Programming with C I

Fangtian Zhong
CSCI 112

Gianforte School of Computing
Norm Asbjornson College of Engineering
E-mail: fangtian.zhong@montana.edu

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Objectives

- To learn how to use the relational, equality, and logical operators to write expressions that are true or false.
- To learn how to write selection statements that choose between two alternatives in a program using the if statement.

Conditions

- **an expression that is either false**
  - represented by 0
- **or true**
  - usually represented by 1

```
rest_heart_rate > 75
```

Relational and Equality Operators

Operator	Meaning	Type
<	less than	relational
>	greater than	relational
<=	less than or equal to	relational
>=	greater than or equal to	relational
==	equal to	equality
!=	not equal to	equality

Logical Operators

logical expressions

- an expression that uses one or more of the logical operators
  - && (and)
  - || (or)
  - ! (not)

Logical Operators

logical complement (negation)

- the complement of a condition had the value 1 (true) when the condition's value is 0 (false)
- the complement of a condition has the value 0 (false) when the condition's value is nonzero (true)

```
! (0 <= n && n <= 100)
```

Operator Precedence

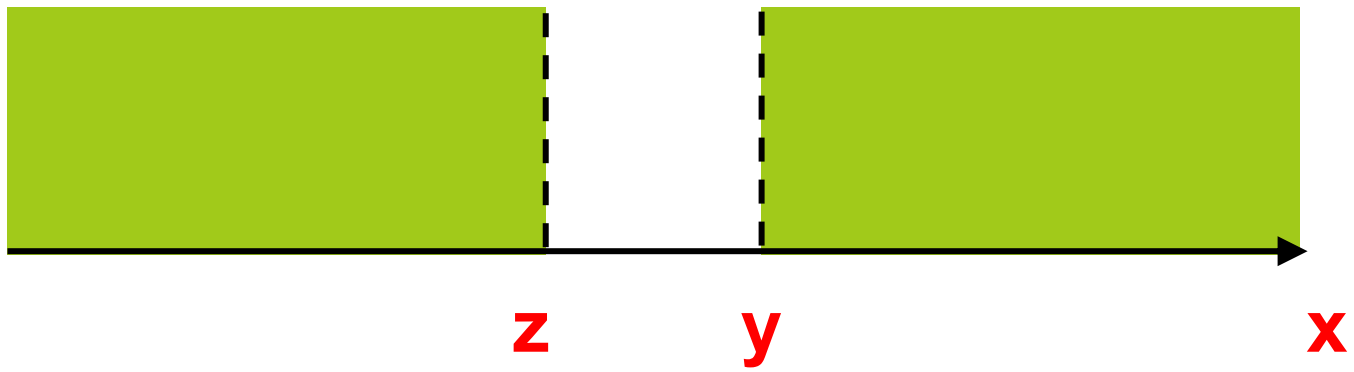
Operator	Precedence
function calls	highest (evaluated first)
! + - & (unary operator)	
* / %	
+ -	
< <= >= >	
== !=	
&&	
||	
=	lowest (evaluated last)

