Jiangxi University of Science and Technology

Chapter02 Getting Started in C Programming

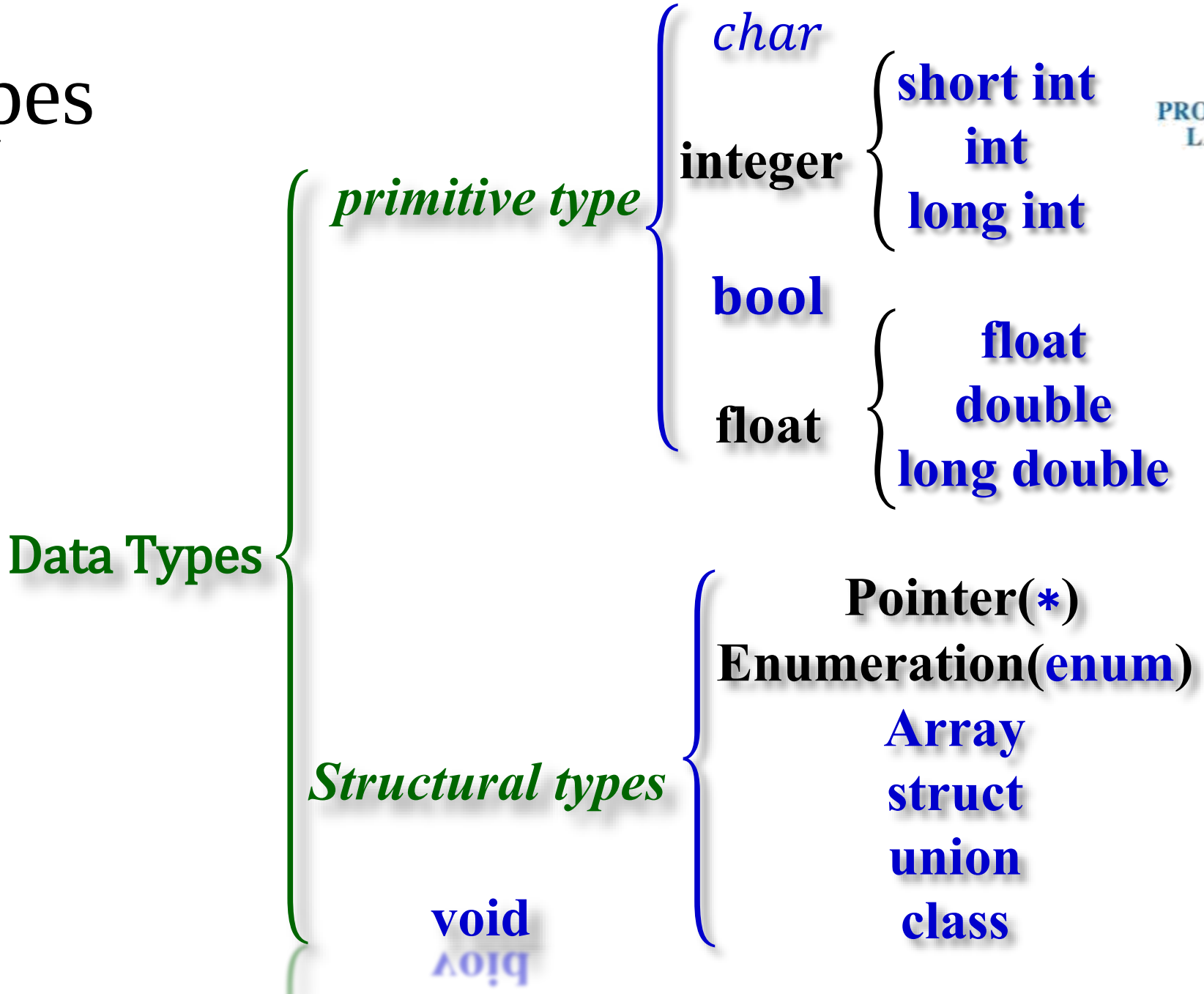
Lecture0202: Data type and Arithmetic Operations

