Programming 1

Lecture 1 - Introduction
COP 3014 Fall 2021

August 25, 2021

Some More Course Policy

1. How to find your section number?
   - Your "section" depends upon your discussion session time. It is the attached to COP 3014 on your course schedule on myFSU, NOT the number on Canvas. We cross-list multiple section son Canvas and it shows only 1 of those numbers.
   - You can also find your section number on the syllabus. Match your Discussion Session's Time with your section.
2. How to find instructional staff for Help Sessions?
   - The instructor, TA and LA's have offices in the JJ Love building which is currently under renovation.
   - We will list temporary office locations and times on the course website once we have a full list of instructional staff, and send out a course announcement.
   - We will also announce in class and send out course announcements as people slowly move into their permanent offices upon completion of renovation.

Some More Course Policy

1. General Email Policy
   - The instructor, TA's and LA's are available through email.
   - When you send us email, please make sure you use an appropriate subject line.
   - If you need us to look at your code, please attach the source code file. No screenshots please.
   - Emails received before 5PM on business days will generally get a same day response. Emails received after 5PM will get a response (if required) on the next business day.
   - Most of us receive canvas Messages as a digest (all of them in one lot, once a week). So, Canvas messages might not get a very quick response. Please email us directly (from outlook).
2. Special Note for emailing the instructor
   - Please use Sharanya's CS email (jayarama@cs.fsu.edu) - preferred, or FSU work email (sjayaraman@fsu.edu). Simple looking it up on outlook might result in the email going to other people with similar names (there are at least 2 of them).
   - If you email goes to the wrong person, or Sharanya's student email, the response may be delayed.

Some More Course Policy

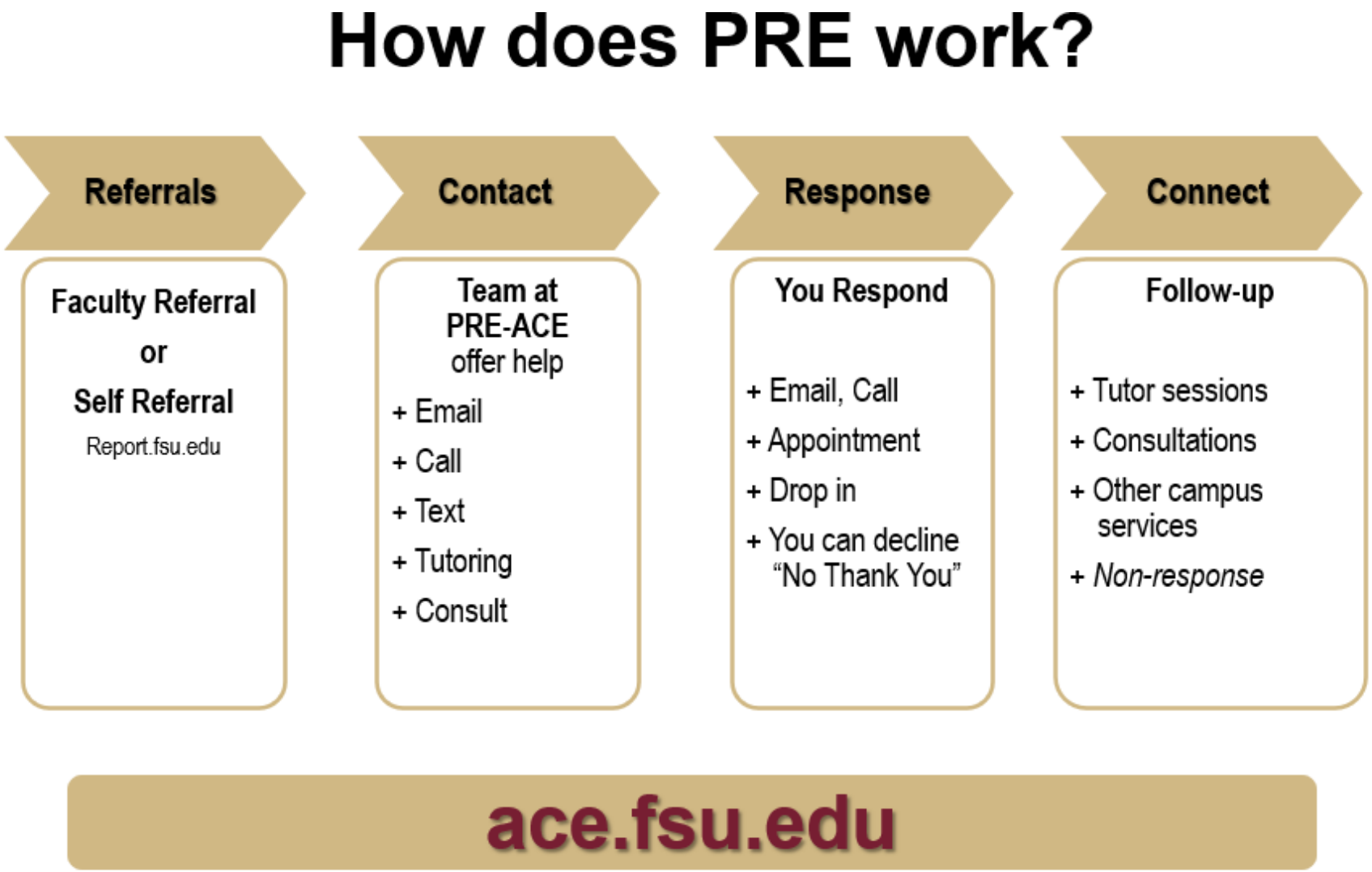
- The final grade is calculated on a weighted average based on percentages, as shown int he syllabus. All assessments are not the same in terms of points.
- The grade totals are hidden on Canvas, since Canvas overestimates ungraded assessments. If you wish for an accurate picture of your current standing, please request an Excel formula/file from the instructional staff.
- **Please read the course announcements sent out through Canvas**. They usually contain explanations regarding grades or assignments.
- **If we need to contact you individually, we will send email to your myFSU email.** Please check that regularly.

