Beyond CSE 142

Wrapup and Look Ahead

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What did we learn in CSE142?

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What did we learn in CSE142?

• A fundamental view of computing: classes and objects
• Methods & messages
• Variables, types, and expressions
• Collections (ArrayList, etc.) and arrays
• Iteration and conditional statements
• Some basic algorithms including binary search, sorting
• Concepts of software quality
• Fundamentals of interfaces and inheritance

• and some Java….
    • Java is not the main point ultimately; the underlying ideas are

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What next?

• CSE 143
• Direct continuation of CSE 142 – also uses Java
• Students say "Intense, time-consuming, but rewarding"
• 5 credit hours
• Prerequisite for all further CSE courses

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CSE143 Topics

- No review – pick up where CSE142 leaves off
- Programming topics
  - Class relationships, inheritance, interfaces
  - Java user interface (SWING); event-driven programming; callbacks
    - Continued use of standard libraries and practices
  - Exception handling
  - Streams, files, I/O
  - Recursion; divide & conquer algorithms (binary search, quicksort)
- Data structures and algorithms
  - Lists, stacks, queues, trees
  - Implementation tradeoffs
  - Basic algorithm analysis, O( )-notation

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## Trends in Programming

Old School	*New Wave*
- Input/process/output	- Event-driven
- Reuse via libraries of functions	- Reuse via libraries of classes, components, and design patterns
- Programmer calls functions	- Programmer inherits from classes, links components together
- COBOL, C/C++, Ada, Pascal, etc.	- C++, Java, C#, Visual Basic, scripting languages, etc.
- Data stored in files and databases	- All that, plus data from OO databases, persistent object stores, networks, Web

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Java Class Hierarchy Chart
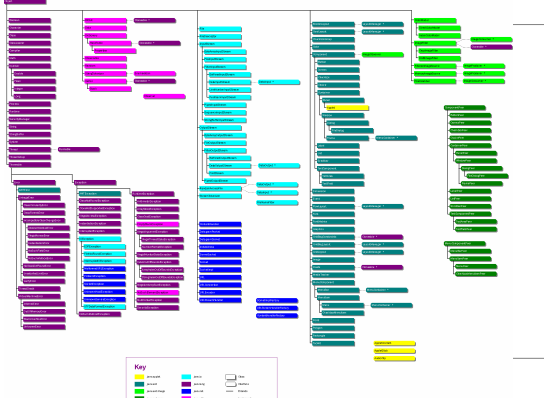
Beyond Objects: Components

- Component: a "sealed" object
  - Some methods and data are "exposed" to the outside world
- Language-neutral
  - source code not visible
  - may be used within any compliant programming language or environment, possibly even at a distance.
- Supporting and related technologies
  - Sun: JavaBeans
  - CORBA
  - Microsoft: VB, COM, OLE, Active-X, ASP,.NET, etc.
  - Scripting languages (VBScript, JavaScript, etc.)

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C++

- Similar to Java in notation and overall concept
  - But some fundamental differences
  - More complicated
- Classes were tacked on to C to form C++
  - No common ancestor Object
  - Object-orientation is not fundamental or enforced
- C++ is still more widely used overall
  - In Windows world C# will gradually take over
  - In non-Windows world Java is the main contender

C++ vs. Java

- Explicit memory management: pointers
  - No garbage collection
  - Huge source of errors in C and C++
- No virtual machine
- Limited standard library
- Some C++ "power" features
  - multiple inheritance
    - Nice, but complex for programmer and compiler writer
  - operator overloading
- Templates: using types as parameters
    - Can create more general methods and classes
    - complex to use
   - Java will probably this feature in version 1.5 (summer 2004)

Legacy Windows C++ Application Development

- Much C++ Windows development used Microsoft Foundation Classes (MFC)
- Not part of the standard language
- MFC Key features
  - Graphical User Interface (GUI)
    - Windows, menus, buttons, drawing areas
  - Event-driven
    - Respond to internal and external events
    - Multi-threaded
  - Object-oriented
    - Built-in class hierarchies for standard reusable objects
  - Programmer's job
    - Understand the hierarchy; use and extend given classes; hook into events; add custom logic

