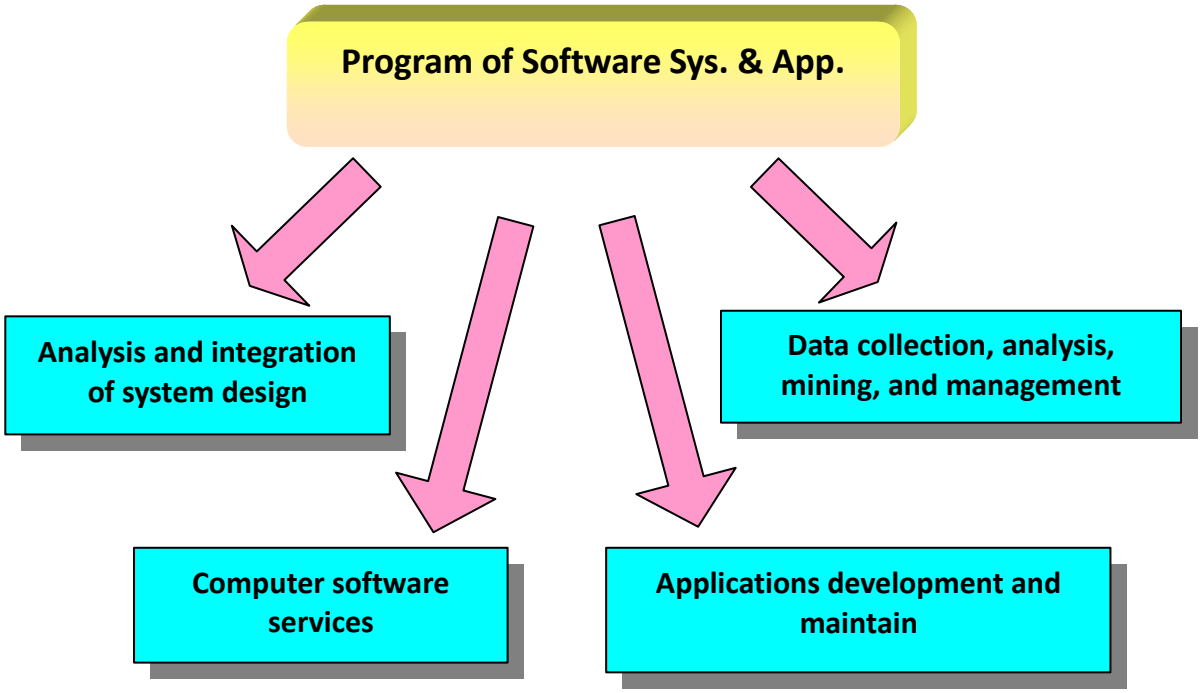


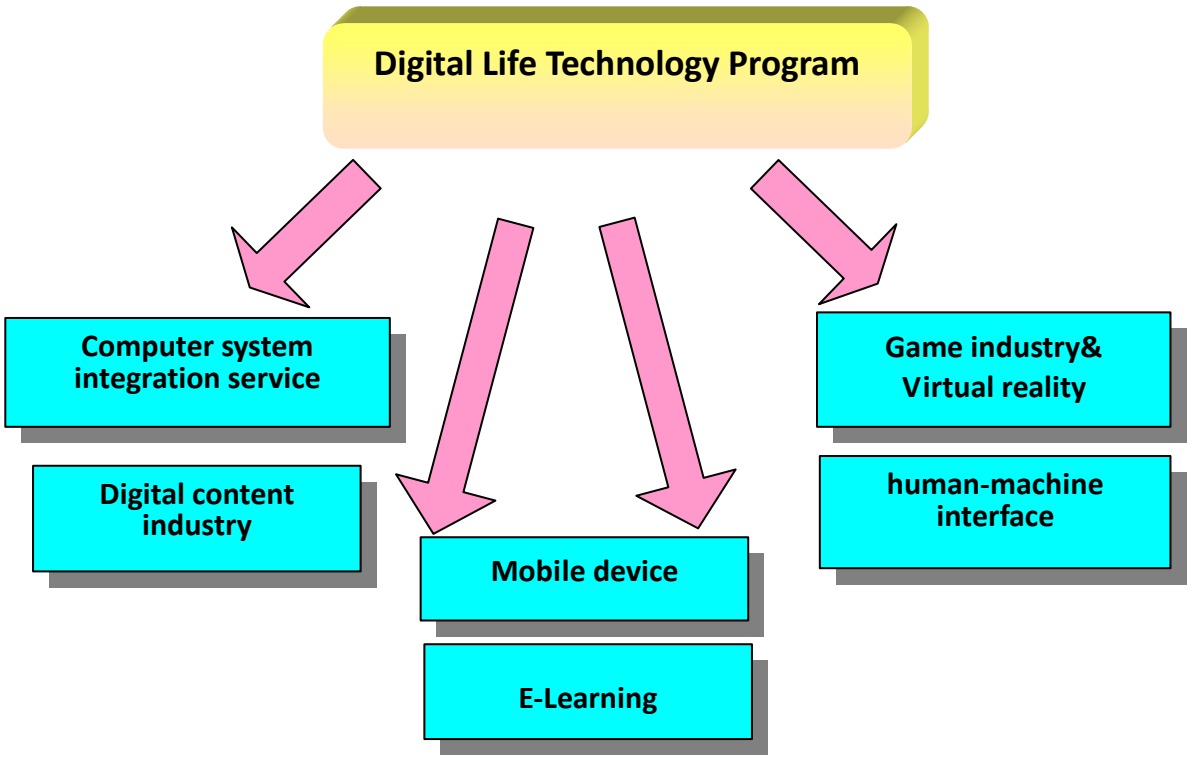
## Careers in Multimedia Technologies and Applications




## Careers in Software Systems and Applications



## Careers in Digital Life Technology




## Career opportunities for information applications

- Every industry needs information technology.
- Sales, accounting, logistics, administrative support
- Banking, commerce, manufacturing
- Government information department
- Market search, system establishment, data analysis
- Teaching, managing, consulting…etc.

