

Mat 2170
WEEK 1

Dr. Van
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Course and
Guidelines

Lab 1

Lab Computers
Requirements
Software
Java, Applets &
Web Page
Linux

Elements of
CS

Design
Components
Language
Choice

Mat 2170 WEEK 1

Dr. Van Cleave

Spring 2012

Mat2170 Course Goals

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- **Develop Algorithm Design Skills:**
writing step-by-step instructions to solve problems
- **Develop Facility with the Object Oriented Paradigm:**
using, extending, and developing Classes and Objects
- **Learn a Subset of the Syntax of the Java language:**
be capable of writing significant Java programs
- **Develop Critical Thinking Skills:**
the processes of discernment, analysis and evaluation of information

General Course Guidelines

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- Syllabus
- Schedule (note **evening** exams)
- Academic Integrity
- Labs – weekly
- Quizzes, Worksheets – weekly
- Workbook
- Course Web Site (www.eiu.edu/~mathcs)

Lab Guidelines

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- Focus on lab work when in lab.
- Come to lab prepared, with **written drafts of programs.**
- **Cheating is not allowed.** Do your own work.
- Unexcused late lab submissions will **not** be accepted.
- Not all labs are worth the same number of points.
- Finish incomplete labs on your own time.

Workbooks — Each Week:

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Clearly label and complete each of the sections:

- **Week:** plus the week number at the top of a right-hand page
- **Topics:** a list of the broad topics covered during the week.
- **Summary:** one or more paragraphs, composed of English sentences, describing in more detail the topics of the week. You are to synthesize this summary from lecture, class notes, and the weekly slides.

Workbooks, Continued

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- **Labs:** a list of the lab exercises, with a description of what you learned and the educational purpose of each, again using English sentences.
- **Examples:** whatever else you think might be important, for example, code fragments.

Everything in your workbook is to be hand-written by you.

Workbooks may be used during quizzes and exams,
unless I inform you otherwise.

Evaluation

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In this course there will be:

- Weekly — labs, worksheets, and quizzes
- Your workbook
- Three written evening exams, and
- A comprehensive final exam

The relative weights of these components are:

Exams (3)	15% (each)
Quizzes, worksheets, workbook	10% (total)
Laboratories	15% (total)
Final	30%

Your Responsibilities for the Semester

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- Attendance — all lectures, labs, and exams
- Investing enough time on the course to succeed – about 15 hours per week outside of class. That's > 2 hrs per day!
- Ask me questions. Come to my office. Send me email.
- Do your own work.
- Read the text & study the lecture slides.

More Responsibilities

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- **Keep up** with the work. Turn assignments in on time.
- Turn off your cell phone and all other electronic devices, put them away, and keep them out of my sight during lectures and labs.
- Make-up exams are available only if agreed upon before the regular exam is given.
- No make-up quizzes will be given.

Week 1 Student Responsibilities

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- **Reading:** Textbook, Chapters 1 and 2.1
- **Lab:** Lab 1, **Prelab**, & Postlab
- **Electronic submission**
- **web publishing**
- **Attendance:** lecture & lab
- **Login** to your account in OM3041 Mac Lab before class Wednesday and report any problems

Week 1 Topics

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- Getting ready for Lab 1:
 - Handouts — follow the directions; use the check-off boxes.
 - The Mathematics and Computer Science lab, OM 3041
 - Requirements
 - Netbeans, Java
 - Hello World Program
- Algorithms
- The Programming Process
- What is Computer Science?
- Computer Hardware

