Welcome to BS in Computer Science:
- Computer Science Option
- Software Engineering Option

Discovery Day
March 27, 2009

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Computer and Information Science Department
http://www.umassd.edu/engineering/cis
CS and SE at UMass Dartmouth

• CS and SE as academic disciplines
• Job market for CS /SE graduates
• CIS Department in the nutshell
• Computer Science Option
• Software Engineering Option
• Environment of studies in CIS Department
• Cooperative Learning and Internships
Computer Science

Organizational Issues & Information Systems
Application Technologies
Software Methods and Technologies
Systems Infrastructure
Computer Hardware and Architecture

Theory Principles Innovation

DEVELOPMENT

More Theoretical More Applied

Application Deployment Configuration

CS
CS spans a wide range, from its theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, and other exciting areas.

We can think of the work of computer scientists as falling into three categories:

- **design and implement software.** Computer Scientists take on challenging programming jobs. They also supervise other programmers.

- **devise new ways to use computers.** Progress in the CS area of networking, database, and human-computer-interface enabled the development of the WWW. CS researchers are working with scientists from other fields to use databases to create new knowledge, and to use computers to help decipher the DNA.

- **develop effective and efficient ways to solve computing problems:** computer scientists develop the best possible ways to store information in databases, send data over networks, and display complex images. Theoretical background allows them to determine the best performance possible, and study of algorithms help them to develop new approaches with better performance.
Software Engineering
- SE is the discipline of 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.

- SE has evolved in response to factors such as the growing impact of large and expensive software systems and increased importance of software in safety critical applications.

- SE is different in character from other engineering disciplines due to both the intangible nature of software and discontinuous nature of software operation.

- SE integrates discrete mathematics and CS with the engineering practices.

- Degree programs in CS and in SE have many courses in common.
- SE students learn more about *software reliability and maintenance* and focus on techniques for *developing and maintaining software that is correct from its inception*.

- The *engineering knowledge and experience* provided in SE programs go beyond what CS programs can provide.

- The importance of this fact is so real that one of the recommendations is that during their program of study *students of SE should participate in the development of software to be used in earnest by others*.

- SE students learn how to *assess customer needs* and *develop usable software* that meets those needs.

- Knowing how to provide genuinely *useful and usable software* is of paramount importance.
- In the workplace, the term software engineer is a job label. There is no standard definition for this term when used in a job description.

- Its meaning varies widely among employers.

- It can be a title equivalent to computer programmer or a title for someone who manages a large, complex, and/or safety-critical software project.

- Do not confuse the discipline of SE with the ambiguous use of the term software engineer.
Software Engineering required courses:

- CIS 264 Software Quality Assurance and Testing
- CIS 290 Software Architectures and Frameworks
- CIS 365 Software Process and Project Management
- CIS 390 Design of Large Software Systems
- CIS 461 Formal Methods for Software Engineering
- CIS 431 Human Computer Interaction
Computer Science Core Courses:

- CIS 180 – Object Oriented Programming I
- CIS 181 – Object-Oriented Programming II
- CIS 190 – Introduction to Procedural Programming
- CIS 272 – Introduction to Computing Systems
- CIS 273 – Computer Organization and Design
- CIS 280 – Software Specification and Design
- CIS 360 – Algorithms and Data Structures
- CIS 361 – Models of Computations
- CIS 370 – Design of Operating Systems
- CIS 481 – Parallel and Distributed Software Systems
- CIS 498 – Software Engineering Project I
- CIS 499 – Software Engineering Project II
- CIS 362 – Empirical Methods for Computer Science
- CIS 381 – Social and Ethical Aspects of Computing
Computer Science Technical Electives  (4 courses required):

CIS 314 – Computer Architecture  
CIS 410 – Programming Language Design  
CIS 412 – Artificial Intelligence  
CIS 421 – Introduction to Theory of Computation  
CIS 422 – Design of Parallel Algorithms  
CIS 430 – Data Mining and Knowledge Discovery  
**CIS 431 – Human Computer Interaction**  
CIS 452 – Database Systems  
CIS 454 – Computer Graphics  
CIS 455 – Bioinformatics  
CIS 465 – Topics in Computer Vision  
CIS 467 – Image Analysis and Processing  
CIS 471 – Compiler Design  
CIS 475 – Computer Networks  
CIS 476 – Network Programming  
CIS 477 – Computer and Information System Security  
CIS 490 – Machine Learning
Job market for CS /SE graduates in 2009

