Computer Programming in Java
Bush School *CPJava Fall 2020*
Block D

Welcome to CPJava!
Start in Remote Schooling format
Follow in Hybrid format in Oct

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Teaching Math and CS

Introductions!

1. State your name - how would you like to be addressed?
2. Your personal pronoun?
3. What are your hobbies?
4. Say something interesting or peculiar about yourself
5. Do you have any exposure to programming?
6. What made you choose this course?
7. What are your expectations from this course?

A unique first course in programming with some advanced topics!

1. Visual and Project-based learning
2. Computing and the Web
3. Programming using Java
4. Simulate Natural Systems
5. Machine Learning
6. Develop Games
7. Learn Math & Physics Concepts
8. AP Exam preparation (optional)

Course Requirements

1. The CPJava course does not require you to have prior programming experience
2. Prerequisites include Algebra 1
3. For students wanting to take the AP CSA exam there will some extra assignments that will need to complete

21st Century Expectations for Learning

- Advanced Java Programming
- Object Oriented including inheritance
- How to make and maintain your own website
- Some basic HTML & CSS
- How to use GitHub
- Searching and sorting
- Recursion, Fractals
- Robust code design and style
- APCS A topics
- Code Vectors, Newton's Laws, Machine Learning etc
- + Fun stuff like Asteroids, Super Mario Games and Computer Art that they don't teach you in college!

- The complete 1-year coursework is online!
- We'll start at the top and work our way to the bottom through this course

You are here! Click here to access.
Bookmark this
You will need it every day!

Course Schedule

LESSON UNITS	APPROXIMATE DURATION	TOPICS
FALL 2020 SEMESTER	**13-Weeks**	**Sep to Dec 2020**
Unit 1	3-Weeks	Introduction to Java, Tools walkthrough, Classroom processes, Environment setup, Java Primitive types and Operators
Unit 2	2-Weeks	Objects, Methods, String, Integer, Double, Math
Unit 3	2-Weeks	Control flow, Booleans, If statements, Object traversals, String, Integer, Double, Math
Unit 4	3-Weeks	Iteration, While loops, For loops, Nested Loops, Loop Analysis
Unit 5	3-Weeks	Anatomy of a class, Constructor, Accessor, Mutator Methods, this keyword, Social Impact of CS
SPRING 2021 SEMESTER	**14-Weeks**	**Jan to May 2021**
Unit 6	3-Weeks	Arrays, Array Lists, Array Traversal, Final Exam or Project
Unit 7	3-Weeks	Searching Sorting Algorithms, Ethics of Data Collection, Privacy
Unit 8	2-Weeks	2D Arrays, Traversal
Unit 9	3-Weeks	Projects, Inheritance, Encapsulation, Hierarchy, Polymorphism
Unit 10	2-Weeks	Recursion, Recursive Search. Sort
Unit 11	1-Weeks	Final Exam or Project. Peer Sharing Final Project Presentation

A complete Syllabus is available at the CPJava Course Website

Grading Policy

Grades are cumulative for the full-year

Fall Semester

40% Projects

40% Classwork / Assignments

20% Student Portfolio

Spring Semester

TBD

Grading Policy

Points are assigned for:

Completing Exercises
Frequency of Code Updates
Submitting Program Assignments
Quizzes and Tests
Paired Programming
Professionalism & Integrity

AP CSA exam is on May 6th 2021
Talk to me if you are going to take it

How to succeed

Simply write lots and lots of Java code

Publish all of your work to the web (Github)

You cannot learn programming by reading or watching!

Make lots of mistakes - truly the best way to learn to code!

Working cooperatively with your peers - Pair Programming!

Don't be afraid to try new things!