The CS Lab and EIU servers

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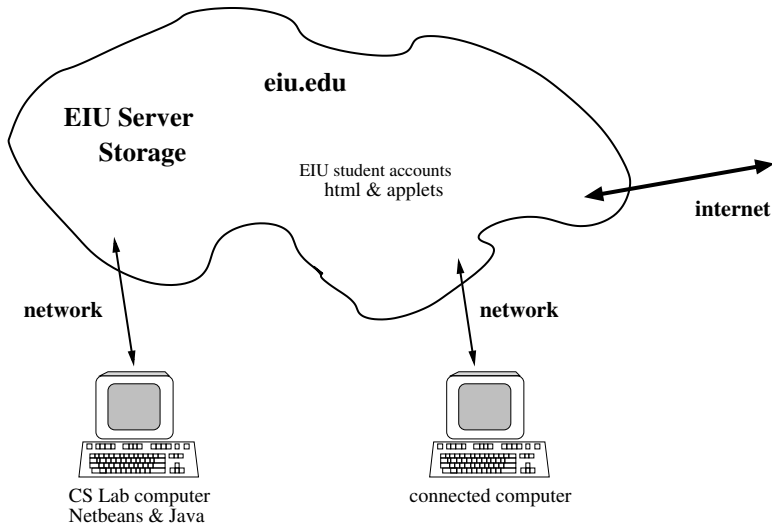
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An Overview of What You'll Need In Lab

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- 1** An EIU student account, web page (automatically created), and your (email) **password**
- 2** The **Lab 1** and **Creating Java Programs...** Handouts

- 3 **acm.jar** — a file containing the ACM graphics library
- 4 **netbeans** — an IDE used to create java programs and applets
- 5 **JDK** — the java interpreter
- 6 **firefox** — a web browser
- 7 A way to electronically submit files for grading
- 8 A way to transfer files from the lab to your web page
- 9 Access to a printer

2170 programming and acm.jar

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- The **Association for Computing Machinery** provides free java libraries (contained in **acm.jar**) which we will be using this semester.
- This library supports graphics, graphical user interfaces, and event-driven programming.
- Programs can be more interesting and fun if we extend what others have written.
- Much more information is available at jtf.acm.org

The Integrated Development Environment (IDE)

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- An **IDE** provides an organized way to:
 - view and select files from a project
 - edit files, and
 - compile and run programs
- There are multiple IDE choices — we will use **netbeans**
- **netbeans** is freely available from Sun Microsystems
- To start up **netbeans**, click the bluish–grey cube on your dock
- **netbeans** itself has several windows and menus — follow the lab handout carefully.

The Java Developers Kit (JDK)

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- Provides the Java compiler, which netbeans accesses.
- **JDK** is freely available from Sun Microsystems
- We are currently using version JDK 1.6
- Programs are compiled into the “machine language” of the Java Virtual Machine (JVM).
- Java then interprets those programs by simulating the JVM.

The Hello World Program

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```
// Header comments go here
import acm.graphics.*;
import acm.program.*;

