



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.

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

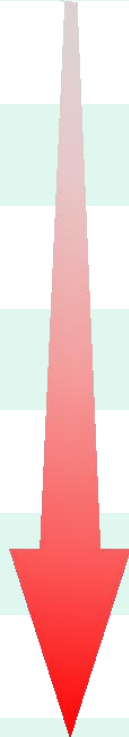
➤ logical complement (negation)

- the complement of a condition has 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)



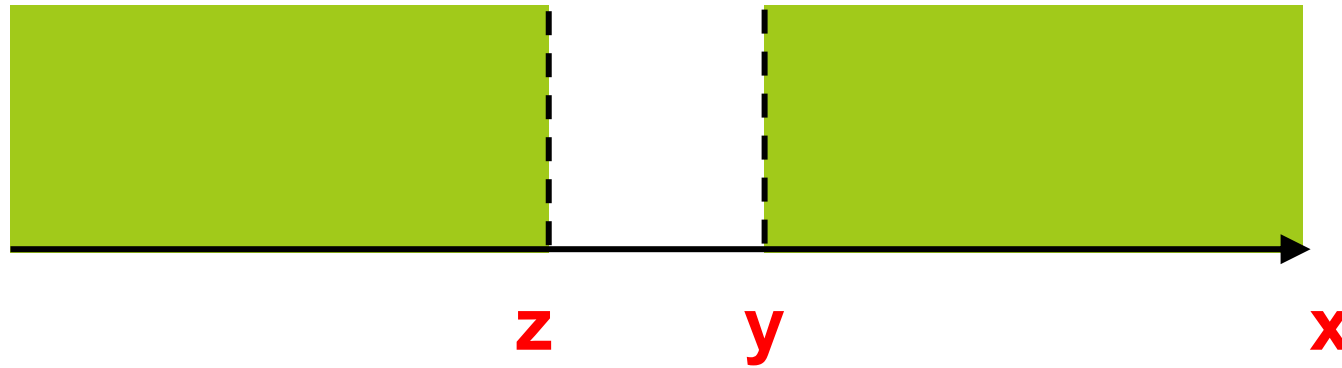
Figure

 **Range of True Values for $\text{min} \leq x \ \&\& \ x \leq \text{max}$**

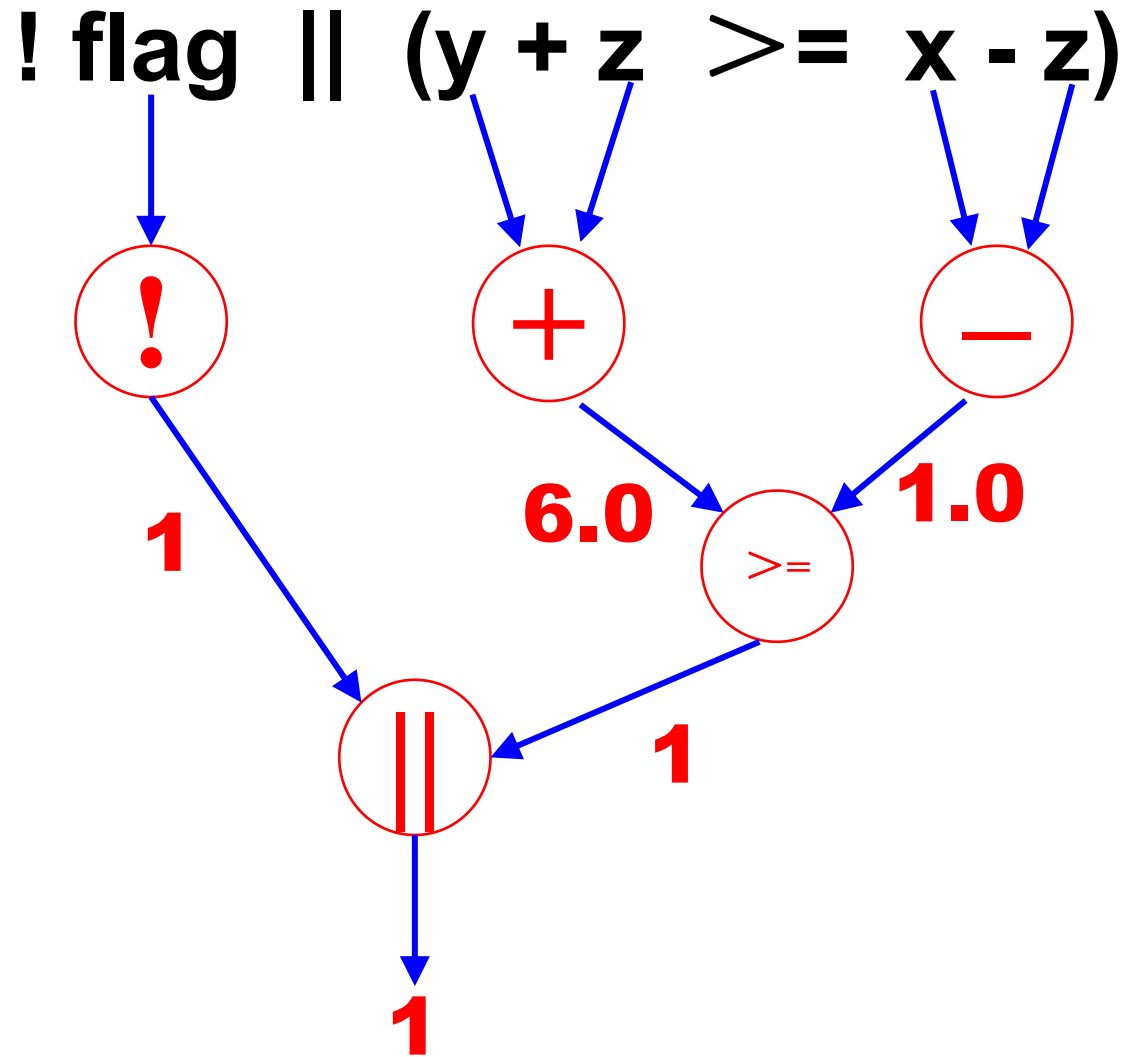


Figure