MFC Class Hierarchy

Microsoft Foundation Class Library Version 4.21
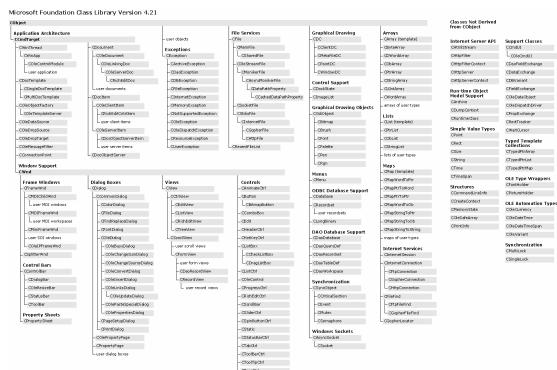
Using MFC

- Hard to learn
  - "Wizards" help somewhat
  - Nevertheless, a big improvement over previous environment:
    - Win16/Win32 API: Hundreds of individual C functions
- Widely used in Windows world
- Not perfectly integrated with Windows OS
  - mismatch with event handling
- Not part of C++
  - Mismatch or conflicts with standard libraries
  - Compiler can't check everything
  - Windows only - not available on other platforms

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Microsoft Today: .NET

- In 2002 Microsoft introduced its .NET framework
- Similar to Java in concept:
  - Programs execute on a "virtual machine"
  - Garbage-collected
  - Type-safe
  - Large standard libraries
  - All languages share the same libraries and basic type system

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Microsoft Languages

- All Microsoft languages will run on .NET
- A new language, C#, will be the main MS development language
  - C# is based closely on Java (NOT on C++)
  - Microsoft is gradually shifting new development to .NET/C#
- C++ is still supported
  - C++ will run on .NET with limitations ("managed" code)
  - can still be run the older unrestricted way ("unmanaged")
    - for high performance, low-safety applications, or compatibility
- Visual Basic has been revised to be very similar to C#
- C# runs only on Microsoft Windows platforms

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Computer-Related Majors at UW

- Within CSE Department:
  - **Computer Science (Arts & Sciences)**
  - **Computer Engineering (College of Engineering)**
- ACMS: Applied Computational and Mathematical Science (Arts and Sciences)
- Information Technology (Library School)
- Information Systems (Business School)
- Plus... UW Bothell and UW Tacoma offer a Computer Software Systems major (CSS)

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CSE Courses

- After 143, it's assumed you can program!
- Non-majors courses
  - 373 (Data Structures) Most direct successor to 143
  - Then 410 (Computer Systems), 413 (Prog. Languages), 415 (Artificial Intelligence)
- Next majors courses to take
  - Need permission if not CSE major (impossible to get)
  - 321 (Discrete Structures)
  - 322 (Formal Models)
  - 326 (Data Structures)
  - 370 (Digital Logic)

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UW Certificate Programs

- Multi-course sequences
- Offered through UW Extension
  - Separate tuition, schedule, registration
  - Most classes in evenings or on weekends
  - Most lead to a "certificate" rather than UW credit
- Over a dozen: C, C++, Java, Perl, Windows, Internet, Graphics, Multimedia, etc. etc.
- Some can be applied toward a degree at UW Bothell/Tacoma

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Programming Day-To-Day

- Programming constructs show up in many common applications
  - MATLAB, calculators, web pages, etc.
  - "Scripting" -- simple programming to automate common tasks
    Available in many applications, if you look for it
  - Expect to find: variables, loops, parameters, functions (methods), libraries, object models, etc.
- Try to relate it to what you did in 142!

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And Beyond College….

- Training for the first job vs education for a 40-year career
- 50 years of computing technology (1950-2000)
- No one foresaw the changes
- No one even foresaw the World Wide Web
- Question for educators:
  - What should we teach?
  - How should be teach it?
- How will information technology transform the world of 2100?

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