Some More Course Policy

This course is partnered with the Proactive Referral Engagement Program (PRE)

1. What is PRE?
   - Early support for students to achieve their academic goals
   - Provide supplemental course-based tutoring and other services
   - Prevent course failure, repeating course, or unnecessary drops/ withdrawals
2. Why?
   - We want you to succeed in this course!
   - You have the capacity to succeed in this course
   - Freely available services for you
   - Quality academic support by vetted tutors on campus and online
   - Private consultations about strategies to address personal challenges

Some More Course Policy



Some More Course Policy

Attendance Policy

- Attendance and Class Participation is required to do well in the course. **However, we're living through an exceptionally difficult time**
- **If you're ill, please stay at home, and let the instructor know**. We can make arrangements to make sure you're caught up with material.
- Please follow FSU guidelines and recommendations with respect to absences and safety protocols.
- This is a fairly large class. Please work with us in creating a safe and positive learning experience for everyone!

Programming is a Ubiquitous Discipline

- Why study Computer Programming?
- Computers are used in nearly every field. A basic understanding of how to effective use a computer is becoming essential in several disciplines.

What makes Computer Programming Different?

- Almost everyone uses a computer.
- The most common uses of computers include end-user-applications (Apps) that do not involve any modifications of the programs. These are "shipped" to the user as a finished product.
- Some applications are "tools". These allow some freedom to put the processing power of the computer to use data and some direction from the user to accomplish a task.
- For example, we can use Microsoft Excel or an ERP application to generate Reports. This involves some knowledge of what the underlying system/data is capable of doing.

What makes Computer Programming Different

- Computer Programming can be done on two levels.
- **Application Development** using mostly existing software products and libraries to put together a product for a specific area of use. This requires domain knowledge as well as a general understanding of Computer Science.
- **Software Development** using basic programming language constructs to develop the software and libraries used in Application Development. This requires deeper knowledge of Computer Science, including theory and hardware.
- Both of the above can be considered **Software Engineering**.

Main Components of a computer

- CPU - Central Processing Unit: The "brain" of the computer.
  - ISA - Instruction Set Architecture: the specific set of low-level instructions available to a CPU. Differs for various CPU types (Intel Pentium, Mac G4, etc).
- ALU - Arithmetic & Logic Unit responsible for performing arithmetic calculations, as well as logical operations (comparisons for equality, inequality, for instance).
- Main Memory (RAM - Random Access Memory).
  - storage close to CPU
  - Faster to access than hard disk
  - stores executing programs and data being currently worked on
- Secondary Memory
  - SSD, hard disk, DVD, etc.