• Currently number of Computer Science students is equal to 2/3 of the number of jobs needed to be filled by US computer industry
"Pure college" occupations with the most job openings for college graduates (2004-2014) projected

- Civil engineers: $64,230, 77 openings
- Mechanical engineers: $66,320, 87 openings
- Computer software engineers – systems software: $79,740, 180 openings
- Lawyers: $94,930, 205 openings
- Physicians: $145,600, 212 openings
- Computer software engineers – applications: $74,980, 268 openings
Highest paying occupations and job openings for college graduates (2004-2014)

- Nuclear engineers: 6 openings, $84,880
- Computer and information scientists - research: 6 openings, $85,190
- Physicists: 6 openings, $87,450
- Marketing managers: 55 openings, $87,640
- Petroleum engineers: 5 openings, $88,500
- Computer and information systems managers: 93 openings, $92,570
- Astronomers: 0.3 openings, $97,320
- Engineering managers: 63 openings, $97,630
"Mixed education" occupations with the most job openings for college graduates (2004-2014)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Openings</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network and computer systems administrators</td>
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<tr>
<td>Customer service reps</td>
<td>173</td>
<td>$27,020</td>
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<tr>
<td>Occupation</td>
<td>Net job openings for college graduates, projected 2004-14 (thousands)</td>
<td>Median annual earnings, 2004</td>
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<td>------------------------------------------------</td>
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<td>Profession</td>
<td>2004 Employment</td>
<td>2014 Employment</td>
</tr>
<tr>
<td>------------------------------------------</td>
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</tr>
<tr>
<td>Computer Software Engineers</td>
<td>800,100</td>
<td>1,168,700</td>
</tr>
<tr>
<td>Computer Scientists and Database Admins</td>
<td>507,200</td>
<td>707,300</td>
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<tr>
<td>Computer Systems Analysts</td>
<td>486,500</td>
<td>639,500</td>
</tr>
<tr>
<td>Computer Support Specialists Admins</td>
<td>796,800</td>
<td>1,022,900</td>
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<tr>
<td>Computer and Information Systems Managers</td>
<td>280,300</td>
<td>352,900</td>
</tr>
<tr>
<td>Computer Programmers</td>
<td>455,300</td>
<td>564,300</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,326,200</td>
<td>4,455,600</td>
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Professions within Computer Science

- Computer programmer
- Computer and information systems manager
- Computer software engineers
- Computer systems analyst
- Network and computer system administrators

Where our graduates work

- EMC
- General Dynamics
- Microsoft, Sun Microsystems
- Raytheon
- Meditech
- Naval Undersea Warfare Center
- Fidelity Investments, other investment houses
- Smaller software development companies
CIS Department in a nutshell

- **funded in 1983** – circa 500 BS in Computer Science degrees awarded
- BS in CS program is **accredited since 1988**
- in 1987 with **MS in Computer Science** – circa 350 degrees awarded
- in 2005 with **BS/MS in Computer Science Option**
- in 2007 with BS in Computer Science, **Software Engineering Option**
- 11+3 FT faculty, 2 technicians, 2 administrative staff
- 140 U/CS + 70 G/CS = 210 CS majors
- Computer Science Industrial Advisory Committee
http://www.careervoyages.gov/infotech-typesofjobs.cfm

• “A great demand exists for workers with a strong understanding of the Internet, intranets, and web-based application design
• People with skills in Java programming, security and firewall expertise
• and the ability to connect presentation level interfaces, databases and legacy systems are also in demand.” ....
Computer Science supports many domains
Programs in CIS Department

• BS in Computer Science
• BS in Computer Science, Software Engineering Option
• Senior year-long group software development project
  – experience based on core CS/SE courses
  – resume-building tool
• BS/MS in Computer Science
  - 5-year integrated degree
• MS in Computer Science program
Student life in CIS Department

• **Cooperative education** – by choice
• **Internships** – as experience building tool
• role of **CITS** and **ATMC**
• strong support from faculty and “mentor” students
• two clubs reflecting students’ interests – **Linux User Club** and **Computer Game Design Club**
Co-op for CS majors

• The Cooperative Education and Internship Program (CEIP) is a highly successful approach that combines classroom education with workplace learning
Co-op is not for everyone

- 2.75 GPA to start work placement
- 2.75 GPA to remain in the program
- minimum of 3 work placements
- no more than 5 work placements
- at least two must be non-summer
- two approved internships may substitute a work placement
- it takes 5 academic years to graduate
Thank you !!!

Questions and Answers