Programming with C I

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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.

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
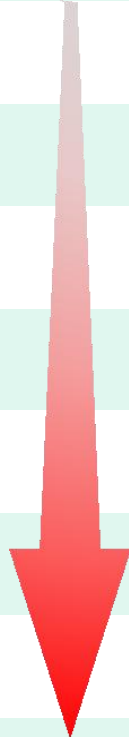 - ➢ && (and)
  - ➢ || (or)
  - ➢ ! (not)

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)

$$! (0 <= n \text{ \&\& } n <= 100)$$

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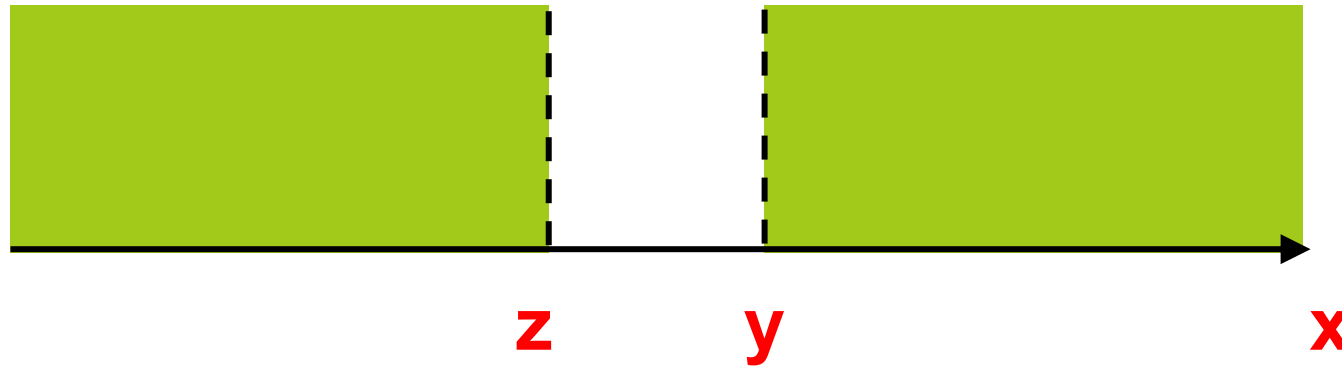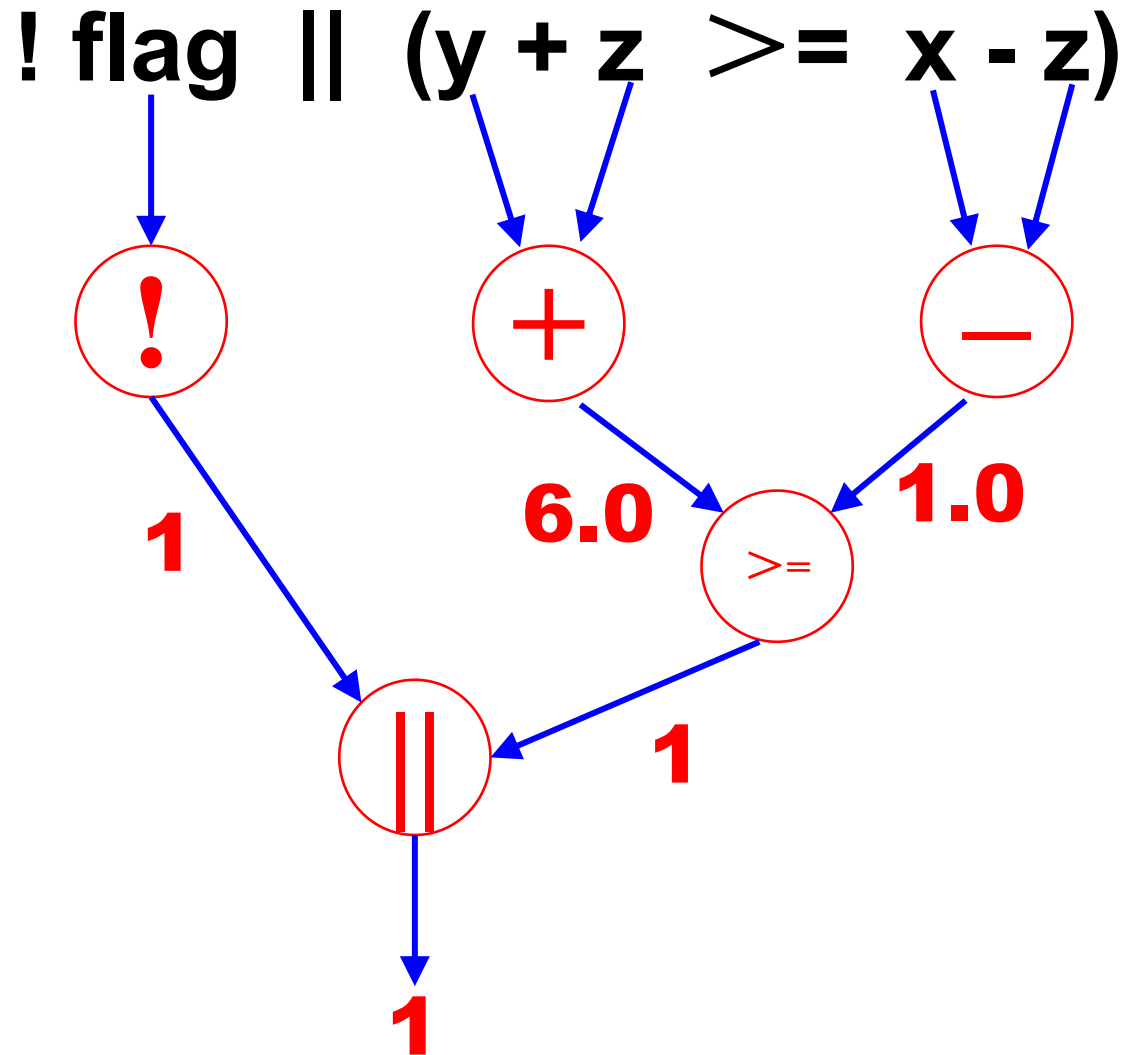
! flag || (y + z >= x - z)