Main Components of a computer

- Input devices
  - mouse, keyboard, scanner, network card, etc.
- Output devices
  - screen/console, printer, network card, etc.
- Operating System
  - Examples: Mac OS, Windows 10, Linux
  - Controls computer operations
  - Manages allocation of resources for currently running applications

Memory Concepts

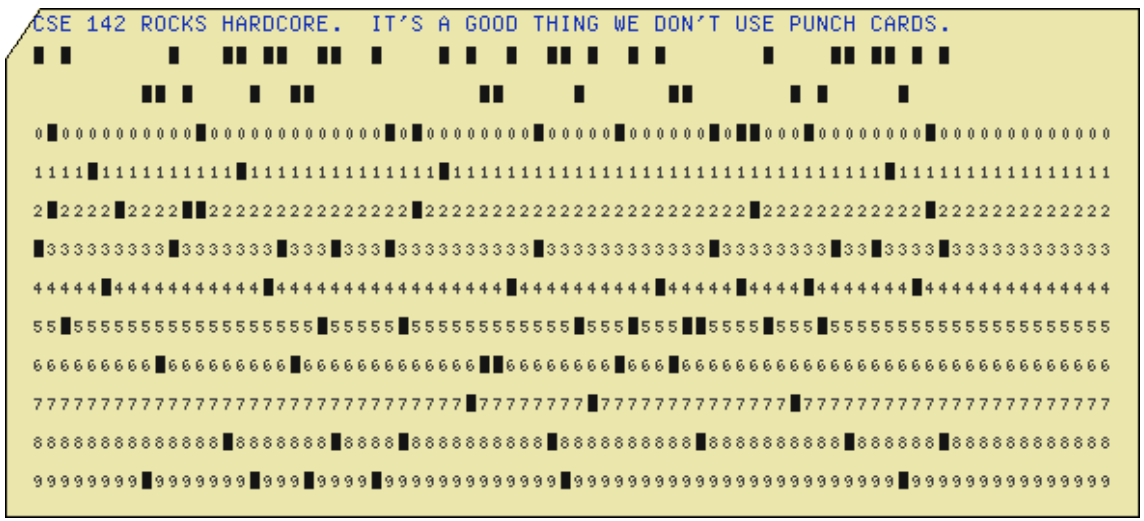
- bit: a binary digit
  - Stores the value 0 or 1
  - Smallest unit of storage in a computer
- byte: 8 bits
  - Smallest addressable unit of storage in a computer
  - Storage units (variables) in a program are 1 or more bytes
  - Each byte in memory has an address (a number that identifies the location)

