

# EECS 10: Computational Methods in Electrical and Computer Engineering

## Lecture 7

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## Lecture 7: Overview

- Warm-up Quiz
- Comparison of Values
  - Relational Operators
  - Logical Operators
  - Conditional Operator
- Conditional Statements
  - `if` statement
- Conditional Programming
  - Example `comparison.c`

## Quiz: Question 11

- What is the value of the integer  $x$  after the following statement?


```
x = 3 << 2 >> 1;
```

- a) **Syntax Error!**
- b) 3
- c) 6
- d) 12
- e) 321

## Quiz: Question 11

- What is the value of the integer  $x$  after the following statement?

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x = 3 << 2 >> 1;
```

- a) Syntax Error!
- b) 3
-  c) 6
- d) 12
- e) 321

## Quiz: Question 12




- Which of the following constants is of type **double**?  
(Check all that apply!)
  - a) **42**
  - b) **.42**
  - c) **4e2**
  - d) **4E2**
  - e) **42f**

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## Quiz: Question 12

- Which of the following constants is of type **double**?  
(Check all that apply!)
  - a) 42
  -  b) **.42**
  -  c) **4e2**
  -  d) **4E2**
  - e) 42f

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### Quiz: Question 13

- What is the result type of the following expression?

```
-1 + 2.3f * (4.5 / 67f) - (short)89
```

- a) `short int`
- b) `int`
- c) `long int`
- d) `float`
- e) `double`

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### Quiz: Question 13

- What is the result type of the following expression?

```
-1 + 2.3f * (4.5 / 67f) - (short)89
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- c) `long int`
- d) `float`
-  e) `double`

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## Quiz: Question 14

- What is the value of  $x$  after the following code segment?


```
int    i = 10;  
double d = 0.5;  
double x;  
  
x = i/3 + d;
```

- a) 0.333333
- b) 3.0
- c) 3.333333
- d) 3.5
- e) 3.833333

## Quiz: Question 14

- What is the value of  $x$  after the following code segment?

```
int    i = 10;  
double d = 0.5;  
double x;  
  
x = i/3 + d;
```

- a) 0.333333
- b) 3.0
- c) 3.333333
-  d) 3.5
- e) 3.833333

## Quiz: Question 15

- Given the following code fragment,

```
double x;
double y;

x = (int)(y + 0.5);
```

which of the following statements is true?  
(Check all that apply!)

- a) for  $y=5.0$ ,  $x$  is set to 5.0
- b) for  $y=5.1$ ,  $x$  is set to 5.0
- c) for  $y=5.49$ ,  $x$  is set to 5.0
- d) for  $y=5.5$ ,  $x$  is set to 6.0
- e) for  $y=5.95$ ,  $x$  is set to 6.0