## New Enterprise

**Start your own business**

- Idea
- Capital/Funding
- Technique
- Management
- Marketing
- Services
- …

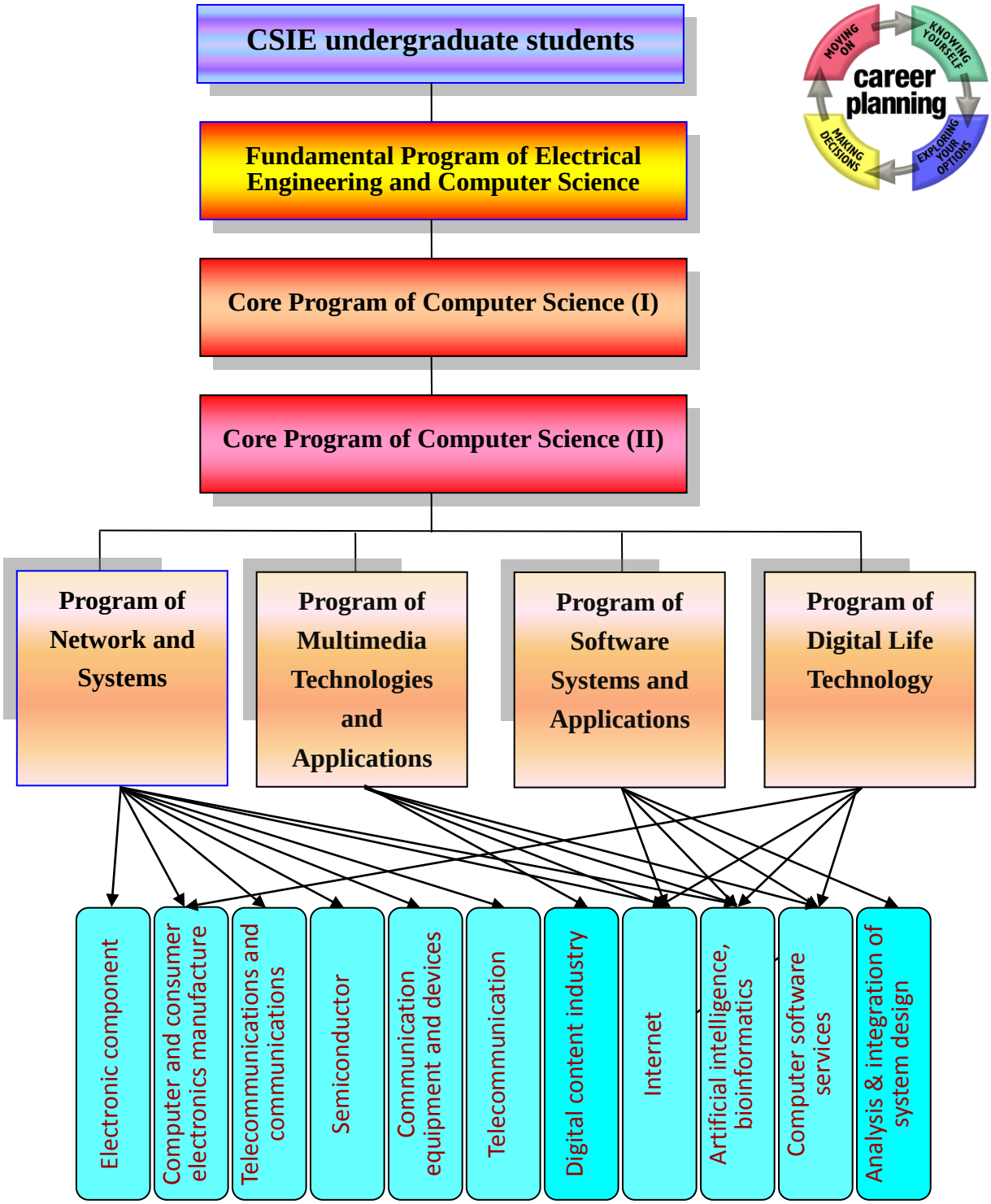
**New Enterprise**

## Plan to take a break

**Take a break**

- Reasoning:
  - Temporary job loss
  - Short-term study
  - Training for the next step
  - Travel
  - Just need a break
- Can be constructive with a proper plan.
- Need to plan and prepare carefully.
- Take a break, and hit the road again !

## 10. Associated program planning and career prospects



From the diagram above, you can see that students acquire knowledge of Computer Science & Information Engineering through the Fundamental Program of Electrical Engineering and Computer Science, and then strengthen their abilities in programming through the Core Program of Computer Science (I) & (II). Six core courses (Linear Algebra, Discrete Mathematics, Data Structures, Algorithm Design and Analysis, Computer Organization, and Computer Architecture) are introduced to give solid trainings to students, which is also helpful for students to pass graduate school entrance exams. In addition, student can choose a main professional program based on his/her own interests or career goals. Students are advised to talk and interact earlier and frequently with our family members to ensure your interests match the courses you take.

Here are some examples of positions and industries that may suit you after the completion of each program.

- **Program of Multimedia Technologies and Applications**
  - Potential industries: computer system integration services industry, internet related industries, computer software services industry, digital content industry, ...etc.
  - Potential positions: animator, game designer, multimedia application designer, network multimedia designer, digital multimedia designer, web multimedia designer, voice product development engineer, VoIP software engineer, image processing engineer, video system application engineer, …etc.

- **Program of Software Systems and Applications**
  - Potential industries: computer system integration services industry, internet related industries, computer software services industry, and other industries related to software and networks.
  - Potential positions: database program development engineer, software design engineer, firmware design engineer, application software and system engineer, web database designer, software project engineer, e-shop designer, system analyst, …etc.

- **Program of Software Systems and Applications**
  - Potential industries: semiconductor related industries, telecommunications industries, electronic components and parts, computer and consumer electronics manufacturing, communication machinery and equipment, computer system integration services industry, internet related industries, ...etc.
  - Potential positions: network software programmer, communication software engineer, software/firmware designer, network planning engineer, communication system engineer, data communication administrator, web site administrator, system designer, …etc.