 **Range of True Values for $z > x \parallel x > y$**



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)

<u>0</u>	<u>4.0 2.0</u>	<u>3.0 2.0</u>
1	<u>6.0</u>	<u>1.0</u>
		<u>1</u>
	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

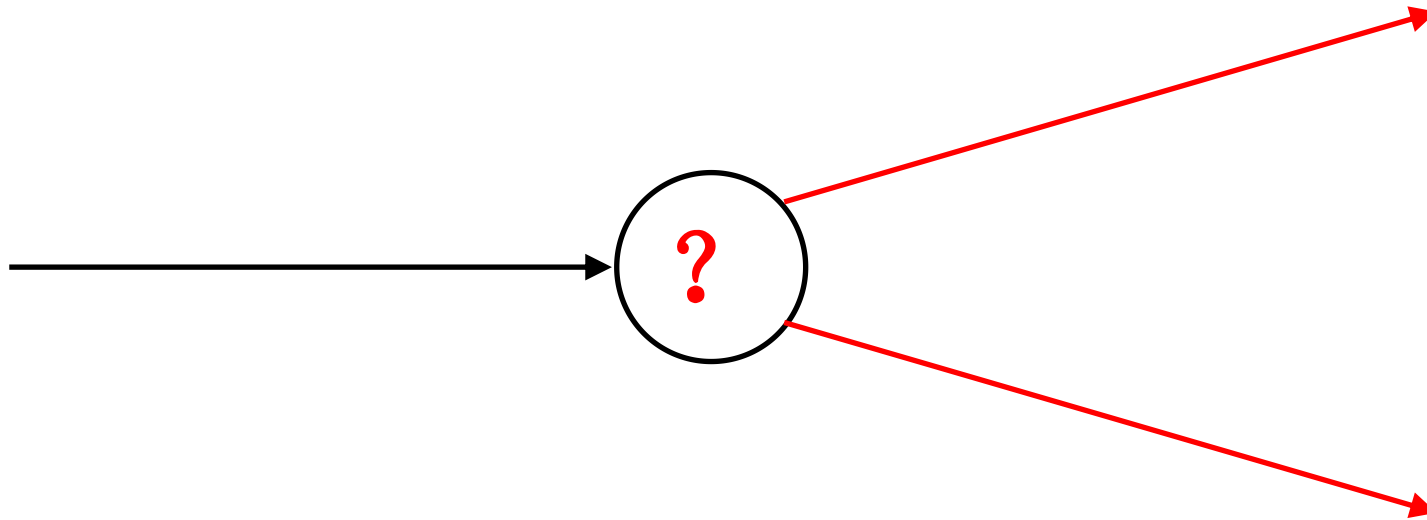
Expression	Value
'9' >= '0'	1 (true)
'a' < 'e'	1 (true)
'B' <= 'A'	0 (false)
'Z' == 'z'	0 (false)
'a' <= 'A'	System dependent
'a' <= ch && ch <= 'z'	1 (true) if ch is a lowercase letter