Professionalism

- How you conduct yourself during your work
- Includes (but not limited to)
  - Phone and Zoom etiquette
  - Reliability and accountability
  - Ethics
  - Working cooperatively with your peers

Office Hours and Class Assistance

- Class Hours
  - Tues 9:00 - 10:10 Zoom Sync sessions
  - Tues 1:20 - 2:30 Zoom Sync sessions
- Wed Async
  - Not time specific - work individually
  - Wed Zoom Scheduler upon request
- 1-1 Conference and Office Hours
  - M-W-T-F 2:30 - 3:30 or Ad-hoc
  - Ad-Hoc Zoom Scheduler upon request
- Class Assistance
  - Mark Parrish is the TA for this class!
  - Contact us via Slack (preferred) or eMail

Tools/Resources for CPJava

Zoom - Live and Recorded Class Sessions

CPJava website - Lesson Plans and Projects

Bush Portal - Course Syllabus, Schedule and Grades

CPJava Google Classroom - Classroom code nnqro5m

Applications for Laptop

- Processing - Java Editor/Compiler
- Slack, Trinket, repl.it, Github
- See Instructions in Google Classroom

Runestone BUSHSCHOOL_CPJAVA Online course

- Online Textbook, Lessons, Exercises, Detailed Reference

System Requirements

An Internet connection

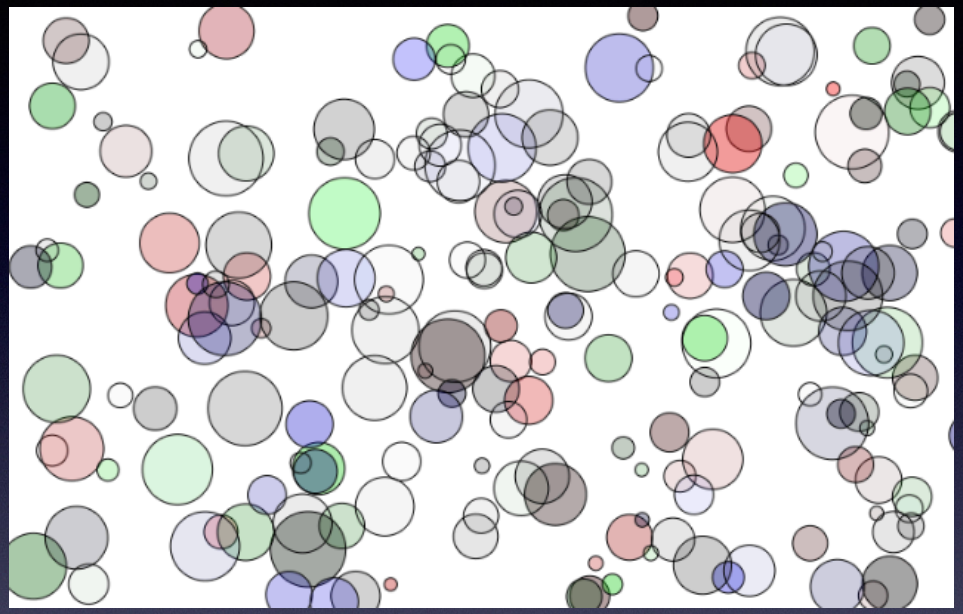
A robust wireless connection is preferred

A laptop Computer - Mac or Windows (Chromebook may not be adequate)

Sufficient disk space, a functioning laptop battery

Functioning Camera and Microphone - especially required for Paired Programming

Let’s run our first Java Program!



Bubbles - click to run the program

You can sort by color (key ’s’) and freeze each bubble by clicking on it

Can you freeze all the bubbles?

You will develop visual code like this in Java and much more!

Let's write our First Java Program!

Go to the Google Classroom (GCL)

- Complete Pre-Course pre-survey
- Install Processing - Java Editor/Compiler
- Write first Java code!

So we begin ....

Overview of Computer Science

What is computer science?

- 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

What is programming?

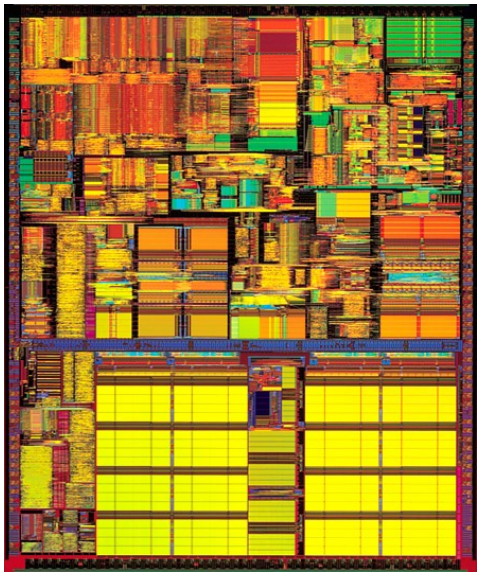
- **program**: A set of instructions to be carried out by a computer.