public class HelloProgram
    extends GraphicsProgram
{
    public void run()
    {
        // Create and display a phrase to the user
        add(new GLabel("hello, world", 100, 75));
    }
}
```

Your Web Page

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- EIU provides students with email and a web page.
- When we compile and run a Java program from netbeans, we call that version an **application**.
- Java also makes it possible to write small interactive programs, called **applets**, that run under the control of a web browser.
- Part of your responsibility for labs and programming assignments will be to update your web page to include applets for each program.
- Follow carefully the instructions given in this week's lab. Refer back to them as needed in subsequent weeks.

Creating a Java Applet — Steps taken by the programmer

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- Design and write the **Java code**: `HelloProgram.java`
Typed into the netbeans editor
- Generate the **intermediate code** for the applet:
`HelloProgram.jar`
netbeans generates this file when you choose: build
- Create a small **HTML file** which tags the applet:
`HelloProgram.html`
Typed into the netbeans editor
- **Publish** an HTML web page that includes a reference to the compiled applet: `index.html`
Copy files, update index.html in netbeans, then synchronize your web site (with **websync** command).

Running a Java Applet — Steps taken by the viewer/user

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- Start a browser, enter the URL for the applet page or click on the link to the applet
- Browser reads and interprets the HTML source for the web page
- The **object** html tag causes the browser to download the compiled applet over the network
- The applet intermediate code is checked to verify it does not violate the security of the user's system
- The Java interpreter in the browser program runs the compiled applet, which generates the desired display on the user's console

Directory Structure

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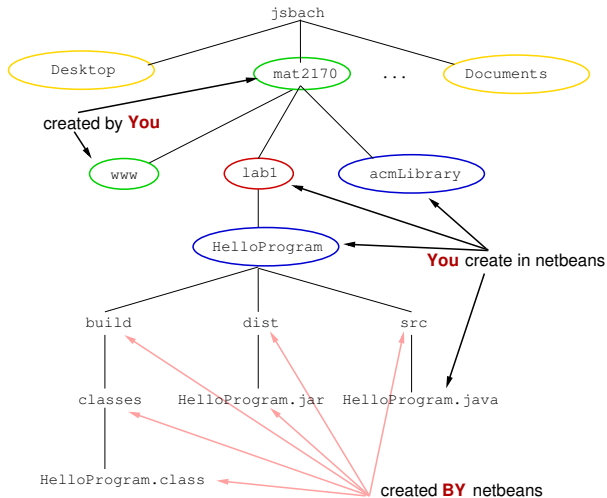
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Directory Structure in Your EIU Account

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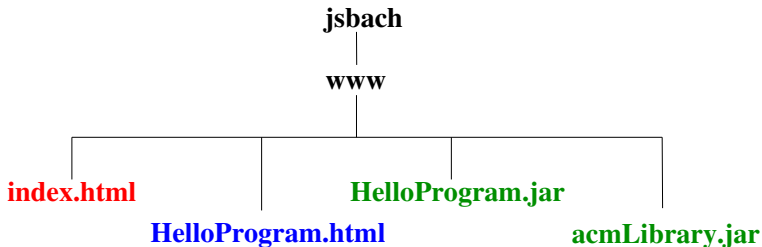
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Directory Structure (Before Postlab)

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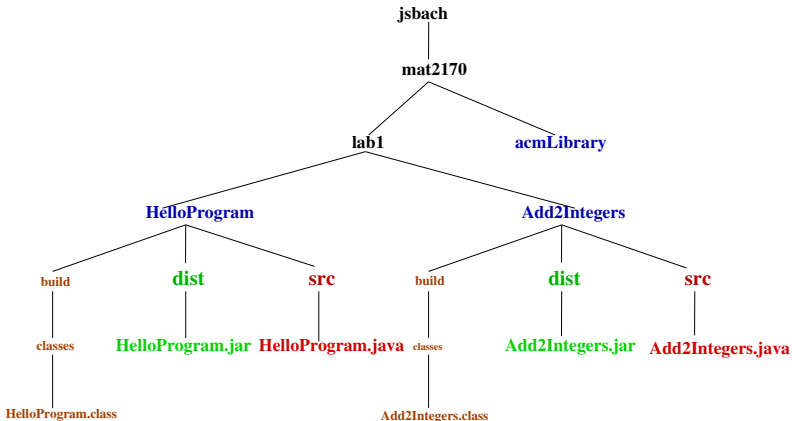
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Directory Structure in EIU Account (Before Postlab)

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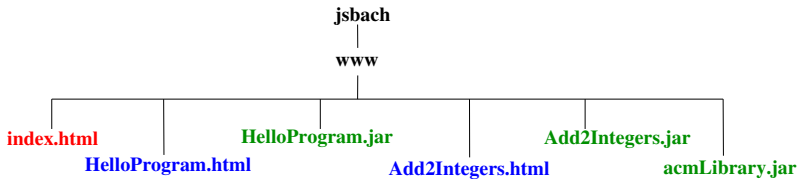
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Algorithms

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- An **Algorithm** is a set of instructions for solving a problem — much like a recipe for a particular dish, or the instructions for putting together a model airplane.
- An Algorithm is the underlying **logic** behind any program.
- **Algorithmic Properties**
 - A **Step-by-step method** for solving a problem
 - All steps must be **unambiguous** and **executable**
 - Must **terminate** with the **correct outcome**

The Programming Process

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■ Algorithmic Design

- **Specifications** – types and restrictions of all required input and output for the program
- **Test Suite** – well-selected inputs with **expected** outputs
- **Logic** which solves problem (human readable)
 - General (Outline)
 - Detailed

■ Software

- **Coding** – translating Detailed algorithm into computer language (JAVA)
- **Debugging** – locating and eliminating errors
- **Maintenance** – evolution of program over time