Control Structures



selection control structure

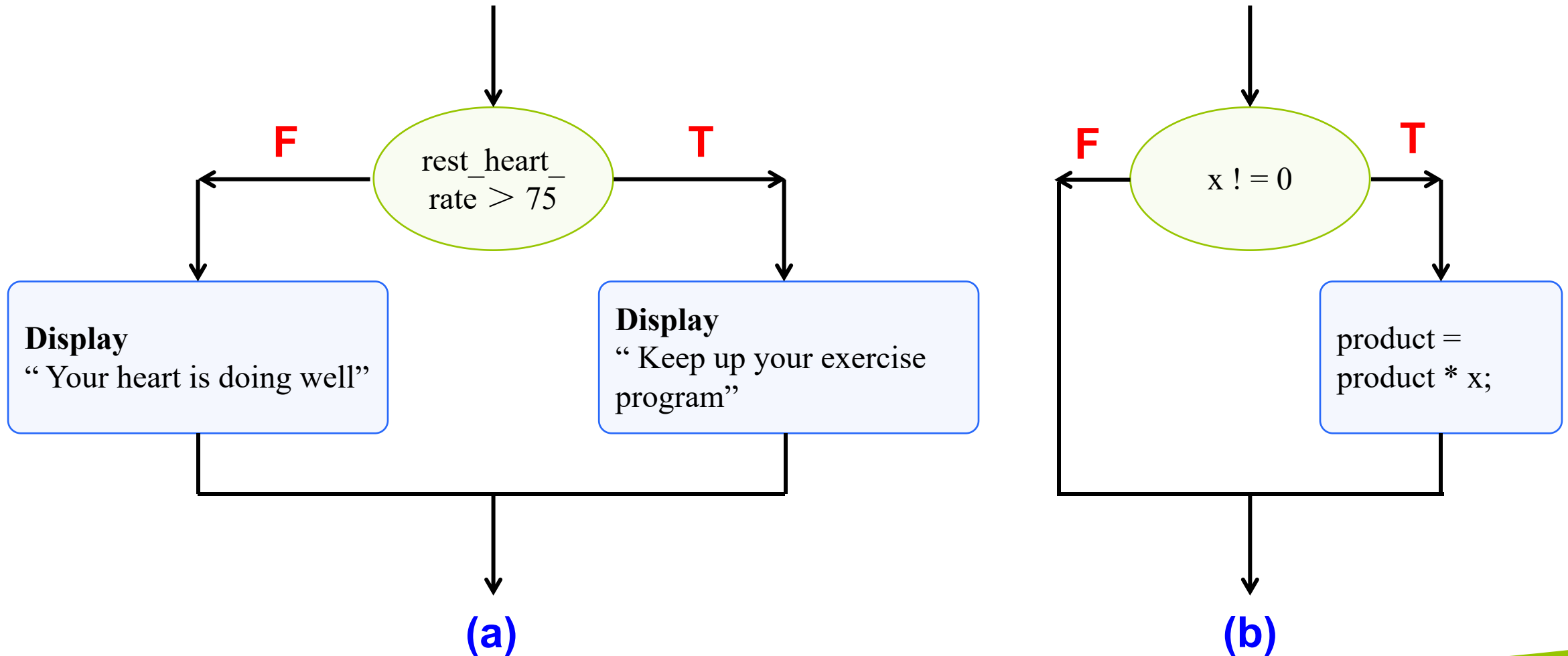
- a control structure that chooses among alternative program statements



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!

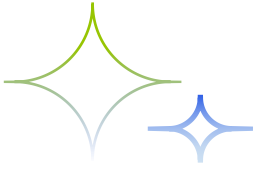
Sample Run 2

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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