COMPUTING CURRICULA

Computing Curricula in CS, SE, IS, IT and CE: Intersection dan Difference

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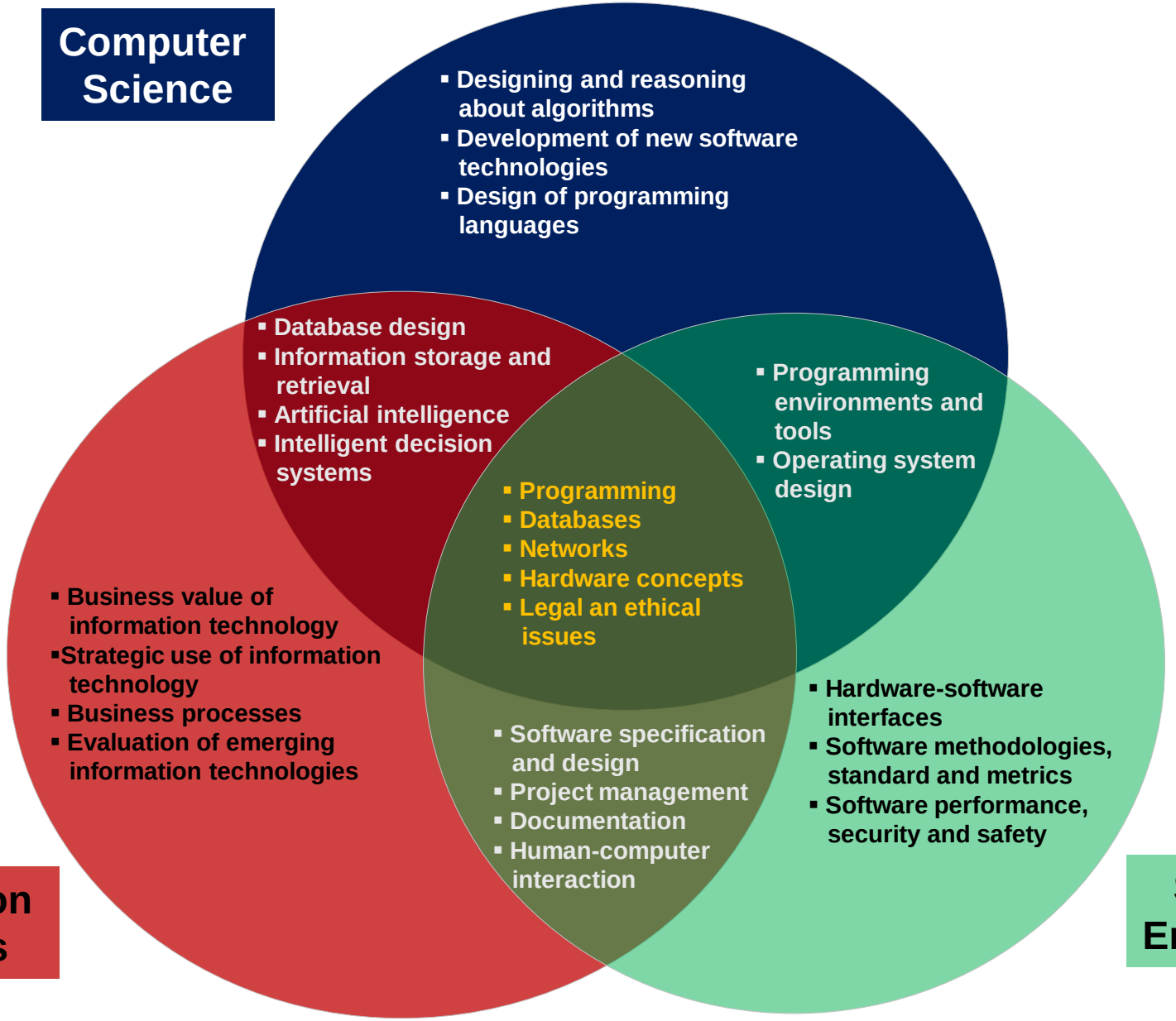
Top 10 Reasons to Major in Computing

1. **Computing is part of everything we do!**
2. **Expertise in computing enables you to solve complex, challenging problems.**
3. **Computing enables you to make a positive difference in the world.**
   - Computing drives innovation in the sciences (human genome project, AIDS vaccine research, environmental monitoring and protection just to mention a few), and also in engineering, business, entertainment and education. If you want to make a positive difference in the world, study computing.
4. **Computing offers many types of lucrative careers.**
5. **Computing jobs are here to stay, regardless of where you are located.**
6. **Expertise in computing helps you even if your primary career choice is something else.**
7. **Computing offers great opportunities for true creativity and innovativeness.**
8. **Computing has space for both collaborative work and individual effort.**
9. **Computing is an essential part of well-rounded academic preparation.**
10. **Future opportunities in computing are without boundaries.**

