Welcome to
BS in Computer Science &
Software Engineering Option

Open House
October 27, 2007

Computer and Information Science Department
http://www.umassd.edu/engineering/cis

Dr. Boleslaw Mikolajczak, Chair
Overview

- What matters in career decision-making?
- Professional occupations of Computer Science & Software Engineering
- Employment opportunities for Computer Science & Software Engineering graduates
- The discipline of Computer Science & Software Engineering
- BS in Computer Science & Software Engineering Option at UMASS Dartmouth
What matters in career decision making?

- Computer Science and Software Engineering dominate professional job market
- The most important career decisions:
  1. Do you have **interest** in solving problems using computers? **YES**
  2. Are you prepared to take a **challenge** of the computing profession? **YES**
  3. What are **outcome expectations** for you:
     a). growth of job market **EX**
     b). frequency of job offerings **High**
     c). starting salaries **>$50K**
Academic Disciplines within Computing

• **Computer Science**
• Computer Engineering
• **Software Engineering**
• Information Systems (MIS, BIS, AIS, …)
• Information Technology
Computer Science vs. other domains

- Medicine
- Science
- Business
- Engineering
- Humanities
- Art
- Entertainment

Computer Science

Computing
Professional Occupations of Computer Science

  - System Analysts, Computer Scientists, and System Administrators ([ocos042.htm](http://ocos042.htm))
  - Computer Programmers ([ocos110.htm](http://ocos110.htm))
  - Computer Software Engineers ([ocos267.htm](http://ocos267.htm))
  - Computer Support Specialists ([ocos268.htm](http://ocos268.htm))
Employment Growth for Computer Science graduates 2004-2014; BLS (www.bls.gov/oco/)

Diagram showing employment growth for various computer science roles from 2004 to 2014. The roles include:
- Software Engineers, applications
- Support Specialists
- Systems Software
- Networks, administrators
- Network systems, communication
- Systems Analysts
- IS Managers
- CS Scientists

The diagram uses bars to represent the number of jobs for each role in 2004 and 2014.
Employment Opportunities for Computer Science graduates

• **Summary** - job growth in Computer Science professional occupations during 2004-2014 by circa **800 thousands NEW jobs** (not counting computer support specialists - additional **500 thousands NEW jobs**).

• The above numbers do not count **job replacements** needed due to **retirements** and other decisions to leave the market place.
Graduates of BS in Computer Science Program at UMASS Dartmouth work in:

- **Raytheon** - Portsmouth, RI; Bedford, MA
- **APC** - American Power Conversion, Providence, RI
- **Microsoft, Lucent Technologies** - MA
- **Naval Undersea Warfare Center** - Newport, RI
- **EMC²** - Hopkington, MA
- **Sun Microsystems** - MA
- **General Dynamics** - Taunton, MA
- **Fidelity Investments, Thompson Investments** - Boston
- **Textron Financial** - Providence; **Goldman Sachs** - NY
- **Meditech** - MA
- **Various software development & consulting houses**
The Discipline of Computer Science

Study of algorithmic mechanisms of computational processes, i.e. how to solve problems of society by means of computers.

“It has often been said that a person does not really understand something until he teaches it to someone else. Actually a person does not really understand something until he can teach it to a computer, i.e. express it as an algorithm.” Donald Knuth
History of Computing

- **Computing** has inherited from Mathematics (discrete) and Electrical Engineering (digital)
- **1936** – Alan Turing defines in his paper “*what is computable*” and “*how a computation can be performed*”, i.e. blueprint of a computer
- **1944** – first physical computers have been built
- **1970** – first Computer Science departments are created in the United States
- **1983** – CIS Department is established at UMASS Dartmouth (formerly SMU) – almost 25 years
Sub-disciplines of Computer Science

- Mathematical Foundations and Theory of Computation
- Algorithms and Data Structure
- Programming Languages and Compilers
- Concurrent, Parallel and Distributed Systems
- Software Science and Software Engineering
- System Architecture
- Communications
- Databases and Information Management
- Artificial Intelligence/Intelligent Computing Systems/Robotics
- Visualization Rendering (or Computer Graphics)
- Human-Computer Communication
- Scientific Computing
What is “Computational Thinking”?

- **Solving problems** taking into account instruction set, resource constraints, and operating environment
- Is **approximate solution** good enough?
- Can we use **randomization** to our advantage?
- Are **false positives** or **false negatives** allowed?
- Reformulating a difficult problem into a one we know already – **reducibility** issue
- Solving problem by **reduction, embedding, transformation** or **simulation**
- Thinking **recursively**
What is “Computational Thinking”?  

- **Parallel and distributed computing**, will it be correct?  
- **Type checking**, i.e. recognizing the virtues and dangers of aliasing  
- Cost and power of *indirect addressing* and *procedure call*  
- Judging a program on **correctness, efficiency, esthetics** and **system’s design, simplicity** and **elegance**  
- **Abstraction** and **decomposition** when it comes to designing complex systems  
- **Separation of concerns**  
- Choosing appropriate **representation** for a problem
What is “Computational Thinking”?

- **Modeling** relevant aspects of the problem to make it tractable
- Using *invariants* to describe system’s behavior succinctly and declaratively
- Using *heuristic reasoning* to discover solution
- **Planning, learning, and scheduling** in the presence of *uncertainty*
- Use *massive amount of data* effectively
- Making *tradeoffs* between time and space; between processing power and storage capacity
What is “Computational Thinking”? 