- **Digital Life Technology Program**
  - Potential industries: mostly similar to students from the Program of Software Systems and

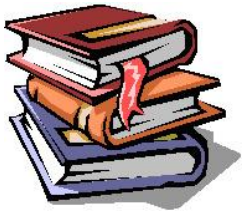
Applications, such as software service industries, digital content industries, consumer electronics manufacture...etc.; only that students of this program would focus more on life technologies.

- Potential positions: positions related to digital life product development and innovation, such as software and application developer and maintainer

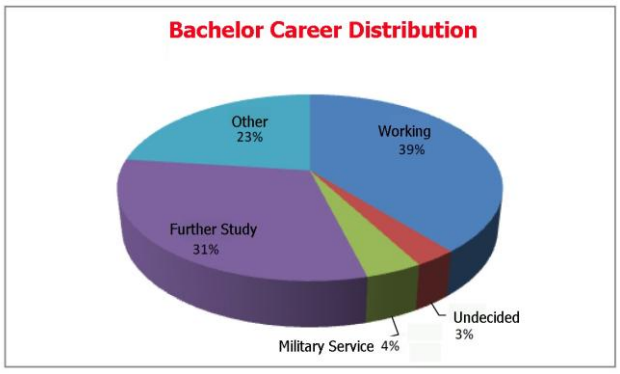
As you may have noticed from the diagram and explanation above, some careers require cross-program knowledge. For example, the Network Multimedia applications requires more than the knowledge of Multimedia Systems, Introduction to Image Processing, and Digital Signal Processing in the Program of Multimedia Technologies and Applications. It also requires the knowledge and trainings from Computer Networks, Internet Protocols, Network Programming Design, Introduction to Embedded System Design, ...etc. Industries constantly need cross-field talents; therefore, you are advised to enroll in related courses from other programs to broaden your knowledge base and increase your competitiveness in the employment market.

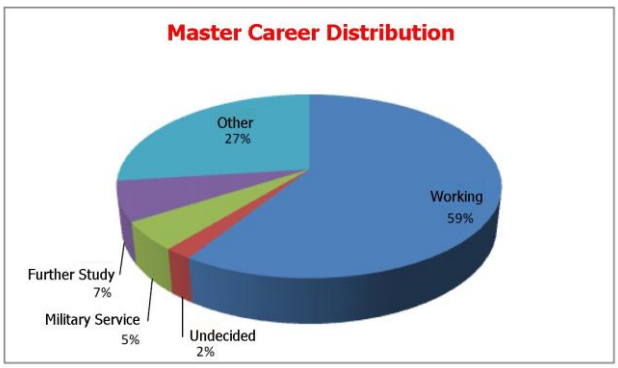
**We wish you all the best in discovering yourself and cultivating your talents. Hope your journey with the Department of Computer Science & Information Engineering and National Dong Hwa University will be fruitful and fulfilling.**