Intersection of Computing Curricula in CS, SE and IS



Computer Science

- spans the range from theory through programming to cutting-edge development of computing solutions.
- offers a foundation that permits graduates to adapt to new technologies and new ideas.
- The work of computer scientists falls into **three categories**:
  a) **designing and building software**;
  b) **developing effective ways to solve computing problems**, such as storing information in databases, sending data over networks or providing new approaches to security problems; and
  c) **devising new and better ways of using computers and addressing particular challenges in areas** such as robotics, computer vision, or digital forensics (although these specializations are not available in all computer science programs).
  d) **Most computer science programs** require **some mathematical** background.

a career path in each area

- **Career Path 1: Designing and implementing software.**
  - This refers to the work of software development which has grown to include aspects of web development, interface design, security issues, mobile computing, and so on.
  - This is the career path that the majority of computer science graduates follow.
  - While a bachelor's degree is generally sufficient for entry into this kind of career, many software professionals return to school to obtain a terminal master's degree. (Rarely is a doctorate involved.)
  - Career opportunities occur in a wide variety of settings including large or small software companies, large or small computer services companies, and large organizations of all kinds (industry, government, banking, healthcare, etc.).
  - Degree programs in software engineering also educate students for this career path.
- **Career Path 2: Devising new ways to use computers.**
  - This refers to innovation in the application of computer technology.
  - A career path in this area can involve advanced graduate work, followed by a position in a research university or industrial research and development laboratory;
  - it can involve entrepreneurial activity such as was evident during the dot-com boom of the 1990s; or it can involve a combination of the two.

Computer Science

- **Career Path 3: Developing effective ways to solve computing problems.**
  - This refers to the application or development of computer science theory and knowledge of algorithms to ensure the best possible solutions for computationally intensive problems.
  - As a practical matter, a career path in the development of new computer science theory typically requires graduate work to the Ph.D. level, followed by a position in a research university or an industrial research and development laboratory.
- **Career Path 4: Planning and managing organizational technology infrastructure.**
  - This is the type of work for which the new information technology (IT) programs explicitly aim to educate students.

Career paths 2 and 3 are undenably in the domain of computer science graduates.

Career paths 1 and 4 have spawned the new majors in software engineering and information technology, respectively, and

Information systems graduates often follow Career path 1, too.

Computer scientists continue to fill these positions, but programs in software engineering, information technology, and information systems offer alternative paths to these careers.

Information Systems

- concerned with the information that computer systems can provide **to aid a company, non-profit or governmental organization in defining and achieving its goals.**
- also concerned with the **processes** that an enterprise can implement and improve **using information technology**.
- **IS professionals:**
  - must understand both technical and organizational factors, and
  - must be able to help an organization determine how information and technology-enabled business processes can provide a foundation for superior organizational performance.

Information Systems

- They serve as **a bridge between** the technical and management communities within an organization.
  - What information does the enterprise need?
  - How is that information generated?
  - Is it delivered to the people who need it?
  - Is it presented to them in ways that permit them to use it readily?
  - Is the organization structured to be able to use technology effectively?
  - Are the business processes of the organization well designed?
  - Do they use the opportunities created by information technology fully?
  - Does the organization use the communication and collaboration capabilities of information technologies appropriately?
  - Is the organization capable of adapting quickly enough to changing external circumstances?
  - These are the important issues that businesses rely on IS people to address.

Information Systems

- **All IS degrees combine business and computing topics**, but the emphasis between technical and organizational issues varies among programs.
  - For example, programs differ substantially in the amount of programming required.
- Traditionally, **many graduates of IS programs have functioned in roles that are similar to the roles for which IT programs** explicitly prepare their students.
  - Information systems graduates continue to fill these roles, but the new programs in information technology offer an alternative path to these positions.

