

Building Java Programs

Chapter 1

Lecture 1-1: Introduction; Basic Java Programs

reading: 1.1 - 1.3

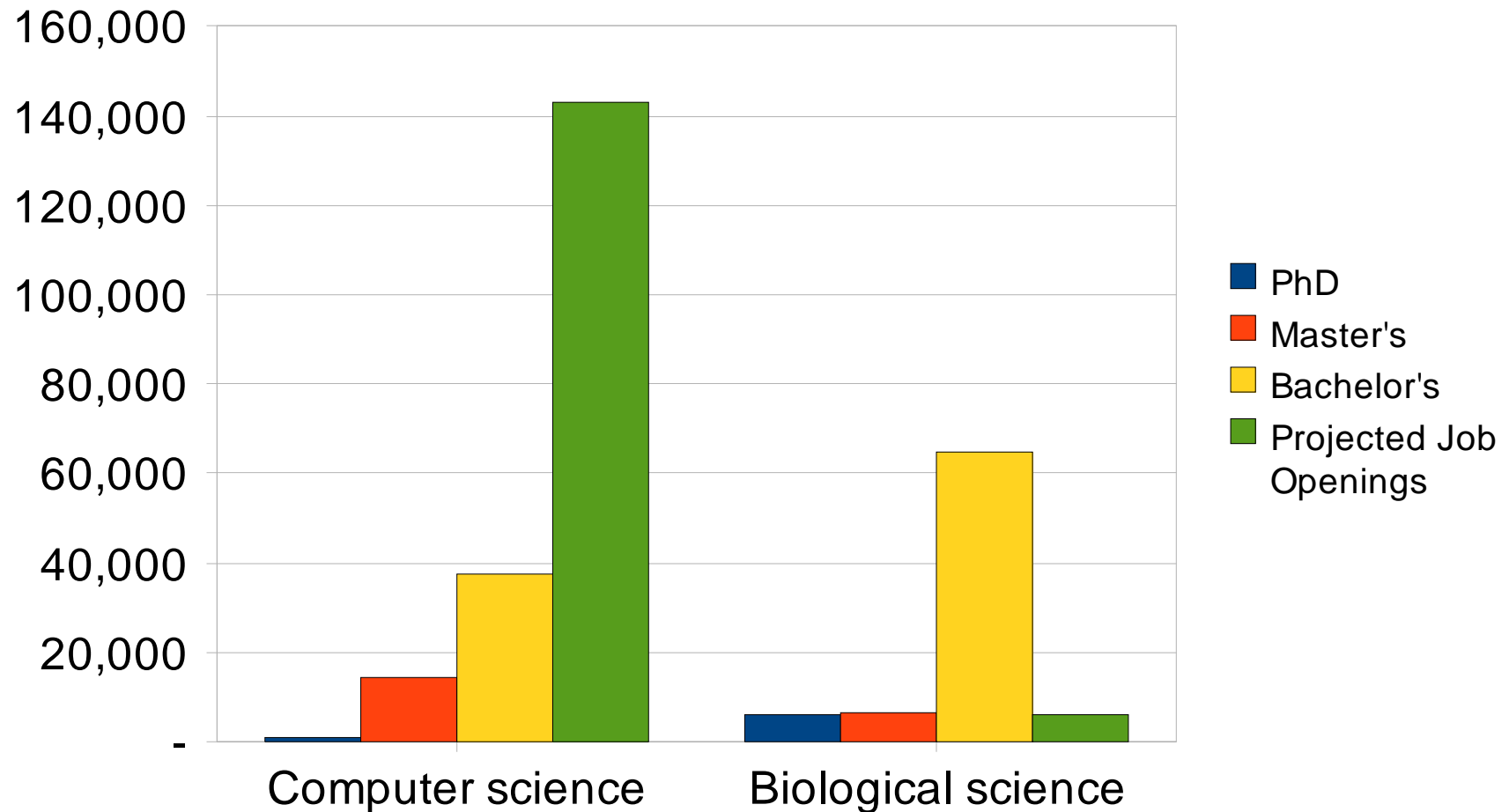
self-check: #1-14

exercises: #1-4

What is CSE?

- Computer Science
 - The study of theoretical foundations of information and computation and their implementation and application in computer systems. -- Wikipedia
 - Many subfields
 - Graphics, Computer Vision
 - Artificial Intelligence
 - Scientific Computing
 - Robotics
 - Databases, Data Mining
 - Computational Linguistics, Natural Language Processing ...
- Computer Engineering
 - Overlap with CS and EE; emphasizes hardware

The CS job market



SOURCES: Tabulated by National Science Foundation/Division of Science Resources Statistics; data from Department of Education/National Center for Education Statistics: Integrated Postsecondary Education Data System Completions Survey; and NSF/SRS: Sur

What is programming?