2.3 Data Types

THE C PROGRAMMING LANGUAGE

- **Data type** (数据类型):
  - set of values and a set of operations that can be applied to these values
- **Built-in data type** (内置数据类型):
  - is provided as an integral part of the language; also known as **primitive type (原始类型)**

2.3 Data Types



3. Data Types

Data Types	Size	Range
[signed] int	4	$-2^{31} \le n \le 2^{31}-1$
unsigned [int]	4	$0 \le n \le 2^{32}-1$
short [int]	2	$-2^{15} \le n \le 2^{15}-1$
unsigned short [int]	2	$0 \le n \le 2^{16}-1$
long [int]	4	$-2^{31} \le n \le 2^{31}-1$
unsigned long [int]	4	$0 \le n \le 2^{32}-1$
[signed] char	1	$-2^{7} \le n \le 2^{7}-1$
unsigned char	1	$0 \le n \le 2^{8}-1$
float	4	$3.4\times10^{-38} \sim 3.4\times10^{38}$
double	8	$1.7\times10^{-308} \sim 1.7\times10^{308}$
long double	8	$1.7\times10^{-308} \sim 1.7\times10^{308}$

2.3 Data Types

THE C PROGRAMMING LANGUAGE

- **constant (常量)**
  - A **literal(字面常量)** is an acceptable value for a data type, Also called a **literal value** or **constant.**
  - **2**, **3.6**, **–8.2**, and **"Hello World!"** are literal values because they literally display their values

2.3 Data Types

THE C PROGRAMMING LANGUAGE

- **`int`** 整型: whole numbers (integers)
  - Decimal integer: 1357, -432, 0, 123**L**, 0**L**
  - Octal integer: **0**20;
  - hexadecimal integer: **0X**20, **0x**20;
- **`char`** 字符型: stores individual characters (ASCII)
  - For example: `'J', 'O', 'N', 'E','S'`