Programming Errors and Debugging

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■ Syntax error

- Violation of the grammatical rules of a language
- Compiler displays error message(s)
- Corrected by tracking error down and editing the program file

■ Logic/semantic error:

- Sometimes called a **bug**; the process of eliminating such errors is called **debugging**
- Logic errors are much harder to find and eliminate than syntax errors
- Good design and testing is essential to writing robust software
- Time spent on design is well worth it

Software Maintenance

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- Between 80% and 90% of total software cost is for maintenance **after** it has been released
- Reasons software requires maintenance:
 - Continued debugging over time
 - feature enhancement - updates requested by users or to compete in the marketplace
- Two Philosophies of Writing Programs
 - **Quick and Dirty** — get the program working and move on to next project
 - **Software Engineering** — the discipline of writing programs so they can be understood and maintained by others
- Programming is an art and skill – **learned by practice**, not rote memorization, much like playing the piano

What is Computer Science?

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- **Hardware** - tangibles; the computer parts we can hold and feel
- **Software** - abstract, intangible
- **Problem Solving** - a **skill** one needs to practice in order to develop

Components of a Typical Computer

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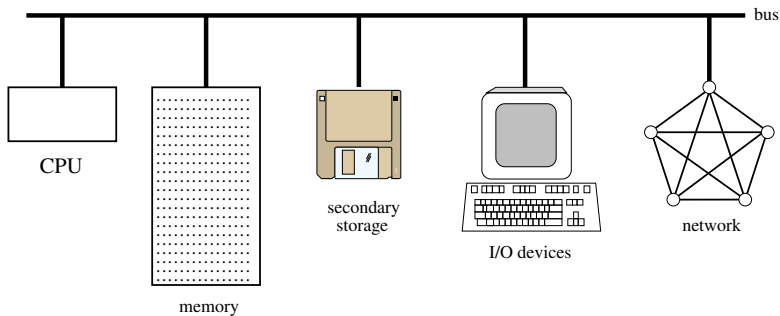
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Computer Hardware

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- **CPU (Central Processing Unit)** - an integrated circuit on a silicon chip; computations, coordinates computer activities
- **Memory (Primary Storage)** - usually a special integrated-circuit chip called a **RAM**, or *random-access memory*; information lost when machine turned off
- **Secondary Storage** - hard disk, thumb drive, CDs, diskettes, etc.; permanent data storage
- **Input/Output Devices (I/O devices)** - keyboard, mouse, monitor, printer
- **Network** - connection to other computers, **Internet**

Java & the Object Oriented Paradigm

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- **Paradigm**: an existing theoretical framework or set of rules
- **Paradigm Shift**: a new idea/framework replaces an older one
- Old programming paradigm: **procedural** — programs were a series of statements, procedures and functions which operated on openly available data
- New programming paradigm: **object oriented** — data and operations are grouped together into integrated units called **objects**, providing some security for data integrity
- Each **object** is an instance of a particular **class**; a single class can serve as a pattern for many different objects.

Why Java?

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- Used on the **AP exam** (of concern to HS teachers)
- **Simple**, efficient object oriented language
- Capacity to access and expand **libraries** of code
- **Robust** and **Secure**: Designed for creating highly reliable software, with security features designed into the language and run-time system
- **Architecture Neutral** and **Portable**: Java was designed to work well over a network, regardless of machine type or operating system (multi-platform)

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- **High Performance**: runs fast, responds quickly, cleans up after itself
- **Interpreted, Threaded, and Dynamic**: faster program development, multiple activities at the same time, and constantly evolving
- **Cost-effective**: open-source freeware is available on the Internet