

The logo for UMass Lowell is located on the left side of the slide. It features the word "LOWELL" in large, blue, stylized letters with a gold outline, set against a gold background. Below "LOWELL" is the word "UMASS" in blue, and to the right of "LOWELL" is the word "DA" in gold. The background of the slide is white with a faint, light blue graphic of a computer mouse and its cord.

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

Computer and Information
Science Department

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**

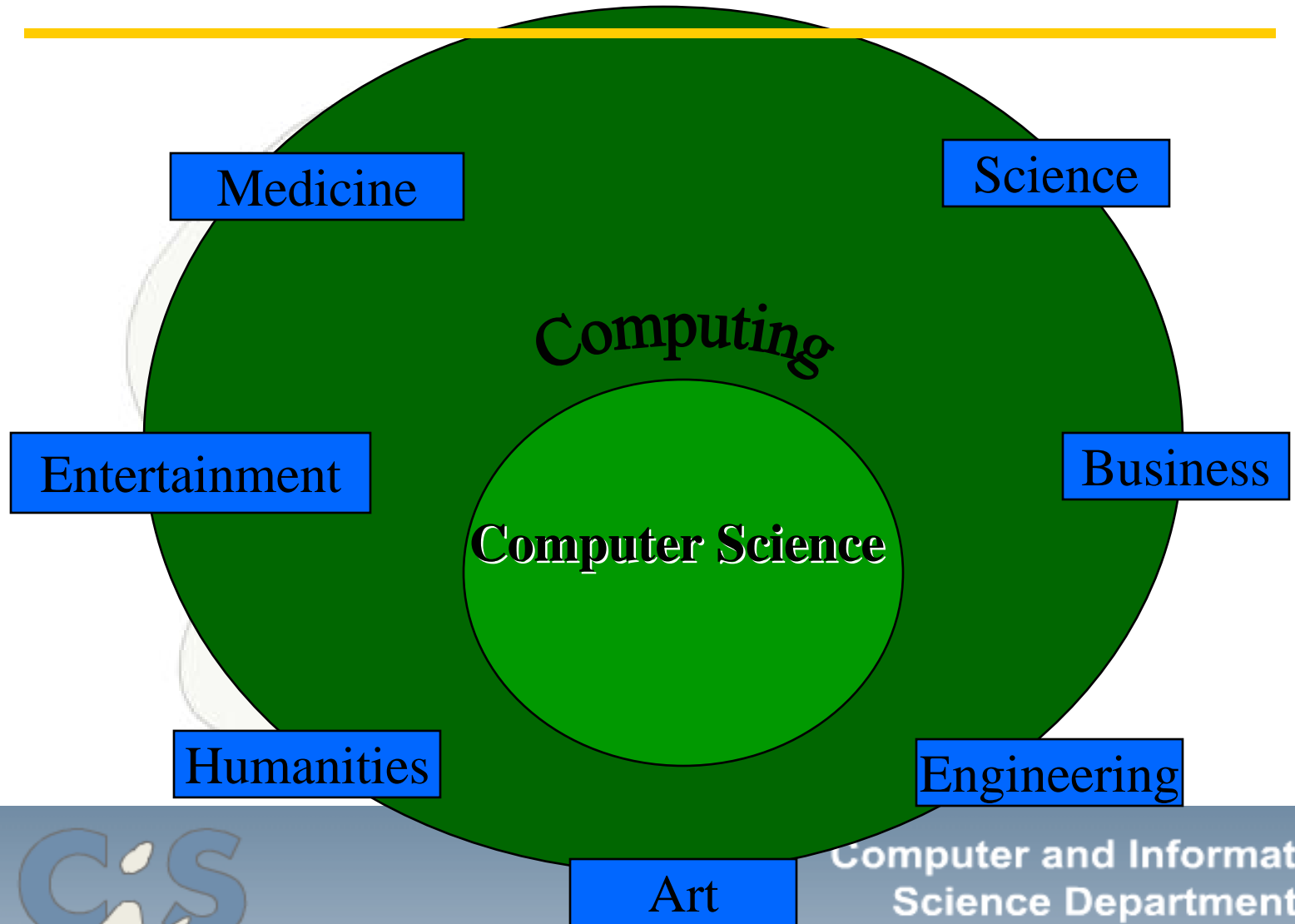
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Academic Disciplines within Computing

- **Computer Science** * * * * *
- Computer Engineering
- **Software Engineering** * * * * *
- Information Systems (MIS, BIS, AIS, ...)
- Information Technology

