Week 1: Hello World!

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Muhao Chen

- Ph.D. Candidate in CS, UCLA (w/ Prof. Carlo Zaniolo) 2014-present
- B.S. in CS, Fudan Univ. 2014

Research interest
Neural language models, deep learning for NLP, knowledge bases

This is a picture of me *unsuccessfully* skiing.

About CS31

- Skills for programming using C++ (without data structures)
- Basic data type models
- Basic principles of memory allocation
- Basic knowledge of object-oriented programming

Outline

- Review
- How to compile programs
- Project 1

Review

- What is a program?
  - A **sequence of rules and instructions** that describe the logic of specific tasks to be processed by the computer.
    - To calculate some formulas, to train some machine learning models.
    - Operating systems, databases, compilers, network system …
    - Websites, games …

Review

- What is a programming language?

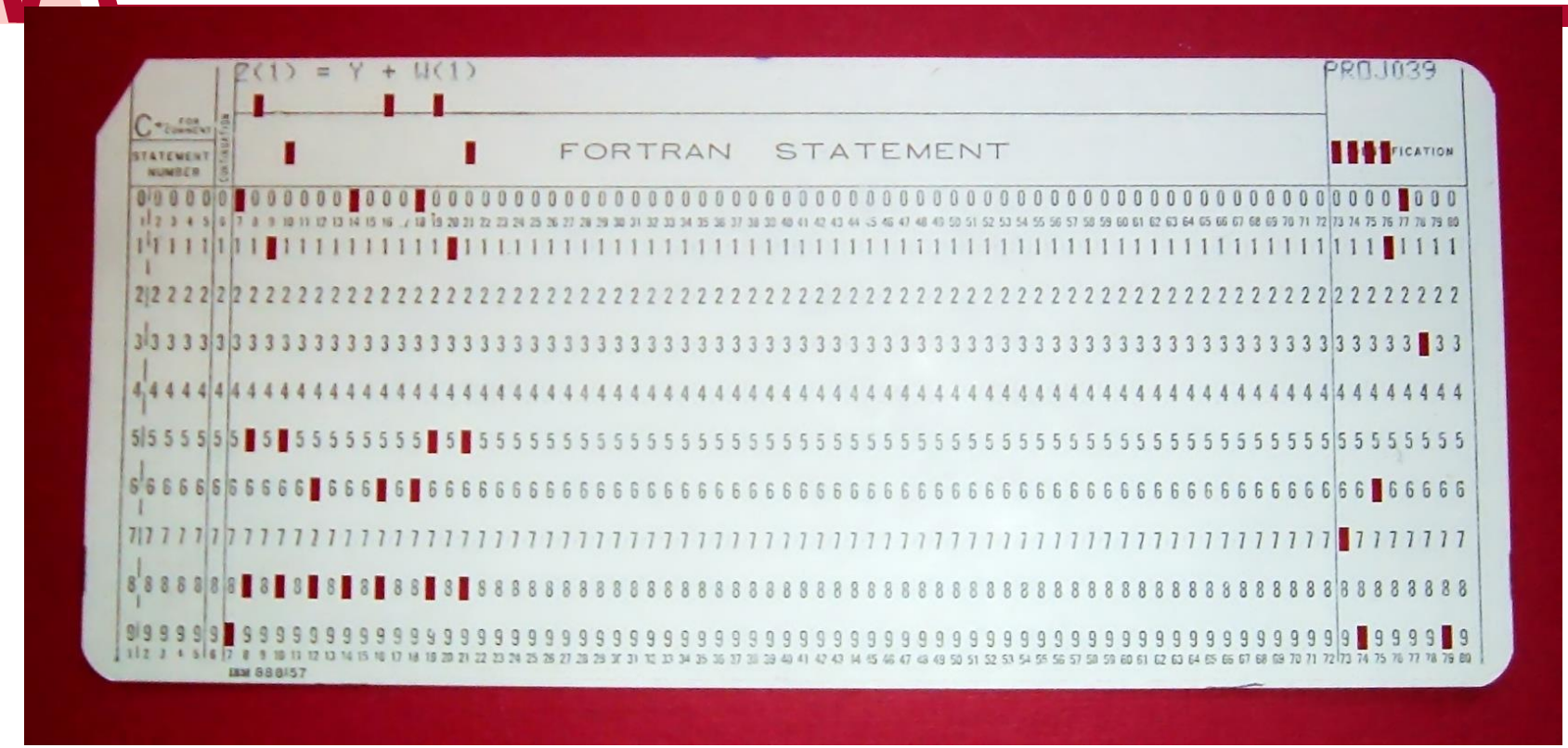
	Human Language	Programming Language	Machine Language
	English Spanish Italian ...	C C++ Java ...	binary numbers
for humans	easy	medium	difficult
for computers	difficult	medium	easy

- A language of medium difficulty to both us and computer. We use it to represent the procedural logic of instructions. Machines map it to machine language and execute the instructions.