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**

$$(\text{div} \mathrel{!=} 0 \mathbin{\&\&} (\text{num} \mathbin{\%} \text{div} \mathrel{==} 0))$$

Comparing Characters

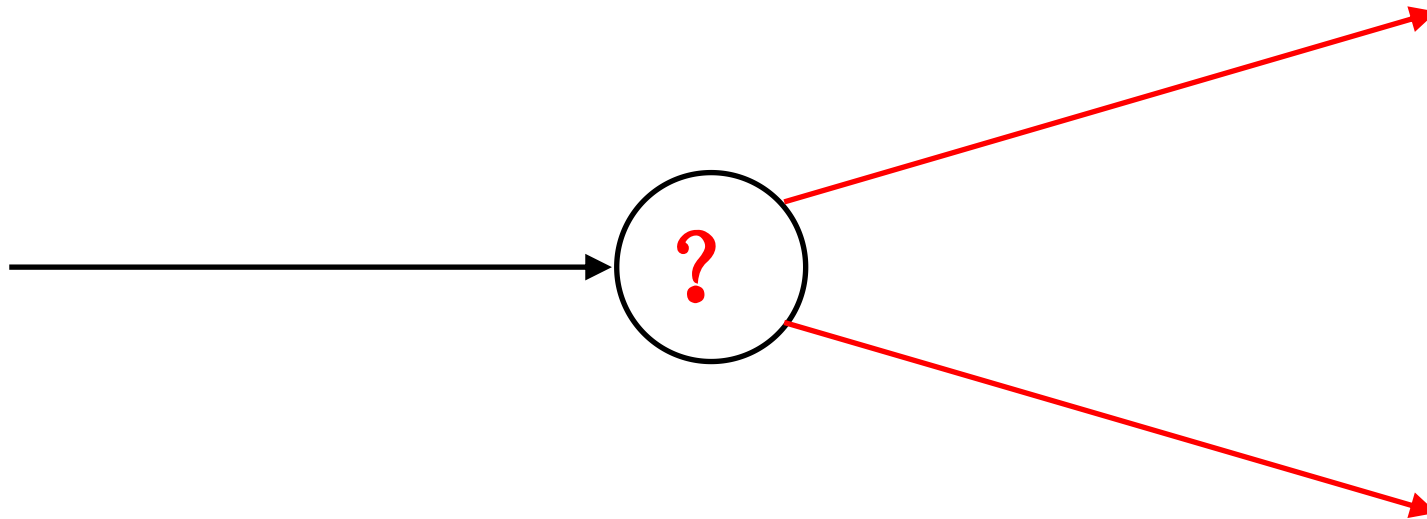| Expression	Value
'9' >= '0'	1 (true)
'a' < 'e'	1 (true)
'B' <= 'A'	0 (false)
'Z' == 'z'	0 (false)
'a' <= 'A'	System dependent
'a' <= ch && ch <= 'z'	1 (true) if ch is a lowercase letter