## Quiz: Question 15

- Given the following code fragment,

```
double x;
double y;

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```

which of the following statements is true?  
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- d) for  $y=5.5$ ,  $x$  is set to 6.0
- e) for  $y=5.95$ ,  $x$  is set to 6.0

## Comparison of Values

- Relational Operators
  - direct comparison of two values
  - Boolean result: truth value, true or false
- Logical Operators
  - Operations on Boolean values
- Conditional Operator
  - Conditional evaluation of expressions

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## Relational Operators

- Comparison operations
  - `<` less than
  - `>` greater than
  - `<=` less than or equal to
  - `>=` greater than or equal to
  - `==` equal to (remember, `=` means assignment!)
  - `!=` not equal to
- Comparison is defined for all basic types
  - integer (e.g. `5 < 6`)
  - floating point (e.g. `7.0 < 7e1`)
- Result type is Boolean, but represented as integer
  - false 0
  - true 1 (or any other value *not* equal to zero)

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## Logical Operators

- Operation on Boolean/truth values

- ! "not" logical negation
- && "and" logical and
- || "or" logical or

- Truth table:

x	y	!x	x && y	x    y
0	0	1	0	0
0	1	1	0	1
1	0	0	0	1
1	1	0	1	1

- Argument and result types are Boolean, but represented as integer

- false 0
- true 1 (or any other value *not* equal to zero)

## Conditional Operator

- Conditional evaluation of values in expressions

- Question-mark operator:

***test ? true-value : false-value***

- evaluates the *test*
- if *test* is true, then the result is *true-value*
- otherwise, the result is *false-value*

- Examples:

- $(4 < 5) ? (42) : (4+8)$  evaluates to 42
- $(2==1+2) ? (x) : (y)$  evaluates to *y*
- $(x < 0) ? (-x) : (x)$  evaluates to **abs(x)**



## Operator Evaluation Order

- Associativity: left to right or right to left
- Precedence: group-wise, top to bottom
 

– parentheses	( , )	n/a
– unary plus, minus, negation	+, -, !	right to left
– type casting	( <i>typename</i> )	right to left
– multiplication, division, modulo	*, /, %	left to right
– addition, subtraction	+, -	left to right
– shift left, shift right	<<, >>	left to right
– relational operators	<, <=, >=, >	left to right
– equality	==, !=	left to right
– logical and	&&	left to right
– logical or		left to right
– conditional operator	?:	left to right
– assignment operator	=	right to left

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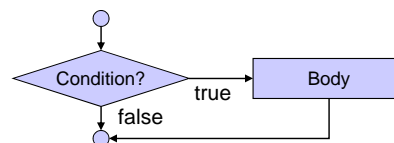
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## Conditional Statements

- **if** statement
  - Control flow statement for decision making
    - Changes control flow depending on a specified condition

- Control flow chart:



- Semantics:
  - Body is executed *only if* the condition evaluates to true

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## Conditional Statements

- **if** statement
  - Control flow statement for decision making
    - Changes control flow depending on a specified condition
  - Example:
    - `if (x < 0)`  
 { `printf("%d is negative", x);` }
    - `if (x >= 0)`  
 { `printf("%d is positive", x);` }
  - Syntax: `if` construct consists of
    - Keyword     `if`
    - Condition   expression evaluated to true or false
    - Body        statement block

## Example Program

- Comparison of values: `Comparison.c` (part 1/3)

```

/* Comparison.c: arithmetic comparisons          */
/*                                              */
/* author: Rainer Doemer                      */
/*                                              */
/* modifications:                             */
/* 10/07/04 RD initial version                 */
/*                                              */

#include <stdio.h>

/* main function */

int main(void)
{
  /* variable definitions */
  int a, b;

  ...

```

## Example Program

- Comparison of values: `Comparison.c` (part 2/3)

```

...
/* input section */
printf("Please enter a value for integer a: ");
scanf("%d", &a);
printf("Please enter a value for integer b: ");
scanf("%d", &b);

/* computation and output section */
if (a == b)
{ printf("%d is equal to %d.\n", a, b);
  } /* fi */
if (a != b)
{ printf("%d is not equal to %d.\n", a, b);
  } /* fi */
if (a < b)
{ printf("%d is less than %d.\n", a, b);
  } /* fi */
...

```

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## Example Program

- Comparison of values: `Comparison.c` (part 3/3)

```

...
if (a > b)
{ printf("%d is greater than %d.\n", a, b);
  } /* fi */
if (a <= b)
{ printf("%d is less than or equal to %d.\n", a, b);
  } /* fi */
if (a >= b)
{ printf("%d is greater than or equal to %d.\n", a, b);
  } /* fi */

/* exit */
return 0;
} /* end of main */

/* EOF */

```

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## Example Program

- Example session: `Comparison.c`

```
% vi Comparison.c
% gcc -Wall -ansi Comparison.c -o Comparison
% Comparison
Please enter a value for integer a: 42
Please enter a value for integer b: 56
42 is not equal to 56.
42 is less than 56.
42 is less than or equal to 56.
% Comparison
Please enter a value for integer a: 6
Please enter a value for integer b: 6
6 is equal to 6.
6 is less than or equal to 6.
6 is greater than or equal to 6.
% Comparison
Please enter a value for integer a: 77
Please enter a value for integer b: 6
77 is not equal to 6.
...
```