Computer Science vs. other domains

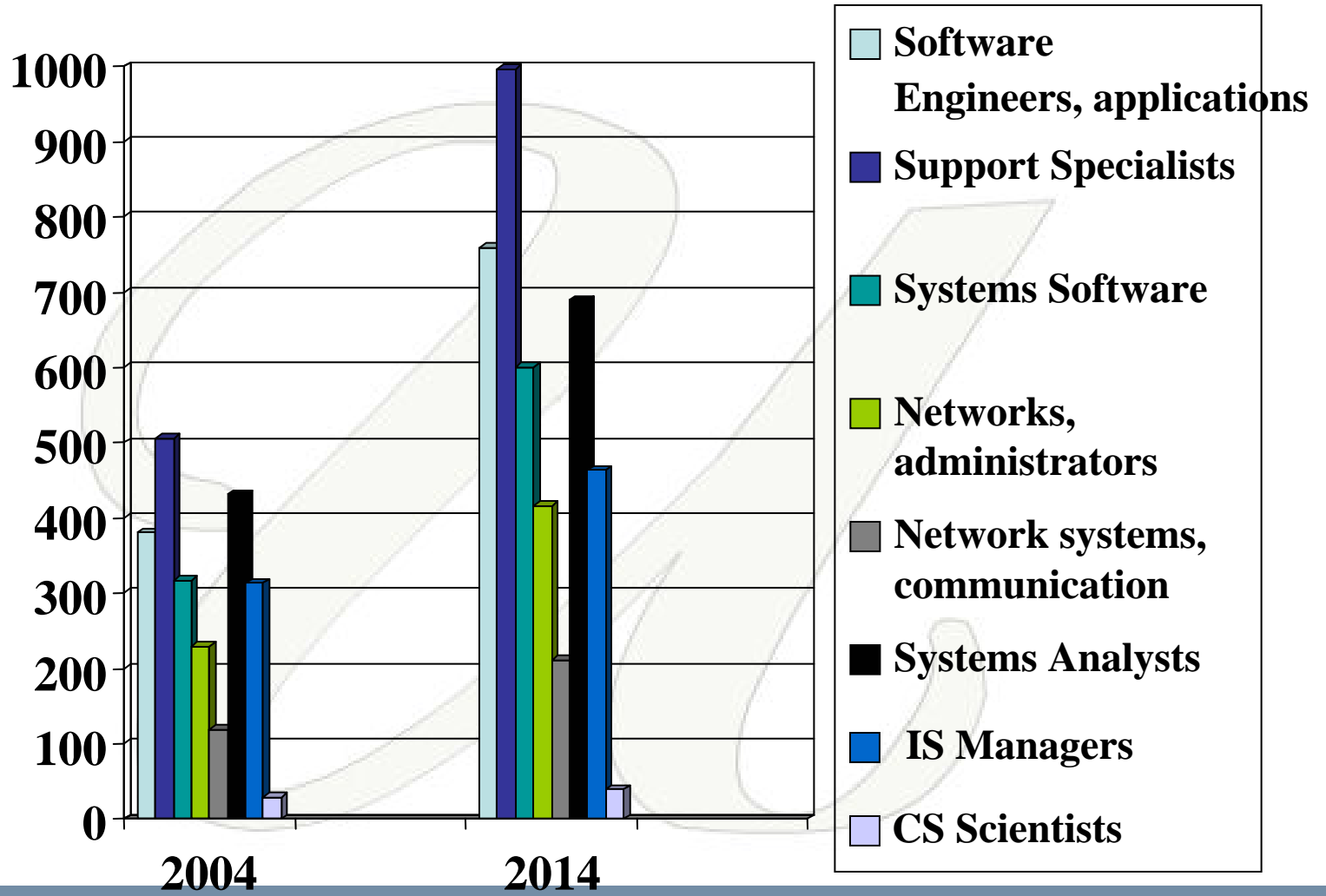


Professional Occupations of Computer Science

- **US Department of Labor; Bureau of Labor Statistics** (www.bls.gov/oco/):
 - **System Analysts, Computer Scientists, and System Administrators** ([ocos042.htm](http://www.bls.gov/oco/ocos042.htm))
 - **Computer Programmers** ([ocos110.htm](http://www.bls.gov/oco/ocos110.htm))
 - **Computer Software Engineers** ([ocos267.htm](http://www.bls.gov/oco/ocos267.htm))
 - **Computer Support Specialists** ([ocos268.htm](http://www.bls.gov/oco/ocos268.htm))



Employment Growth for Computer Science graduates 2004-2014; BLS (www.bls.gov/oco/)



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

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Computer and Information
Science Department