- **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.

Processors

- Computers are fast
  - Pentium 4 chip from 2001 can perform approximately 1,700,000,000(1.7 Ghz) computations per second
  - made up of 42,000,000 transistors (a switch that is on or off)
- Computers are dumb
  - They can only carry out a very limited set of instructions
    - on the order of 100 or so depending on the computer's processor
    - machine language instructions, aka instruction set architecture (ISA)
    - Add, Branch, Jump, Get Data, Get Instruction, Store



Neumann's Idea

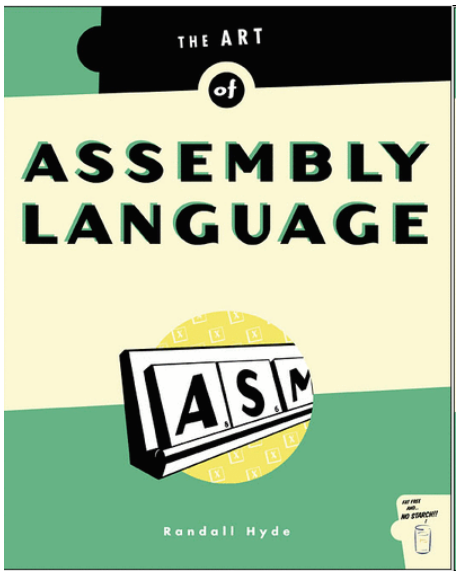
- John von Neumann - co-author of paper in 1946 with Arthur W. Burks and Hermann H. Goldstine,
  - "Preliminary Discussion of the Logical Design of an Electronic Computing Instrument"
- One of the key points
  - program commands and data stored as sequences of bits in the computer's memory
- A program:

```
1110001100000000
0101011011100000
0110100001000000
0000100000001000
0001011011000100
0001001001100001
0110100001000000
```

Low Level Programming

- Programming with Strings of bits (1s or 0s) is not the easiest thing in the world.
- Assembly language
  - mnemonics for machine language instructions

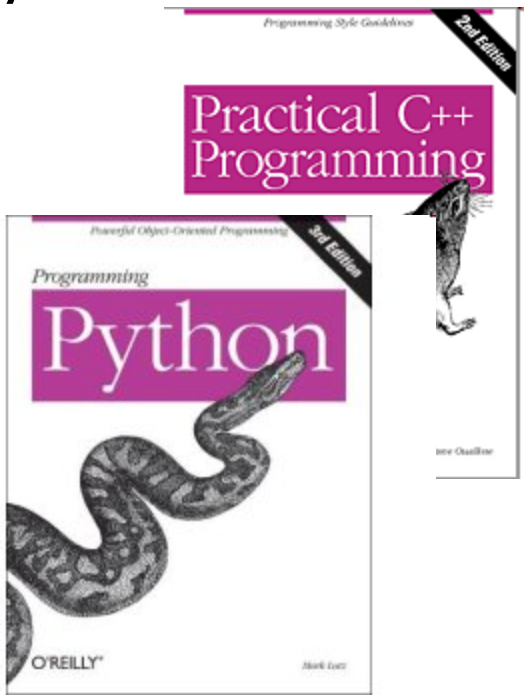
```
        .ORIG       x3001
        LD          R1, x3100
        AND         R3, R3 #0
        LD          R4, R1
        BRn         x3008
ADD             R3, R3, R4
        ADD         R1, R1, #1
LD              R4, R1
        BRnzp   x3003
```



High Level Programming

- Assembly language, still not so easy, and lots of commands to accomplish things
- High Level Computer Languages provide the ability to accomplish a lot with fewer commands than machine or assembly language in a way that is hopefully easier to understand:

```
int sum = 0;
int count = 1;
while(count <= 100){
    sum += count;
    count += 1;
}
```