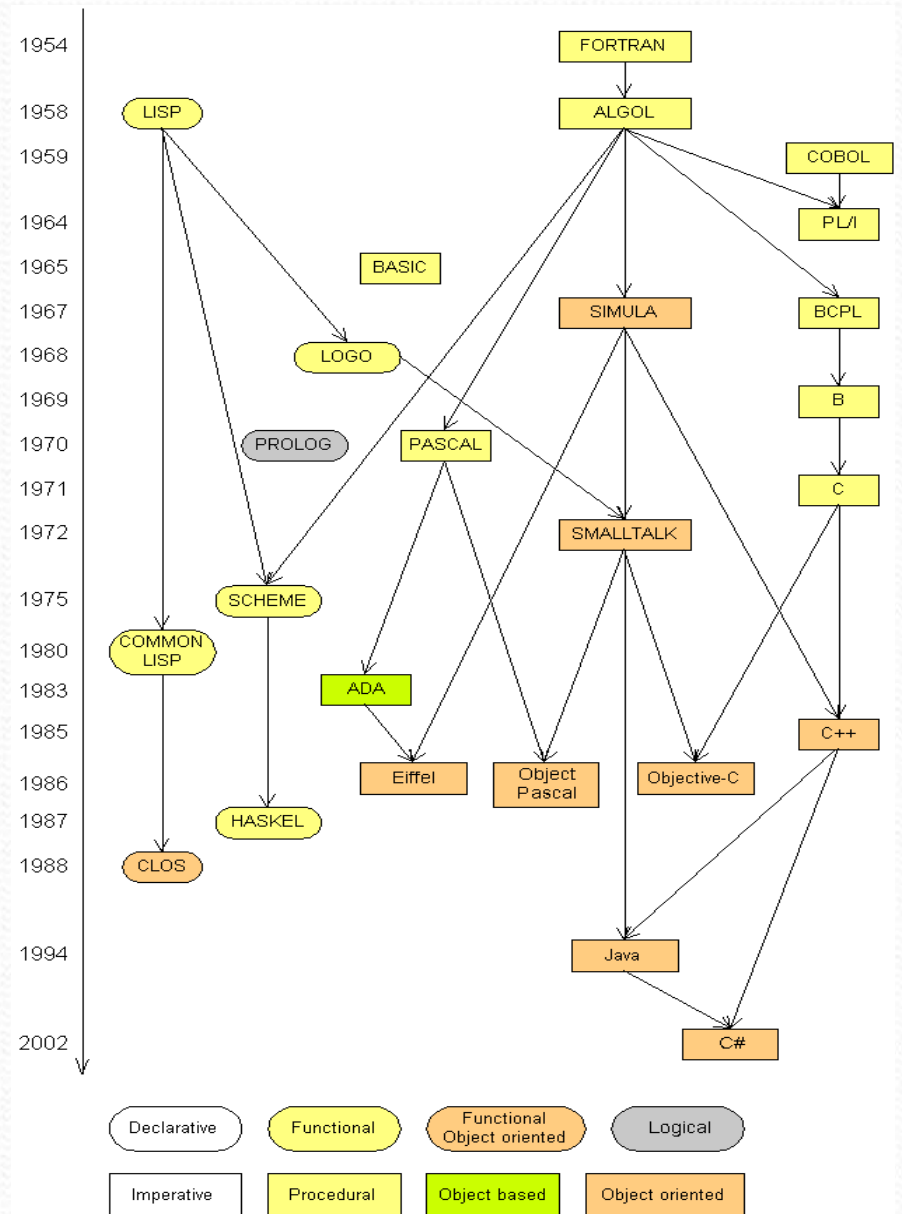
- **program:** A set of instructions to be carried out by a computer.
- **program execution:** The act of carrying out the instructions contained in a program.
- **programming language:** A systematic set of rules used to describe computations in a format that is editable by humans.
 - This textbook teaches programming in a language named Java.



