Intro. Computing with the C Programming Language

Variables and Types

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Values

- Computer programs operate on values stored in memory
- There are different types of values which are written in different forms
  - string
  - character
  - integer number
  - real number

- A value is given to an argument at a function call, or assigned to a variable

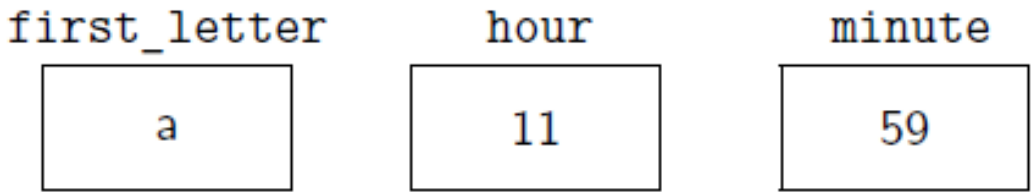
Variables

- A variable is a named memory location where a value is stored and updated
  - a variable name must be given as a word
- A variable must be declared with a type
  - a type defines the kind of values that the variable can hold
  - a variable declaration statement consists of a variable name and type
- A variable can be assigned with a value of the same type

Assignment

- an assignment statement is a command to store a value to a variable
  - a variable at the left-hand side indicates the storage location
  - a variable at the right-hand side represents the value contained in the variable

```
first_letter = 'a';   /* give first_letter the value 'a' */
hour = 11;            /* assign the value 11 to hour */
minute = 59;          /* set minute to 59 */
```



Variable Name

- most of words can be used as a variable name, except reserved keywords

Reserved keywords in the C language

auto	double	inline	sizeof	volatile
break	else	int	static	while
case	enum	long	struct	_Bool
char	extern	register	switch	_Complex
const	float	restrict	typedef	_Imaginary
continue	for	return	union	
default	goto	short	unsigned	
do	if	signed	void	

Operators

- Operators involves mathematical computations like addition and multiplication

```
1+1        hour-1        hour*60+minute      minute/60
```

- An expression is a combination of variables, values and operators, that defines a value

```
int hour, minute;
hour = 11;
minute = 59;
printf ("Number of minutes since midnight: %i\n", hour*60 + minute);
printf ("Fraction of the hour that has passed: %i\n", minute/60);

printf ("Percentage of the hour that has passed: ");
printf ("%i\n", minute*100/60);
```

Operators for characters

- In C, a character is represented as a single-quoted letter, or an integer between 0 and 255

- a character can be applied to an arithmetic operator

Composition

- We can compose an expression by connecting values and variables with operators in a nested manner
  - examples
    - (2 + 3) * 5
    - 2 + 3 * 5
    - 2 / 3 – 1

- When more than one operator appears in an expression, the order of evaluation depends on the rules of precedence.
  - e.g., multiplication happens before addition and subtraction
    if operators have the same precedence, they are evaluated from left

Floating-point Type

- Two floating-point types of real numbers: `float` and `double`

- Typecasting a double value to an integer rounds down the value
  - an integer value can be typecasted to a double without loosing any information

- The math library provides a set of built-in functions
  - log()
  - sin()
  - cos()