Figure

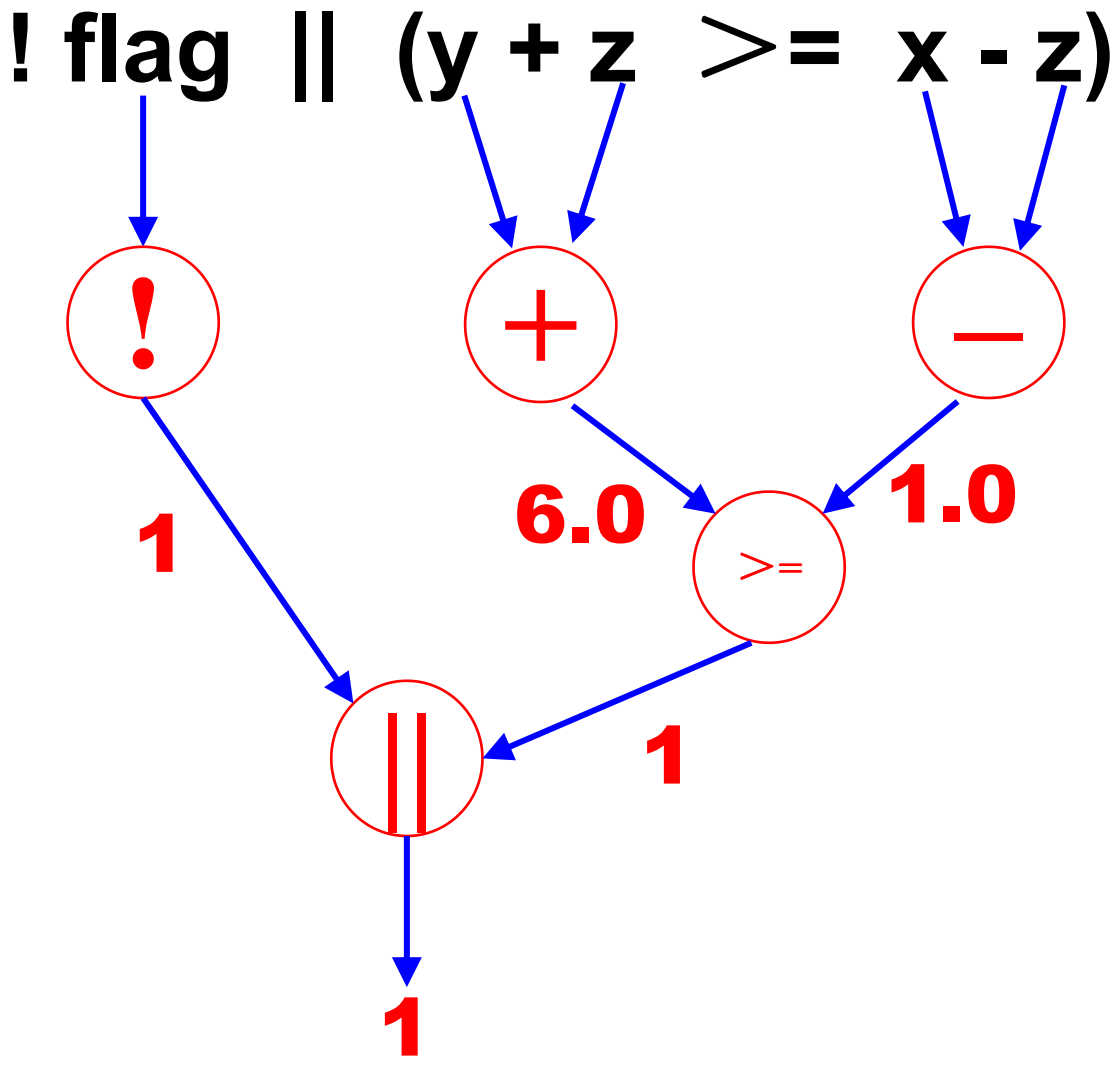
Range of True Values for min <= x && x <= max

Figure

Range of True Values for z > x || x > y



Evaluation Tree and Step-by-Step Evaluation for !flag || (y + z >= x - z)



flag	y	z	x
0	4.0	2.0	3.0

! flag || (y + z >= x - z)

0 4.0 2.0 3.0 2.0

1 6.0 1.0

1

1

Short-Circuit Evaluation

- stopping evaluation of a logical expression as soon as its value can be determined

```
(div != 0 && (num % div == 0))
```