Programming languages

- Some influential ones:

- FORTRAN
 - science / engineering
- COBOL
 - business data
- LISP
 - logic and AI
- BASIC
 - a simple language



Some modern languages

- *procedural languages*: programs are a series of commands
 - **Pascal** (1970): designed for education
 - **C** (1972): low-level operating systems and device drivers
- *functional programming*: functions map inputs to outputs
 - **Lisp** (1958) / **Scheme** (1975), **ML** (1973), **Haskell** (1990)
- *object-oriented languages*: programs use interacting "objects"
 - **Smalltalk** (1980): first major object-oriented language
 - **C++** (1985): "object-oriented" improvements to C
 - successful in industry; used to build major OSes such as Windows
 - **Java** (1995): designed for embedded systems, web apps/servers
 - Runs on many platforms (Windows, Mac, Linux, cell phones...)
 - The language taught in this textbook

Basic Java programs with `println` statements

reading: 1.2 - 1.3

self-check: #5-14

exercises: #1-4

Compiling/running a program

1. Write it.

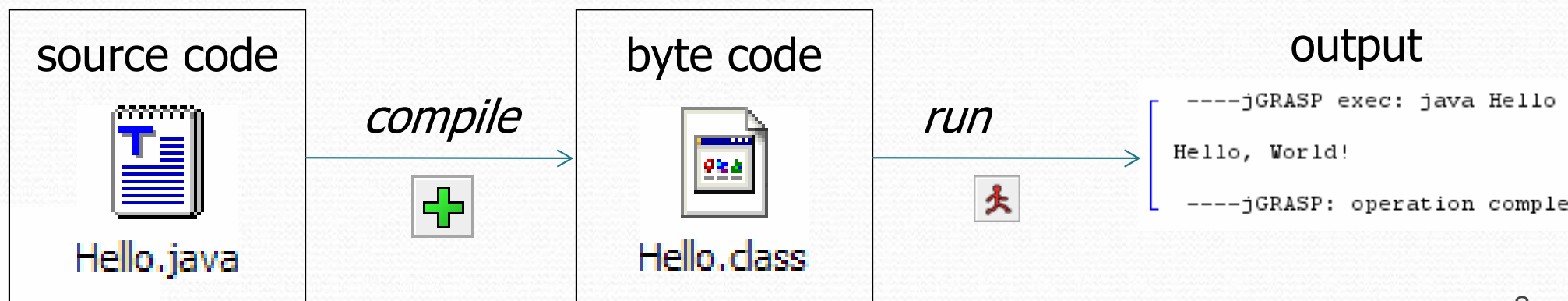
- **code** or **source code**: The set of instructions in a program.

2. Compile it.

- **compile**: Translate a program from one language to another.
- **byte code**: The Java compiler converts your code into a format named *byte code* that runs on many computer types.

3. Run (execute) it.

- **output**: The messages printed to the user by a program.



A Java program

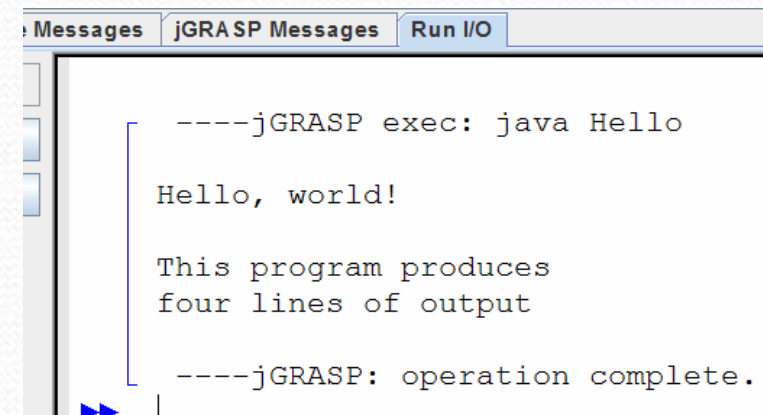
```
public class Hello {  
    public static void main(String[] args) {  
        System.out.println("Hello, world!");  
        System.out.println();  
        System.out.println("This program produces");  
        System.out.println("four lines of output");  
    }  
}
```

- Its output:

Hello, world!

This program produces
four lines of output

- **console:** Text box into which the program's output is printed.



The screenshot shows a console window with three tabs: "Messages", "jGRASP Messages", and "Run I/O". The "Run I/O" tab is active and displays the following output:

```
----jGRASP exec: java Hello  
  
Hello, world!  
  
This program produces  
four lines of output  
  
----jGRASP: operation complete.
```

Structure of a Java program

```
public class name {  
    public static void main(String[] args) {  
        statement;  
        statement;  
        ...  
        statement;  
    }  
}
```

class: a program

method: a named group
of statements

statement: a command to be executed

- Every executable Java program consists of a **class**,
 - that contains a **method** named `main`,
 - that contains the **statements** (commands) to be executed.