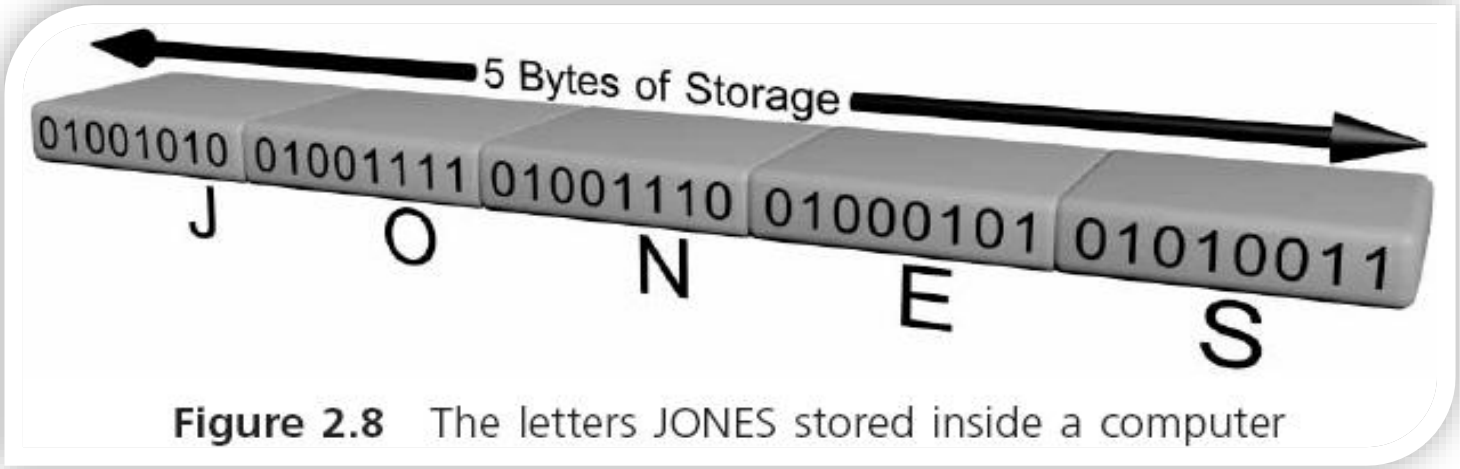


Figure 2.8 The letters JONES stored inside a computer

2.3 Data Types

THE C PROGRAMMING LANGUAGE

- ASCII and ANSI codes

ble 2.4 ASCII and ANSI Letter Codes

Letter	Code	Letter	Code	Letter	Code	Letter	Code
a	01100001	n	01101110	A	01000001	N	01001110
b	01100010	o	01101111	B	01000010	O	01001111
c	01100011	p	01110000	C	01000011	P	01010000
d	01100100	q	01110001	D	01000100	Q	01010001
e	01100101	r	01110010	E	01000101	R	01010010
f	01100110	s	01110011	F	01000110	S	01010011
g	01100111	t	01110100	G	01000111	T	01010100
h	01101000	u	01110101	H	01001000	U	01010101
i	01101001	v	01110110	I	01001001	V	01010110
j	01101010	w	01110111	J	01001010	W	01010111
k	01101011	x	01111000	K	01001011	X	01011000
l	01101100	y	01111001	L	01001100	Y	01011001
m	01101101	z	01111010	M	01001101	Z	01011010

2.3 Data Types

THE C PROGRAMMING LANGUAGE

➢ Escape Character (转义字符)

\n	New Line	**\r**	Carriage Return
\t	Tab	**\v**	Vertical Tab
\b	Backspace	**\a**	Alert
\'	Single quote	**\"**	Double Quote
****	Backslash	**\/**	Slash
\f	Form Feed	**\?**	Question mark

\nnn: ***nnn*** is Octal number, it represent the character whose ASCII code is ***nnn***.

\xhhh: ***xhhh*** is Hexadecimal number, it represent the character whose ASCII code is ***xhhh***.

\0 Null Character

2.3 Data Types

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- **Floating-Point Data Types** (浮点数据类型)
  - A **floating-point value** (**real number)** can be the number zero or any positive or negative number that contains a decimal point
  - `float`: **single-precision** number
  - `double`: **double-precision** number
  - `9.234` indicates a `double` literal
  - `9.234f` indicates a `float` literal
  - `9.234L` indicates a `long double` literal

2.3 Data Types

THE C PROGRAMMING LANGUAGE

- Exponential Notation (指数计数制)
  - In numerical theory, the term **precision** typically refers to **numerical accuracy**.

Table 2.7 Decimal Numbers Expressed in Exponential Notation

Decimal Notation	Exponential Notation
1625.	1.625e3
63421.	6.3421e4
.00731	7.31e-3
.000625	6.25e-4

2.4 Arithmetic Operations

THE C PROGRAMMING LANGUAGE

- **Arithmetic operators (算术运算符):**
  - Addition **+**
  - Subtraction **-**
  - Multiplication *****
  - Division **/**
  - Modulus Division **%**
  - **Binary operators (二元运算符)** require two operands
  - An **operand (操作数)** can be either a literal value or an identifier that has a value associated with it

2.4 Arithmetic Operations

THE C PROGRAMMING LANGUAGE

- Arithmetic Expression (算术表达式)
  - Any combination of arithmetic *operators* and *operands* that can be evaluated to yield a value
  - 3 + 7
  - 12.62 - 9.8
  - 0.08 * 12.2
  - 12.6 / 2

2.4 Arithmetic Operations

THE C PROGRAMMING LANGUAGE

- Displaying Numerical Values (显示数值)
  - **printf("The total of 6 and 15 is %d", 6+15);**
  - The string is termed a ***control string*** 控制字符串, %d is also called ***format specifier*** 格式说明符.
  - printf() ***replaces*** a ***format specifier*** in its control string with ***the value of the next argument***.
  - **printf ("The sum of %f and %f is %f", 12.2, 15.754, 12.2+15.754);**

Reference

- BOOK
- Some part of this PPT given by Prof 区 **Chengtian Ouyang)**
- with special thank
- https://www.codingunit.com/c-tutorial hello-world