Software Engineering

- concerned with **developing and maintaining software systems** that
  - behave reliably and efficiently,
  - are affordable to develop and maintain, and satisfy all the requirements that customers have defined for them.
  - It is important because of the impact of large, expensive software systems and the role of software in safety-critical applications.
- It integrates significant **mathematics, computer science and practices** whose origins are in engineering.
- We can find software engineering **in two contexts**:
  - **computer science programs offering one or more software engineering courses as elements of the CS curriculum, and**
  - **in separate software engineering programs.**

Software Engineering

- Degree programs in computer science and in software engineering tend to have many courses in common; however,
  - as of Spring 2006 there are few SE programs at the bachelor's level.
- Software engineering focuses on **software development and goes beyond programming to include such things as eliciting customers' requirements, and designing and testing software.**
- SE students **learn how to assess customer needs and develop usable software that meets those needs.**

Intersection of Computing Curricula in CS and SE

- **Both computer science and software engineering curricula** typically require a **foundation in programming fundamentals and basic computer science theory.**

- They **diverge in their focus beyond these core elements**.
  - Computer science programs tend to keep the core small and then expect students to **choose among more advanced courses (such as systems, networking, database, artificial intelligence, theory, etc.).**
  - **In contrast**, SE programs generally expect students to focus on a range of topics that are essential to **the SE agenda (problem modeling and analysis, software design, software verification and validation, software quality, software process, software management, etc.).**
  - While both CS and SE programs **typically require students to experience team project activity,**
  - SE programs tend to involve the **students in significantly more of it, as effective team processes are essential to effective SE practices.**
  - In addition, a key requirement specified by the SE curriculum guidelines is that SE **students should learn how to build software that is genuinely useful and usable by the customer and satisfies all the requirements defined for it.**

Intersection of Computing Curricula in CS and SE

- **Most people** who now function in the U.S. as serious software engineers have degrees in computer science, not in software engineering.
  - In large part this is because computer degrees have been widely available for more than 30 years and software engineering degrees have not.
  - Positions that require development of large software systems often list “Software Engineer” as the position title. Graduates of computer science, computer engineering, and software engineering programs are good candidates for those positions, with the amount of software engineering study in the programs determining the suitability of that graduate for such a position.
- **Most IT professionals** who have computing degrees come from CS or IS programs.
  - It is far too soon for someone who wants to work as a software engineer or as an information technology practitioner to be afraid that they won’t have a chance if they don’t graduate from a degree program in one of the new disciplines.
  - In general, a CS degree from a respected program is the most flexible of degrees and can open doors into the professional worlds of CS, SE, IT, and sometimes CE.
  - A degree from a respected IS program allows entry to both IS and IT careers.

Information Technology

- Information technology (IT) is a label that has **two meanings**.
  - **In common usage**, the term “information technology” is often used to refer to all of computing.
  - **As a name of an undergraduate degree program**, it refers to the preparation of students to meet the computer technology needs of business, government, healthcare, schools, and other kinds of organizations.
- **IT professionals:**
  - **possess** the right combination of knowledge and practical, hands-on expertise to take care of both an organization’s information technology infrastructure and the people who use it.
  - **assume** responsibility for selecting hardware and software products appropriate for an organization.
  - **integrate** those products with organizational needs and infrastructure, and **install, customize and maintain** those applications, thereby providing a secure and effective environment that supports the activities of the organization’s computer users.
  - In IT, **programming often involves writing short programs that typically connect existing components (scripting).**

Information Technology

- **Planning and managing an organization's IT infrastructure** is a difficult and complex job that requires **a solid foundation in applied computing as well as management and people skills.**
  - Those in the IT discipline require **special skills** – in understanding, for example, how networked systems are composed and structured, and what their strengths and weaknesses are.
  - There are **important software systems concerns** such as reliability, security, usability, and effectiveness and efficiency for their intended purpose; all of these concerns are vital. These topics are difficult and intellectually demanding.

Skills You'll Learn if You Study Computing

Learn two types of skills:

1. **Technical computing skills**
2. **General professional skills**

In addition, depending on your interests you will acquire specialized domain knowledge such as business, medicine, or biology.

1. Technical computing skills

- **Problem-solving ability**, recognizing levels of abstraction in software, hardware systems, and multimedia
- **Practical skills** such as building and using database management systems and other sophisticated software tools
- **Programming**
- **Using existing software** libraries to carry out a variety of computing tasks, such as creating a user interface
- **Being aware of the uses** to which computers are put, recognizing issues to do with security, safety, etc.
- **Looking at innovative ways** of using computers, creating tools, providing tools support, etc.

Skills You'll Learn if You Study Computing

2. General professional skills

- **Communicating in writing**, giving effective presentations and product demonstrations, and being a good negotiator (both in traditional environments and electronically)
- **Preparing for a job search**; this involves building an impressive curriculum vitae and basing this confidently on technical and other skills
- **Being an effective team member**
- **Understanding the special requirements** of a globally distributed project with participants from multiple cultures
- **Recognizing the challenges and opportunities** of keeping skills up-to-date and understand how to do so
- **Literacy/fluency in computing**; organizing all your professional information effectively

Tanya Jawab

The End