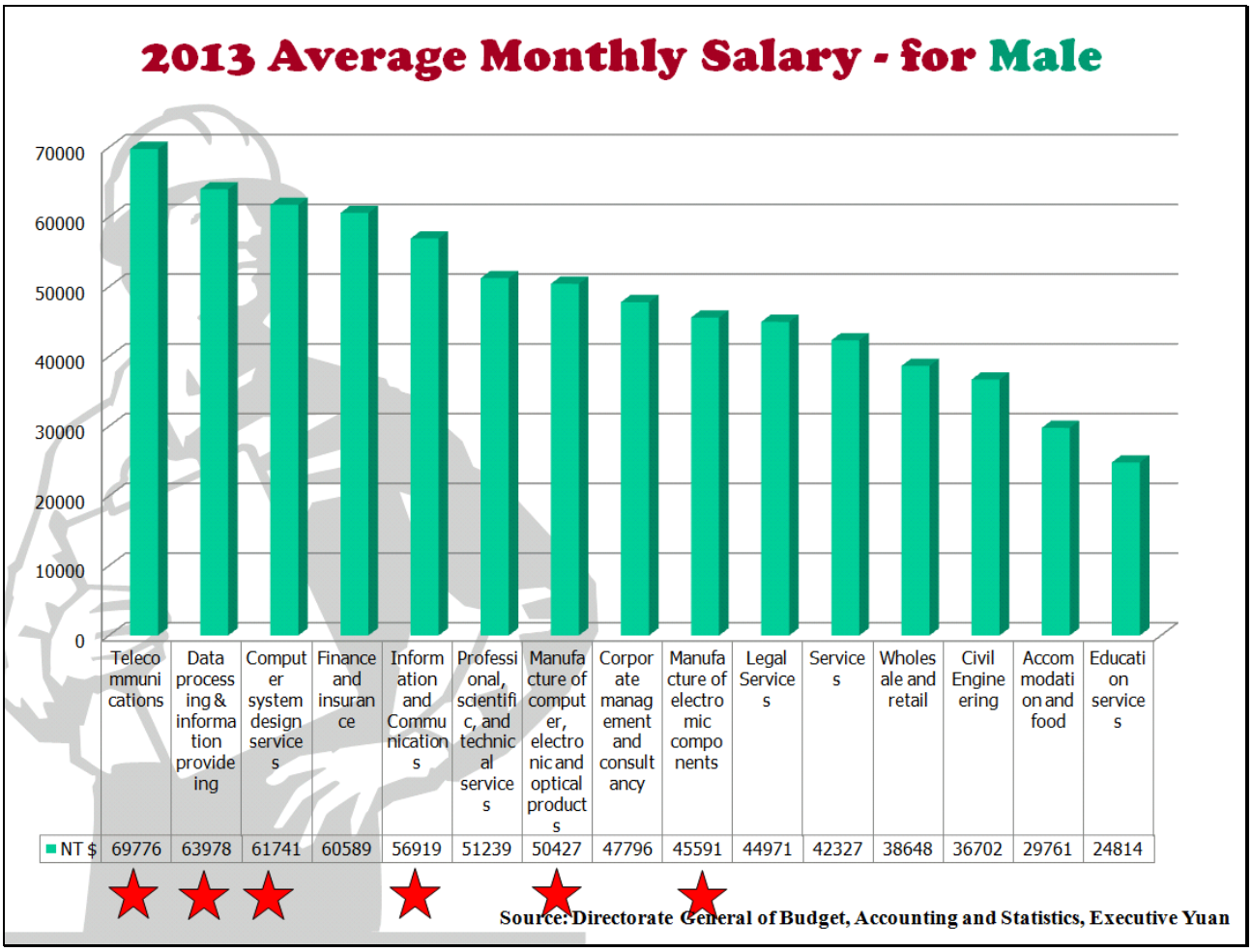
# 11. Appendix

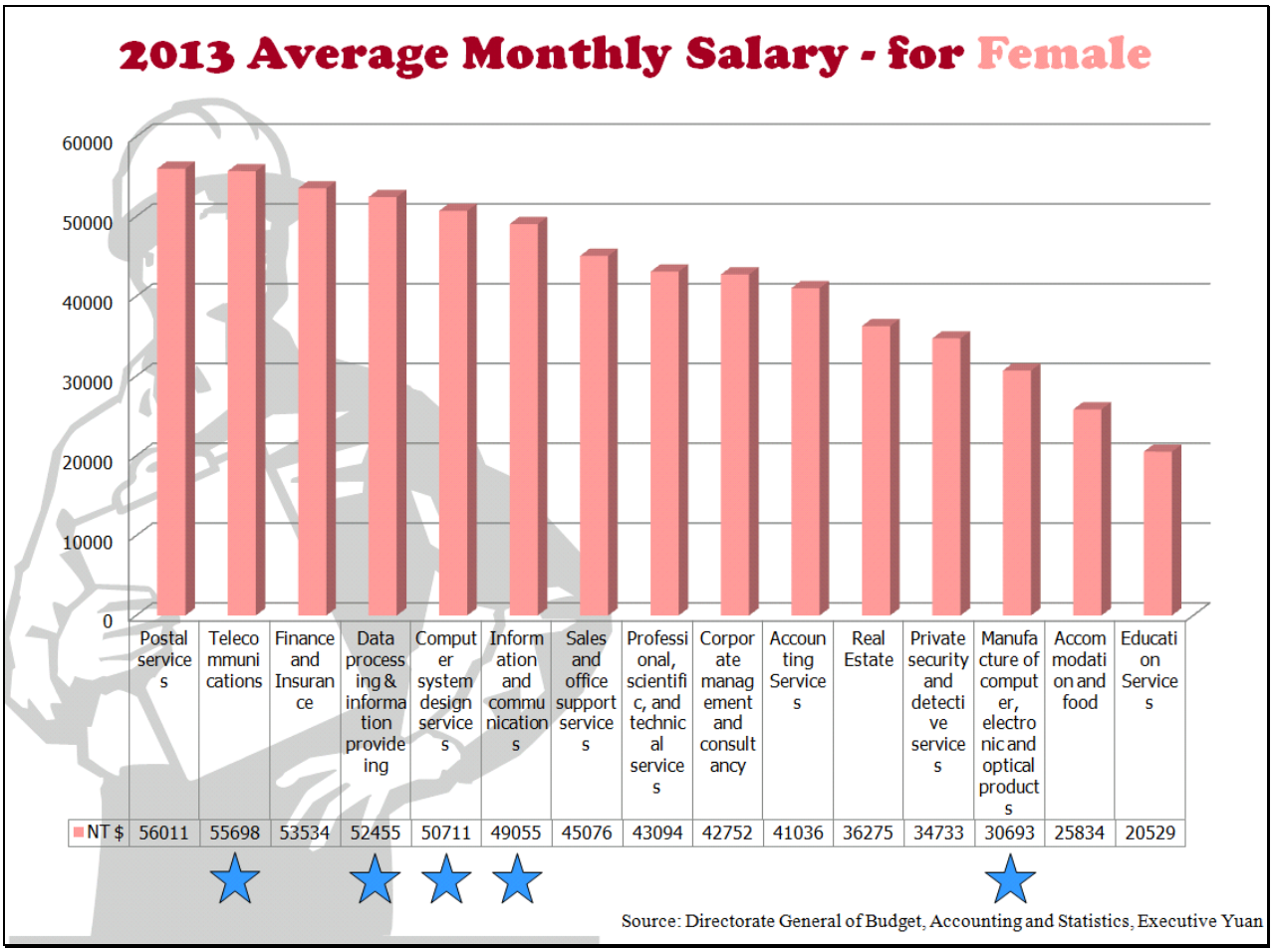


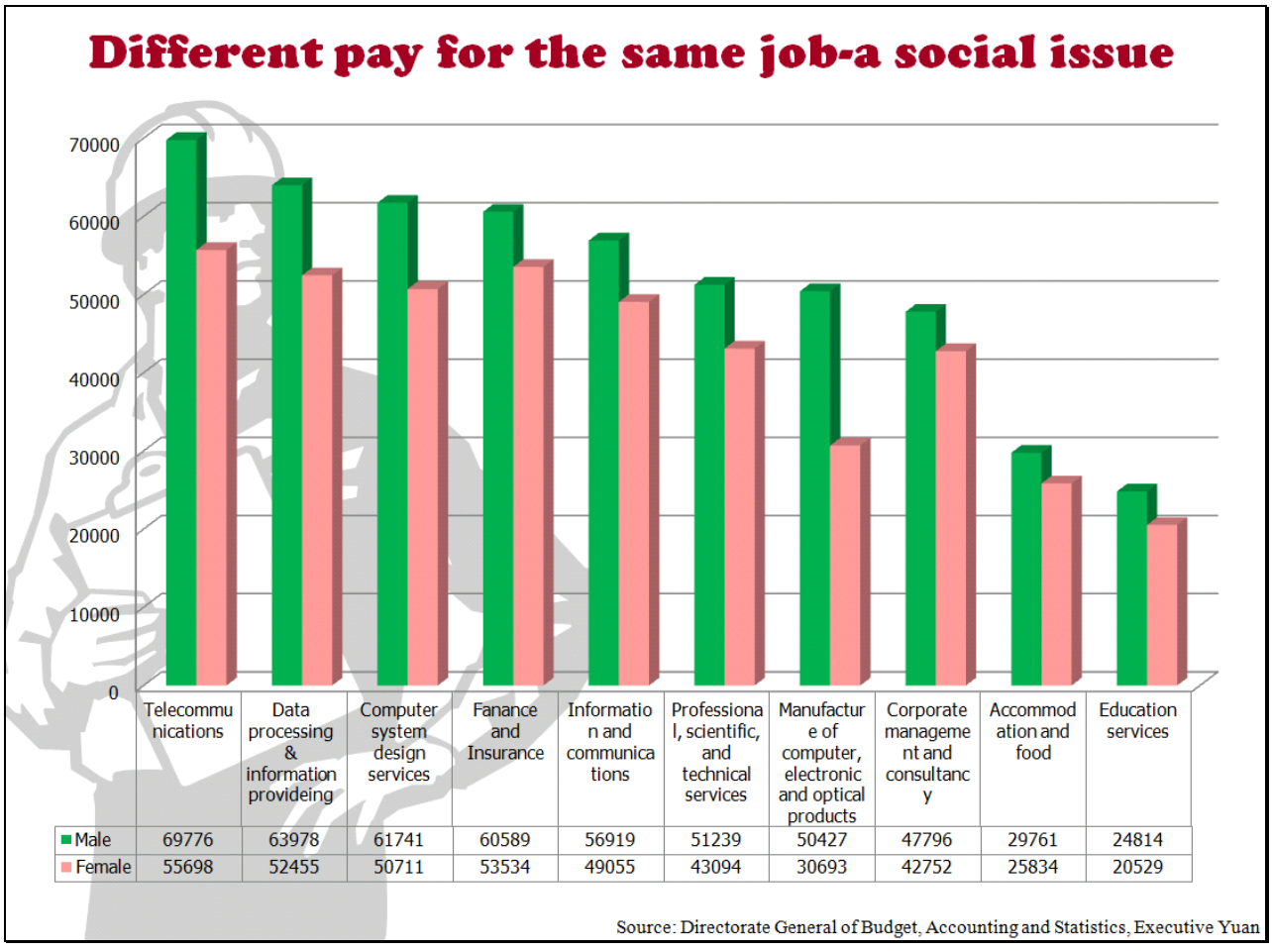
## 11.1. Statistics on our alumni's career status




2013 Average Monthly Salary - for Female
60000
50000
40000
30000
20000
10000
0
Postal services
Telecommunications
Finance and Insurance
Data processing & information provideing
Computer system design services
Information and communications
Sales and office support services
Professional, scientific, and technical services
Corporate management and consultancy
Accounting Services
Real Estate
Private security and detective services
Manufacture of computer, electronic and optical products
