Computer Sciences 302
Introduction to Programming

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Algorithms

Definition

An **algorithm** *is a sequence of steps to accomplish a task. An algorithm must be:*

1. *Unambiguous*
2. *Executable*
3. *Terminating*

Algorithms

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Example algorithm: Which is the most popular comic?

1. For each student, determine favorite comic
2. If comic already mentioned, add student to that comic's column
3. Otherwise, create a new column
4. When all students are sorted, locate longest list

End.

Programs And How They Work

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Definition

A **program** *is a sequence of instructions and decisions.*

Programs are written in human-readable, *high-level* programming languages and *compiled* to produce files in *low-level* languages a computer can understand.

Java makes use of the JVM (Java Virtual Machine) in order to share compiled files across different computer architectures.

Eclipse

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Integrated Development Environments (IDEs) can help programmers write code more efficiently.
We're using Eclipse - more on that in your lab next week.

Basic steps: edit $\rightarrow$ compile $\rightarrow$ run (and backup!)

Java Source Code Files

In Java, the basic steps become:

1. Edit the source code: `X.java`
2. Compile the source code: `X.class`
3. Run the program

Note: `X.java` and `x.java` are *two different files*.

Program Building Blocks

Definition

A **class** *is the fundamental building block of a Java program.*

Example program `Hello.java`:

```
public class Hello {
    public static void main(String[] args) {
        System.out.println("Hello, world!");
    }
}
```

In this program: class, method, statement, string, parameters

Compile-Time Errors

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Programming languages are not very tolerant to programmer errors:

1. `public class hello {...}`
2. `public staitc void main(String[] args) {...}`
3. `System.out.println("Hello,world!")`

Your program will not compile properly with these errors (and Eclipse will probably yell at you too).

Run-Time Errors

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Compilers don't catch everything!

```
public class Hello {
    public static void main(String[] args) {
        System.out.println("Hello, word!");
    }
}
```

Writing Java Programs: Memorizing

There are a few things you'll need to *memorize verbatim*:

1. Class header (`public class X` in file `X.java`)
2. Main method header (`public static void main(String[] args)`)
3. Braces {} and semicolons ;

Building Programs That Change!

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Definition

Variables *are locations in programs that can store data.*

Variables have a:

1. type
2. name
3. value

For example, `int x;` is a *declaration* of a variable named `x` which can store data of type `int`. The first time we assign `x` a value, we *initialize* `x`.

Variable Types

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Programs use lots of different kinds of data (number of bottles, area of sphere, film title, etc)
For numbers, we'll use: `int` and `double`
For words and letters, we'll use: `char` and `String`

Variable Names

Convention: variables start with a *lower-case letter*, e.g. `myLength` or `film_name`.

Note: some words are *reserved* (you can't use them for variable names)!

Variable Values

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Assigning values to variables requires the = operator:

```
int x = 2;
double y = 3.5;
x = x+1;
y = 5;
```

NO: `x = 2.3;` (why not?)

Let's Practice

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Task: Write a program to calculate and output the surface area of paper in a ream of printer paper.
Relevant numbers:

1. paper dimensions: 8"x11"
2. number of sheets of paper in a ream: 500

Making Code Readable: Comments

Adding comments makes code easier to read:

```
/* variable declarations */
int l =  8; // length
int w = 11; // width

/* calculate area */
int a = l*w;
System.out.println("Area = " + a);
```

The compiler ignores these; they're just for the programmer.

Next Time

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Variable operations and user input!