Review

- Example
- In Human language:
  - Print out “Hello World!” on the screen.
- In a programming language:
  - cout << “Hello World!” << endl;
- In machine language:
  - 01011011111010101011010110 …

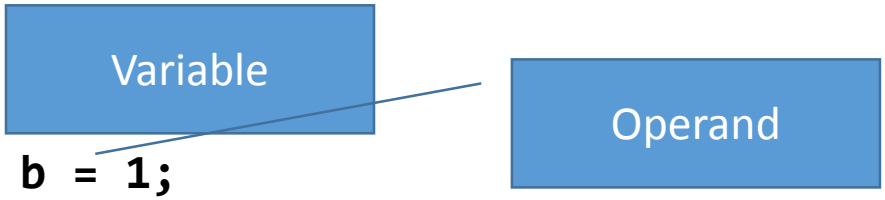
Compiler.
VC++, g++, etc



A punch card used in 1960s to program Fortran (the very early programming language which was extremely close to machine languages)

Compile a Program

```
#include <iostream>
using namespace std;

int main()
{
    int a = 1, b = 1;
    cout<< a + b << endl;
}
```



- Include the <iostream> library to use “cout”
- Use namespace std (standard)
  - Namespace is a collection of name definitions
  - A function name can be given different definitions in two namespaces
- endl – output a new line
- main() function: where the C++ program begins its logic.
- Note: it is case-sensitive in C++

Compilers

- Compiling with a Visual Studio (VC++)
  - Wysiwyg
  - ** (Choose win32/win64 console application when you create the project!)

- Compiling with g++
  - g++ -g source_code.cpp -o target
  - ./target

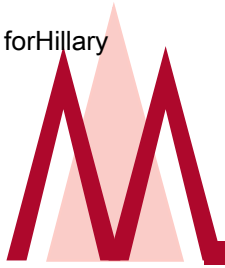
Errors

- What is a compile error?
  - Fails to compile.
  - Syntax errors, library errors, link errors, etc.
- What is a logical error?
  - Compiles successfully.
  - Program may run well / Or may crash (e.g. infinite loop, over-allocated memory, etc).
  - Gives incorrect results / undefined behaviors.

Project 1

- http://web.cs.ucla.edu/classes/fall17/cs31/

```
int main()
{
                int numSurveyed;
                int numApprove;
                int numDisapprove;

                cout << "How many people were surveyed? ";
                cin >> numSurveyed;
                cout << "How many of them approve of the way the president is handling his job? ";
                cin >> numApprove;
                cout << "How many of them disapprove of the way the president is handling his job? ";
                cin >> numDisapprove;

                double pctApprove = 100.0 * numApprove / numSurveyed;
                double pctDisapprove = 100.0 * numDisapprove / numSurveyed;

                cout.setf(ios::fixed);      // see pp. 32-33 in Savitch 6/e
                cout.precision(1);

                cout << endl;
                cout << pctApprove << "% say they approve." << endl;
                cout << pctDisapprove << "% say they disapprove." << endl;

                if (numApprove > numDisapprove)
                   cout << "More people approve than disapprove." << endl;
                else
                   cout << "More people disapprove than approve." << endl;
}
```



Project 1

- One thing we should pay attention to
  - In step 5, find input integer values that cause it to produce **incorrect**, **unusual**, or **nonsensical** results.
  - Is this to cause a compile error or a logical error?
  - Note: The variables numSurveyed, numApprove, and numDisapprove are **integer types**, so it is not the case to input floating type values like 12.3456.
  - What values should we input to trigger incorrect results?
  - Incorrect results: numSurveyed != numApprove + numDisapprove (e.g. 3000, 2000, 2000)

Unusual or nonsensical results?

Data types

Type	SIze
int (Integer)	4Bytes (=32bits) or 8Bytes (=64bits)
double (double precision float)	8Bytes (=64bits)
float (single precision float)	4Bytes (=32bits)

- long int, unsigned int, char, boolean …

int (suppose it's on a 32bits system)

- int: 4Bytes. Range: -2147483648~2147483647 (-2^{31}~2^{31}-1)

5 = 0 000 0000 0000 0000 0000 0000 0000 0101

Signed bit (S) Value bits (V)

-5 = 1 111 1111 1111 1111 1111 1111 1111 1011

If S = 0: Value = V
If S = 1. Value = V - 2^{31}

int a=2147483647; // 0 1111 … 1111, i.e. 2^{31} - 1
a += 1;

/// How much is a now?

Bit overflow

- A bit overflow occurs when an arithmetic operation attempts to create a numeric value that is **too large** to be represented within the available storage space.
- So just assign **99999999999999999999999999999999** also gives logic error.

Project 1

- The zip file you submit must follow the instructions **exactly**. (Pay attention to how to name each cpp file and your zip file!)
- Be careful about compile error and logical error.
- Projects submitted after the due time will receive **reduced or no credit**.

- (Something about David's projects)

Next week

- Data types and variables
- Operators
- Conditions
- Loops
- I/O

Thank you!