Accommodation and food
Education Services
NT $ 56011 55698 53534 52455 50711 49055 45076 43094 42752 41036 36275 34733 30693 25834 20529
Source: Directorate General of Budget, Accounting and Statistics, Executive Yuan


Different pay for the same job-a social issue
70000
60000
50000
40000
30000
20000
10000
0
Telecommunications
Data processing & information provideing
Computer system design services
Fanance and Insurance
Information and communications
Professional, scientific, and technical services
Manufacture of computer, electronic and optical products
Corporate management and consultancy
Accommodation and food
Education services
Male 69776 63978 61741 60589 56919 51239 50427 47796 29761 24814
Female 55698 52455 50711 53534 49055 43094 30693 42752 25834 20529
Source: Directorate General of Budget, Accounting and Statistics, Executive Yuan

## 11.2. Career Planning Resources

- Bureau of Employment and Vocational Training (BEVT), Council of Labor Affairs http://www.ejob.gov.tw/
- National Youth Commission, Executive Yuan http://www.nyc.gov.tw/
- 104 Job Bank http://www.104.com.tw/
- 1111 Job Bank http://www.1111.com.tw/
- Cheers Magazine Job Information Net http://www.career.com.tw/
- Core Asia Human Resources http://www.coreasia.com.tw/
- Monster Global Job Database http://www.monster.com
- CareerBuilder Global Job Database http://www.careerbuilder.com