• Using **pre-fetching** and **caching** in anticipation of future use
• Using **backtracking** to trace back previous actions
• Using **performance modeling** for multi-server systems.
• Using **redundancy** in design
• **Modularizing** design in anticipation of **multiple users**
• Thinking in terms of **prevention, protection**, and **recovery** from **worst-case scenario** through **redundancy, damage containment**, and **error correction**
Exciting New Areas of Computer Science

- Internet and Intranet computing
- Security of computer and information systems
- Programming support for electronic commerce
- Mobile and Wireless computing
- Optical and Multimedia-based computer networks
- Agent-based computing
- Bioinformatics, bio-technology, bio-engineering
- Software factories for software development
- Knowledge discovery through data mining and visualization
- Mobile Robotics
- Intelligent Information Systems
BS in Computer Science at UMASS Dartmouth

• Accredited by CAC of the ABET since 1988 - www.abet.org
• Program’s Goals and Outcomes
• Computer Science Curriculum
• Program Features
• Faculty - 12 full-time tenured and tenure-track faculty + 1-2 new Faculty in Fall 2008
• 2 professional technicians + 2 administrative staff
BS in Computer Science - Program Goals

• Graduates who succeed as practicing computer scientists

• Graduates who succeed in advanced study in computer science

• Graduates who adopt and evolve in complex technological environments such as those found in workplace

• Graduates who influence the development of professional, ethical, and legal aspects of computing
BS in Computer Science - Program Outcomes

- Are able to **individually solve problems** in algorithmic manner with given computer resources and constraints
- Apply their **knowledge of mathematics, science, and computer science** to solve technical problems
- Apply **analytic and empirical techniques** to evaluate technical problems and their solutions
- **Design** system, component, or process to meet specified requirements
- Participate as an **effective member** of a problem solving team
Program Outcomes, continued

- Identify, formulate, and solve problems encountered when constructing solutions involving information technology.
- Articulate the social, professional, ethical, and legal aspects of a computing milieu.
- Evaluate the impact of computing and information technology at the global societal level.
- Analyze contemporary issues related to the evolving discipline of computer science.
- Communicate effectively.
- Apply modern skills, techniques, and tools during professional practice.
Computer Science Curriculum at UMASS Dartmouth

• 120 semester credits to graduate (4 years)
• at least 56 credits in **computer science**:
  • required courses (44 credits) and
  • elective courses (12 credits)
• 17 semester credits in **mathematics** (calculus, discrete structures, probability and statistics)
• 14 semester credits in **sciences (PHY, CHM or BIO)**
• 9 semester credits of **English** (including written and spoken technical communication)
• 18 semester credits of **humanities and social sciences**
• 6 semester credits of **FREE electives** (to choose minor in another discipline)
Software Engineering Option

- CIS 264 Software Quality Assurance and Testing
- CIS 290 Software Architecture and Frameworks
- CIS 365 Software Process and Project Management
- CIS 390 Design of Large Software Systems
- CIS 461 Formal Methods in Software Engineering
- CIS 498/499 Software Engineering Project I & II (Capstone Project)
BS/ MS in Computer Science Option

- Both BS and MS degrees in Computer Science in 5 years
- High probability of Teaching or Research Assistantship during the 4-th/5-th years of study
- Extended internship opportunities in industry, esp. in national defense and security sector
- Industry needs for employees with Master degrees in Computer Science are now more frequent
CO-OP and Internship Opportunities

- Must have 2.75 GPA to start work placement
- Must maintain 2.75 GPA to remain in the program
- A minimum of 3 work placements but not more than 5 work placements
- At least 2 work placements must be non-summer
- Two approved internships may substitute a work placement
- CS juniors and seniors are hired as interns by ATMC and computer industry – summer and semester breaks
BS in Computer Science -
program features

- Program is **affordable**
- Program is **flexible** to complete **minor** in another discipline
- **CS=software track+systems track+foundations track**
- intellectual control over systems/software development
- focus on design in computer systems development
- object-oriented (**Java**) and procedural programming (**C**)
- group software/systems projects
- **senior group capstone year-long project**
- courses with **required and supervised labs** (hands-on experience)
- **quality of lecture/lab instructions** - 32/16 section size
- **faculty current in discipline** through research and professional development
BS in Computer Science, Program Features - continued

- CSIAC – Computer Science Industrial Advisory Committee
- individual curricular and career advising process
- comprehensive tutoring system
- BS/MS in Computer Science Option in 5 years
- Integration of professional and general education
- Integration of enduring methodologies and evolving technologies - to know, to understand, to apply
- Cooperative Learning & Internship Program
- Two computing platforms - Windows and Linux
BS in Computer Science,
Program Features - continued

✓ Specialized research labs: concurrent computing, computer vision, mobile robotics, neural and intelligent systems, computer networks, databases, image processing, concurrent software engineering

✓ Student Chapter of the Association for Computing Machinery (ACM)

✓ Student Computer Game Design Club

✓ Student Linux Users Club

✓ students participate in ACM programming contest and in IEEE Design Competition
Faculty and their Scholarly Specializations

• **Software Science and Software Engineering** – Drs. Jan Bergandy, Paul Bergstein, Boleslaw Mikolajczak, Gaoyan Xie, Haiping Xu, Prof. Richard Upchurch

• **Computer Systems and Networking** – Drs. Emad Aboelela, Michael Geiger, Vinod Vokkarane

• **Intelligent Information Systems** – Drs. Ramprasad Balasubramanian, Iren Valova, Shelley Zhang
Computer Science majors
- Fall 2007

• 150 students in BS in Computer Science program

• 80 students in MS in Computer Science program

• 230 students in both Computer Science programs
Thank you for your attention !!!

Questions