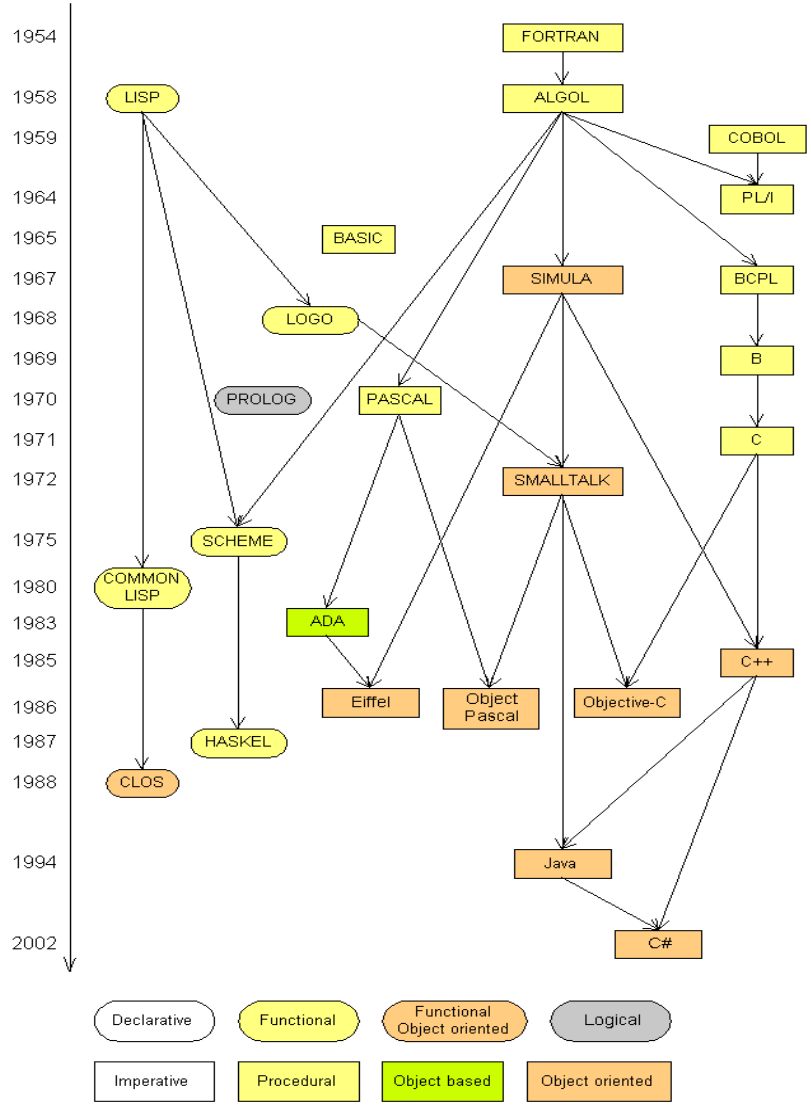


Programming Languages

- There are hundreds of high level computer languages. Java, C++, C, Basic, Fortran, Cobol, Lisp, Perl, Prolog, Eiffel, Python
- The capabilities of the languages vary widely, but they all need a way to do
  - declarative statements
  - conditional statements
  - iterative or repetitive statements
- A **compiler** is a program that converts commands in high level languages to machine language instructions