The if-statement

making decisions

Control Structures

selection control structure

- a control structure that chooses among alternative program statements

Conditions

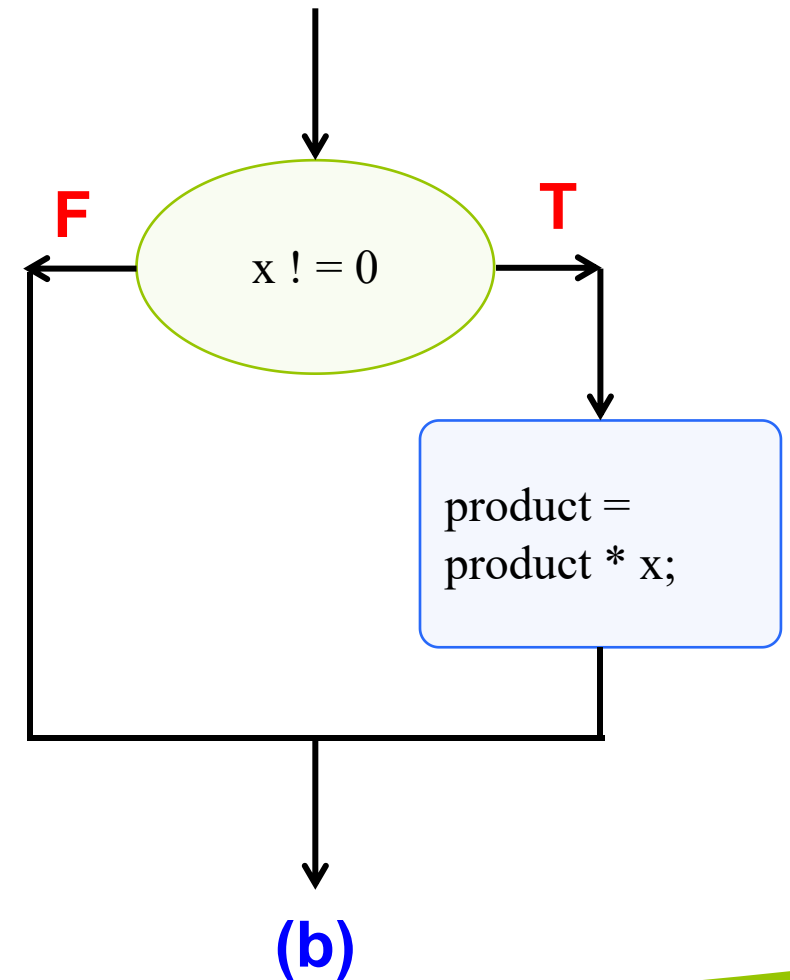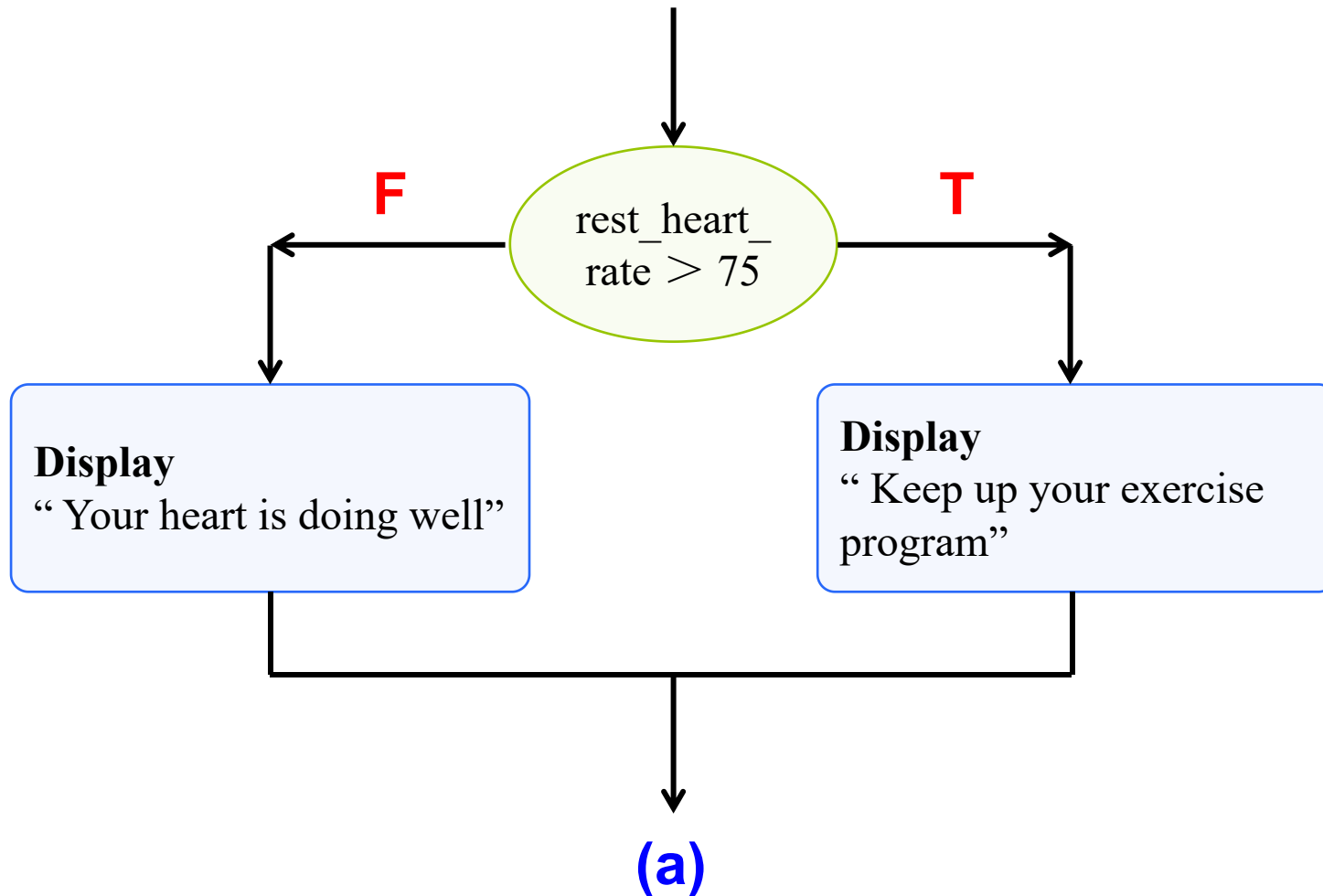- **an expression that is either false**

  - represented by 0

- **or true**

  - usually represented by 1

<div style="text-align:center">

rest_heart_rate > 75

</div>

(a)

(b)

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");
```

if-statement with one alternative

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

Figure Program Using an if statement for selection

```c
/*
 * 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.
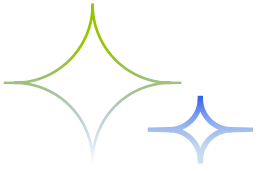Keep up your exercise program!

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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