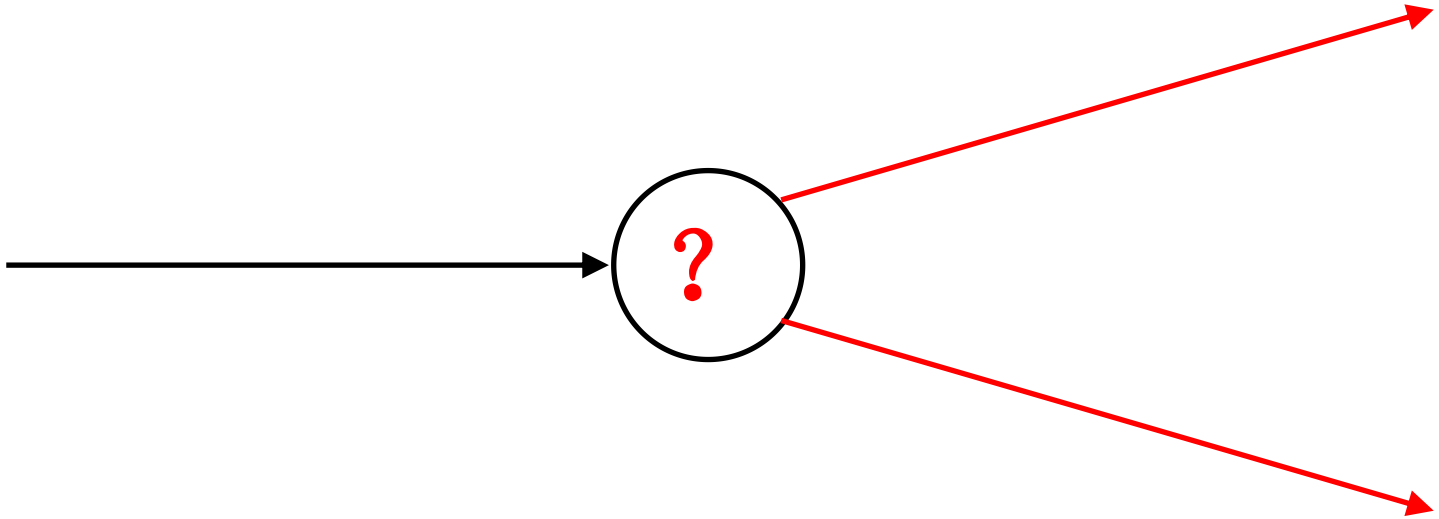
Comparing Characters

Expression	Value
‘9’ >= ‘0’	1 (true)
‘a’ < ‘e’	1 (true)
‘B’ <= ‘A’	0 (false)
‘Z’ == ‘z’	0 (false)
‘a’ <= ‘A’	System dependent
‘a’ <= ch && ch <= ‘z’	1 (true) if ch is a lowercase letter

Control Structures

selection control structure

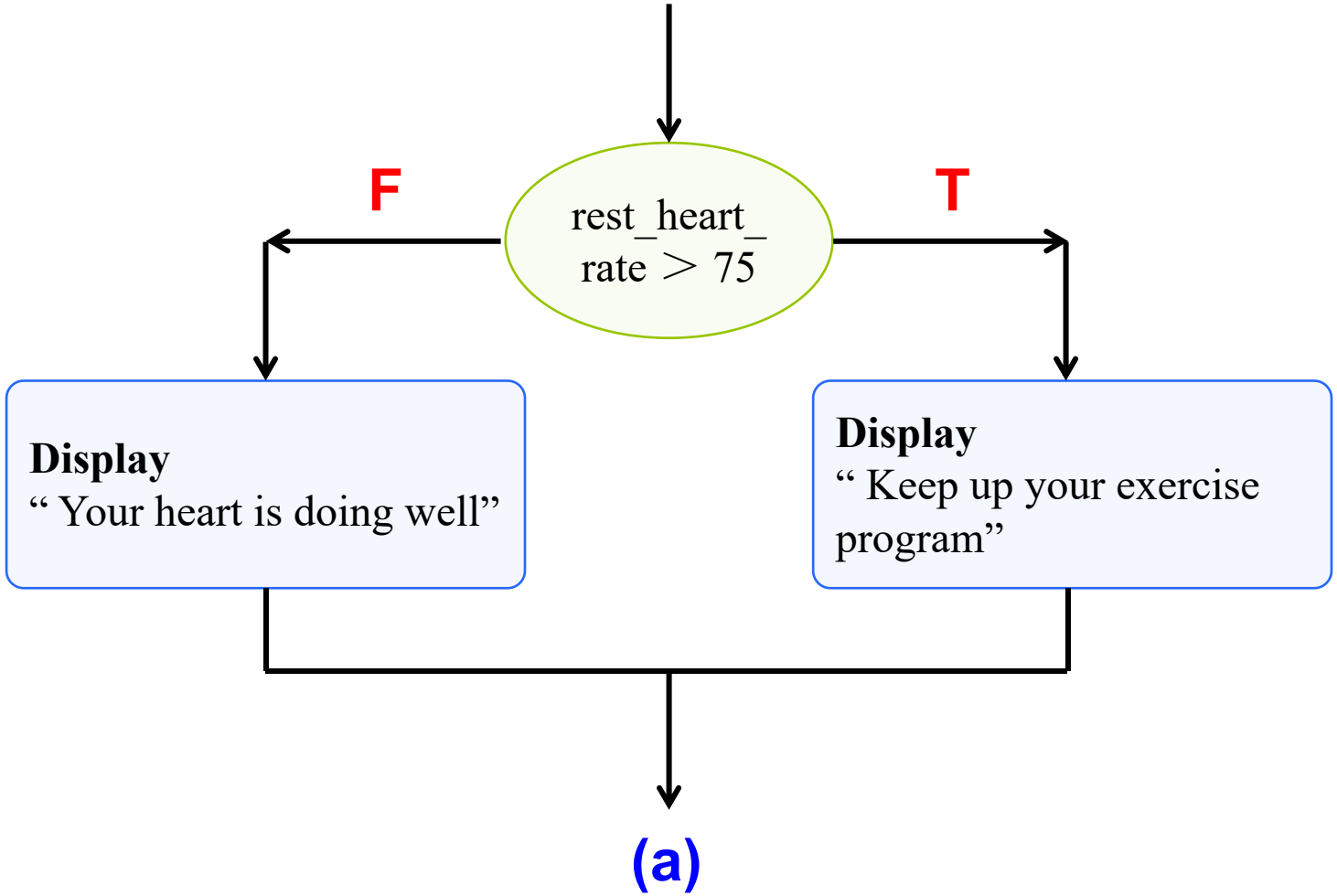
- a control structure that chooses among alternative program statements