Programming, and Programming Languages

Program - a set of instructions for a computer to execute

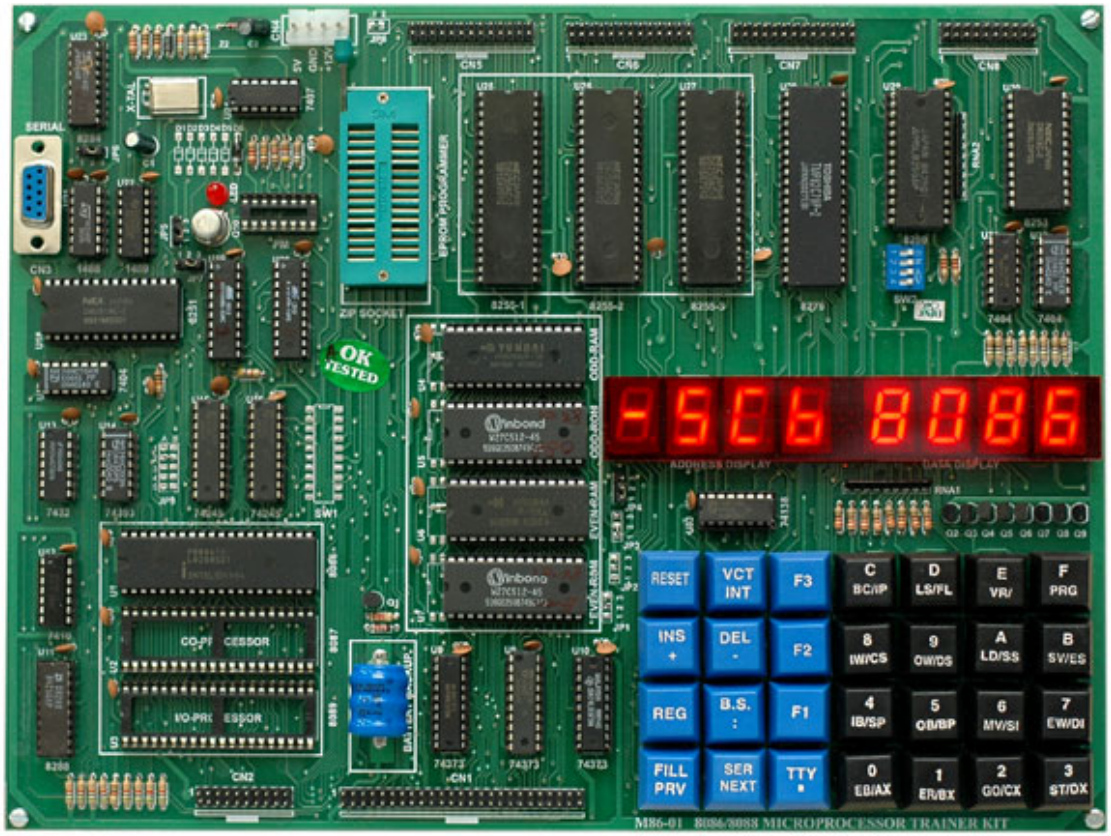
Evolution of Programming languages

- Machine Language
  - Based on machine's core instruction set
  - Needed by computer, hard for humans to read (1's and 0's)
  - Example: 11101101010101100011101010



Programming, and Programming Languages

- Assembly Language
  - translation of machine instructions to symbols, slightly easier for humans to read
  - Example: ADD $R1, $R2, $R3



Programming, and Programming Languages

- High-level procedural languages
  - Abstraction of concepts into more human-readable terms
  - Closer to "natural language" (i.e. what we speak)
  - Easy to write and design, but must be translated for computer
  - Examples include C, Pascal, Fortran
- Object-oriented languages
  - Abstraction taken farther than procedural languages
  - Objects model real-world objects, not only storing data (attributes), but having inherent behaviors (operations, functions)
  - Easier to design and write good, portable, maintainable code
  - Examples include Smalltalk, C++, Java

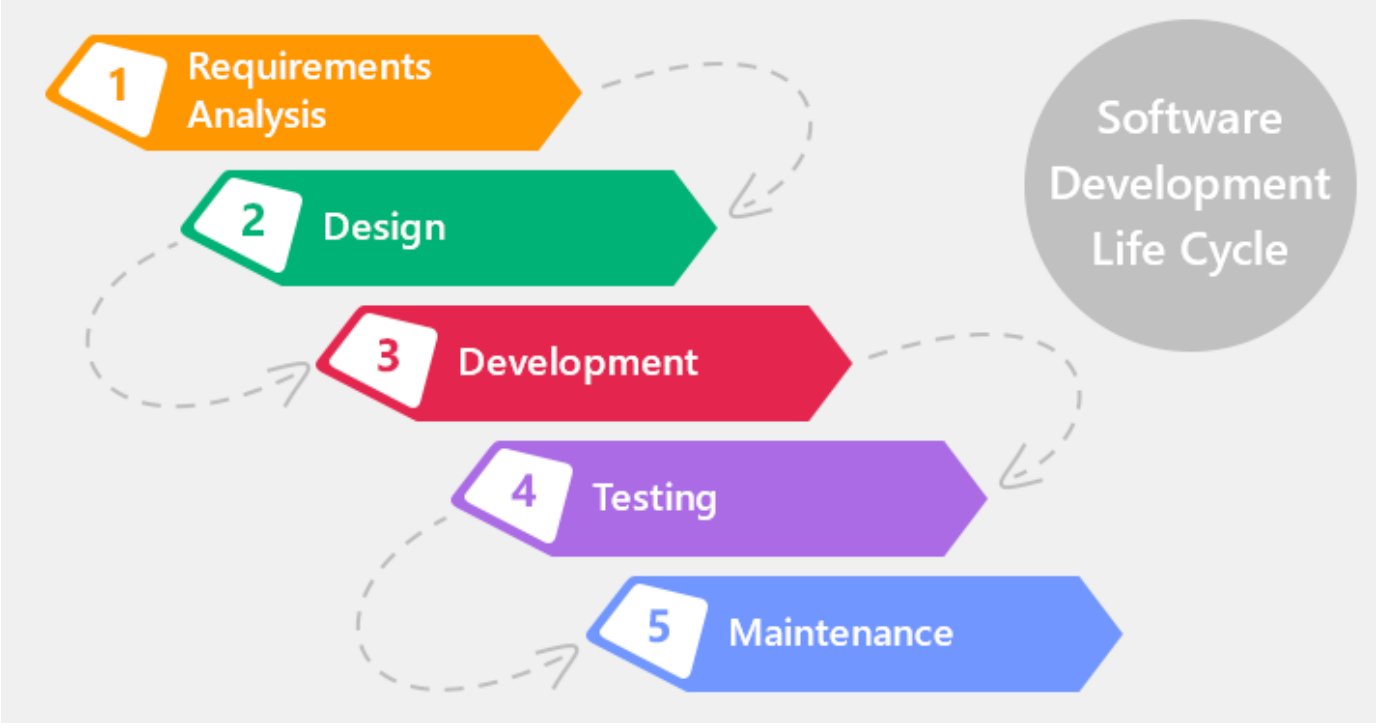
Code Translation

Bridging the gap between high-level code and machine code

- Interpreted languages – source code is directly run on an interpreter, a program that runs the code statements
- Compiled Languages
  - A compiler program translates source code (what the programmer writes) to machine language (object code)
  - A linker program puts various object code files together into an executable program (or other target type, like a DLL)
  - C and C++ are compiled languages