System.out.println

- A statement that prints a line of output on the console.
 - pronounced "print-linn"
 - sometimes called a "println statement" for short
- Two ways to use System.out.println :
 - `System.out.println("text");`
Prints the given message as output.
 - `System.out.println();`
Prints a blank line of output.

Names and identifiers

- You must give your program a name.

```
public class GangstaRap {
```

- Naming convention: capitalize each word (e.g. `MyClassName`)
- Your program's file must match exactly (`GangstaRap.java`)
 - includes capitalization (Java is "case-sensitive")
- **identifier**: A name given to an item in your program.
 - must start with a letter or `_` or `$`
 - subsequent characters can be any of those or a number
 - **legal**: `_myName` `TheCure` `ANSWER_IS_42` `$bling$`
 - **illegal**: `me+u` `49ers` `side-swipe` `Ph.D's`

Keywords

- **keyword:** An identifier that you cannot use because it already has a reserved meaning in Java.

abstract	default	if	private	this
boolean	do	implements	protected	throw
break	double	import	public	throws
byte	else	instanceof	return	transient
case	extends	int	short	try
catch	final	interface	static	void
char	finally	long	strictfp	volatile
class	float	native	super	while
const	for	new	switch	
continue	goto	package	synchronized	

Syntax

- **syntax:** The set of legal structures and commands that can be used in a particular language.
 - Every basic Java statement ends with a semicolon ;
 - The contents of a class or method occur between { and }
- **syntax error (compiler error):** A problem in the structure of a program that causes the compiler to fail.
 - Missing semicolon
 - Too many or too few { } braces
 - Illegal identifier for class name
 - Class and file names do not match
 - ...

Syntax error example

```
1 public class Hello {
2     pooblic static void main(String[] args) {
3         System.owt.println("Hello, world!")_
4     }
5 }
```

- **Compiler output:**

```
Hello.java:2: <identifier> expected
    pooblic static void main(String[] args) {
        ^
```

```
Hello.java:3: ';' expected
    }
    ^
```

2 errors

- The compiler shows the line number where it found the error.
- The error messages can be tough to understand!

Strings

- **string**: A sequence of characters to be printed.
 - Starts and ends with a " quote " character.
 - The quotes do not appear in the output.
 - Examples:

```
"hello"  
"This is a string.  It's very long!"
```
- Restrictions:
 - May not span multiple lines.

```
"This is not  
a legal String."
```
 - May not contain a " character.

```
"This is not a "legal" String either."
```


Escape sequences

- **escape sequence:** A special sequence of characters used to represent certain special characters in a string.

\t tab character
\n new line character
\\" quotation mark character
\\ backslash character

- **Example:**

```
System.out.println( "\\hello\nhow\tare \"you\"?\\\\\");
```

- **Output:**

```
\hello  
how       are "you"?\\
```

Questions

- What is the output of the following `println` statements?

```
System.out.println( "\ta\tb\tc" );
```

```
System.out.println( "\\\\" );
```

```
System.out.println( "'" );
```

```
System.out.println( "\"\"\"\"" );
```

```
System.out.println( "C:\nin\tthe downward spiral" );
```

- Write a `println` statement to produce this output:

```
/ \ // \\ /// \\\
```


Answers

- Output of each `println` statement:

```
      a      b      c
\\
'
" " "
C:
in      he downward spiral
```

- `println` statement to produce the line of output:

```
System.out.println("/ \\ // \\\\ /// \\\\\\\");
```

Questions

- What `println` statements will generate this output?

This program prints a quote from the Gettysburg Address.

```
"Four score and seven years ago,  
our 'fore fathers' brought forth on  
this continent a new nation."
```

- What `println` statements will generate this output?

A "quoted" String is 'much' better if you learn the rules of "escape sequences."

Also, "" represents an empty String.
Don't forget: use \" instead of " !
' is not the same as "

Answers

- `println` statements to generate the output:

```
System.out.println("This program prints a");  
System.out.println("quote from the Gettysburg Address.");  
System.out.println();  
System.out.println("\Four score and seven years ago,");  
System.out.println("our 'fore fathers' brought forth on");  
System.out.println("this continent a new nation.\");
```

- `println` statements to generate the output:

```
System.out.println("A \"quoted\" String is");  
System.out.println("'much' better if you learn");  
System.out.println("the rules of \"escape sequences.\");  
System.out.println();  
System.out.println("Also, \"\" represents an empty String.");  
System.out.println("Don't forget: use \"\" instead of \" !");  
System.out.println("' ' is not the same as \");
```