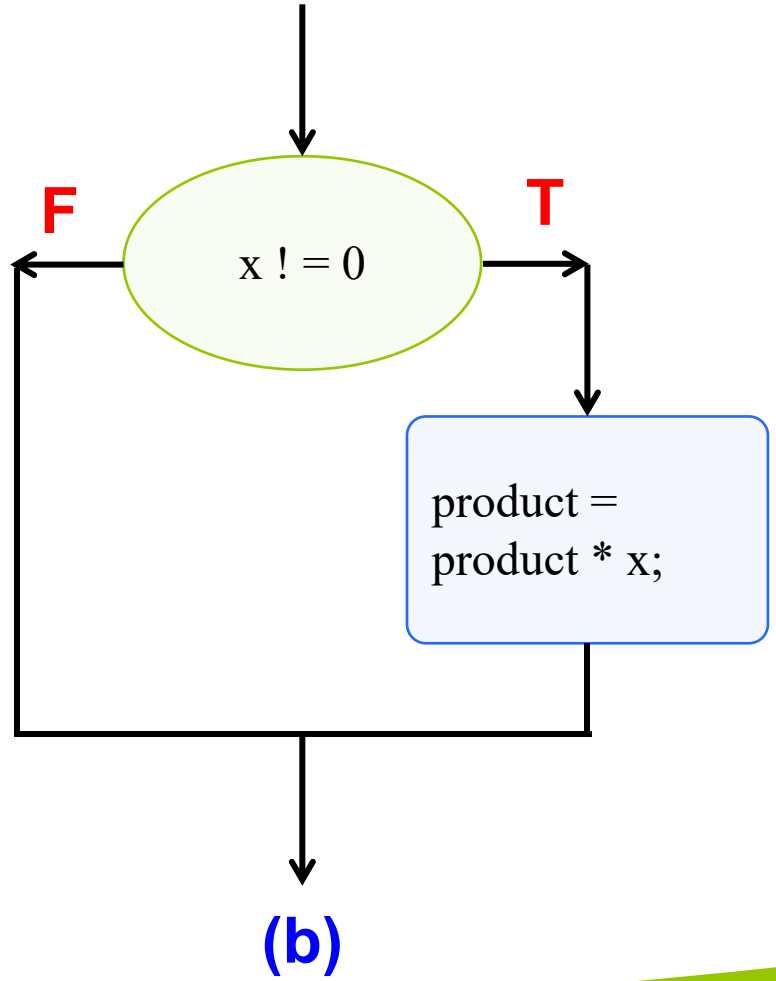


The if-statement

making decisions

Figure Flowcharts of if Statements with (a) Two Alternatives and (b) One Alternative





if-statement with one alternative

```
if (x != 0)
        product = product * x;
```

if-statement with two alternatives

```
if (rest_heart_rate > 75)
        printf( “Keep up your exercise program!\n” );
else
        printf( “Your heart is doing well!\n” );
```

Figure Program Using an if statement for selection

```
/*
 * Displays message about heart rate.
 */
#include <stdio.h>

int main(void)
{
        int pulse;                  /* resting pulse rate for 10 secs */
        int rest_heart_rate;        /*  resting heart rate for 1 minute */

        /* Enter your resting pulse rate */
        printf("Take your resting pulse for 10 seconds. \n");
        printf("Enter your pulse rate and press return>");
        scanf("%d", &pulse);

        /* Calculate resting heart rate for minute */
        rest_heart_rate = pulse * 6
        printf("Your resting heart rate is %d.\n", rest_heart_rate);
        /* Display message based on resting heart rate */
       if (rest_heart_rate > 56)
          printf("Keep up your exercise program!\n");
       else
          printf("Your heart is in excellent health!\n");

        return (0);
}
```

(continued)

Figure Program Using an if statement for selection

Sample Run 1

```
Take your resting pulse for 10 seconds.
Enter your pulse rate and press return> 12
Your resting heart rate is 72.
Keep up your exercise program!
```

Sample Run 2

```
Take your resting pulse for 10 seconds.
Enter your pulse rate and press return> 9
Your resting heart rate is 54.
Your heart is in excellent health!
```

THE END

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