Software Development

Involves more than just writing code



Software Development

- Analysis and problem definition
- Design - includes design of program or system structure, algorithms, user-interfaces, and more
- Implementation (coding)
- Testing - can be done during design, during implementation, and after implementation
- Maintenance - usually the major cost of a software system. Not part of "development", but definitely part of the software life cycle

Programming is about Problem Solving

Programming is about Problem Solving

- Algorithm - a finite sequence of steps to perform a specific task
  - To solve a problem, you have to come up with the necessary step-by-step process before you can code it
  - This is often the trickiest part of programming
- Some useful tools and techniques for formulating an algorithm
  - Top-down Refinement: Decomposing a task into smaller and simpler steps, then breaking down each step into smaller steps, etc
  - Pseudocode: Writing algorithms informally in a mixture of natural language and general types of code statements
  - Flowcharting: If you can visualize it, it's often easier to follow and understand!

Programming is about Problem Solving

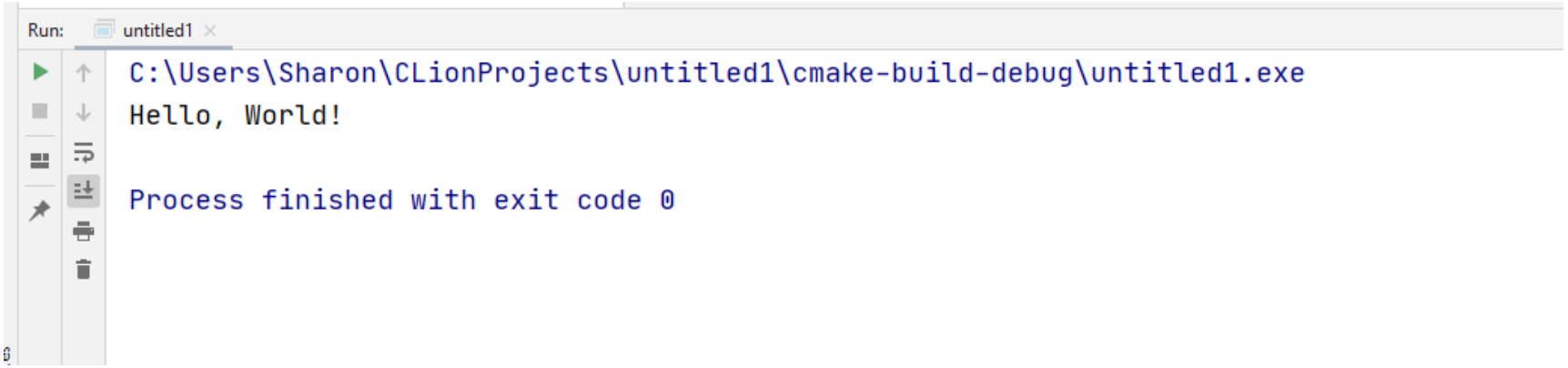
- Testing - algorithms must also be tested!
  - Does it do what is required?
  - Does it handle all possible situations?
- Syntax vs. Semantics
  - Syntax – the grammar of a language.
    A syntax error: "I is a programmer."
  - Semantics – the meaning of language constructs
    Correct syntax, but a semantic error: "The headphones ate the tree."

Basic Creation and Execution of a C++ program

- Create **source code** with a text editor, store to disk.
  - Source code is just a plain text file, usually given a filename extension to identify the programming language (like .c for C, or .cpp for C++)
- **Preprocessor** – Part of compiler process, performs any pre-processing tasks on source code.
- **Compilation** – syntax checking, creation of *object code.*
  - Object code is the machine code translation of the source code.
- **Linking** – Final stage of the creation of an executable program. Linking of object code files together with any necessary libraries (also already compiled).
- Execution of program
  - Program loaded into memory, usually RAM
  - CPU executes code instructions

Our First C++ Program

- Opening a New Project on CLion will create a default "Hello World" program.
- Most C++ programs start out with the same set of basic elements. We will cover these in the next lecture.
- Right now, click on the green "Run" button on the top right. Now look at the Window on the bottom. It should say "Hello, World!"



- All the phases mentioned in the previous slide were triggered by the "Run" button.