Programming languages

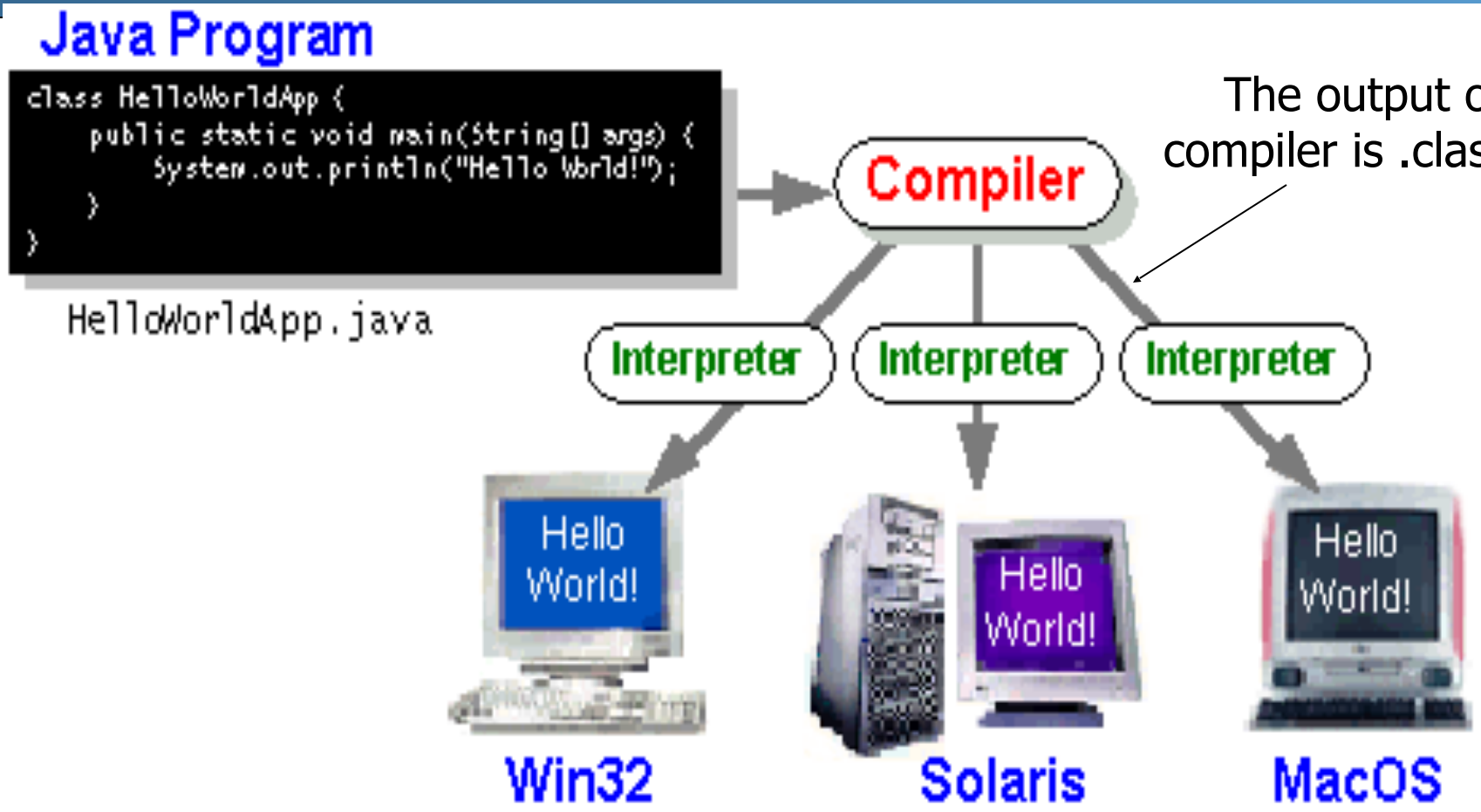
- Some influential ones:
  - FORTRAN
    - science / engineering
  - COBOL
    - business data
  - LISP
    - logic and AI
  - BASIC
    - a simple language



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

A Picture is Worth...



The Interpreter's are sometimes referred to as the Java Virtual Machines

Compile/run 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.
   - **interpreter**: A converts one instruction or line of code from one language to another and then executes that instruction

   When java programs are run the bytecode produced by the compiler is fed to an interpreter that converts it to machine code for a particular CPU.

Compile/run a program

3. Run (execute) it.
   - **output**: The messages printed to the user by a program.

Complete Exercises!

Access Intro Exercises in Google Classroom!

For the first 2 weeks you are working on:

1. Learn about Google Classroom
2. Intro Videos to Watch
3. Setup and Regn -Part 1
4. Java Basics - Four-Fours

References

1) CPJava Website
2) CPJava Google Classroom
3) CPJava repl.it Classroom
4) Runestone CSAwesome BUSHSCHOOL_CPJAVA Course
5) Building Java Programs: A Back to Basics Approach by Stuart Reges and Marty Stepp