

C / C++ / Java

## Structured Programming

Selection - **if** statement

Debugging a program

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## Structured Programming

- Programs are organized into modules, also known as blocks of code. Each block has only one entry point and one exit point.
- Within each block, code is organized using the three constructs and no GO TO statements.
  - \* Sequence
  - \* Selection (if, if/else, case)
  - \* Repetition (LOOPS: while, do...while, for)

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# Structured Programming

**BEFORE** – Spaghetti Code with lots of GO TO statements



**AFTER** – Object Oriented Programming builds on and includes Structured Programming

Spaghetti image credits:  
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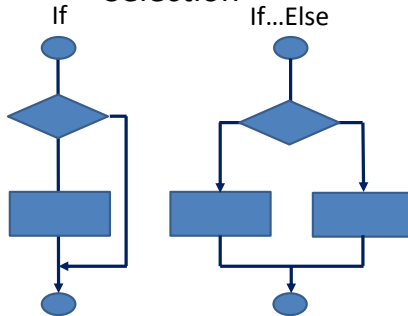
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# Structured Programming

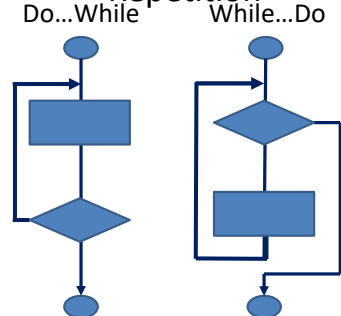
Sequence



Selection

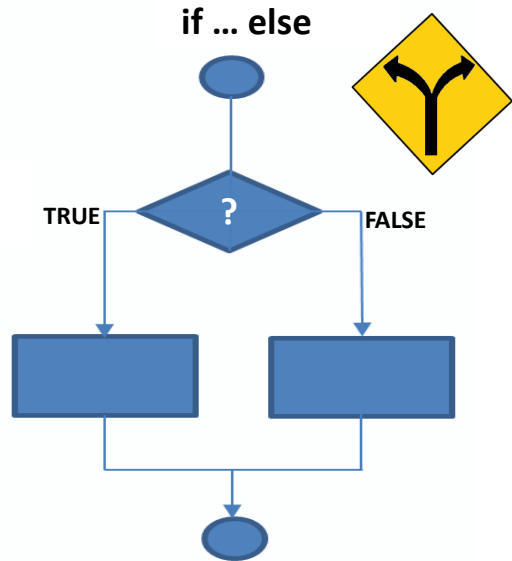
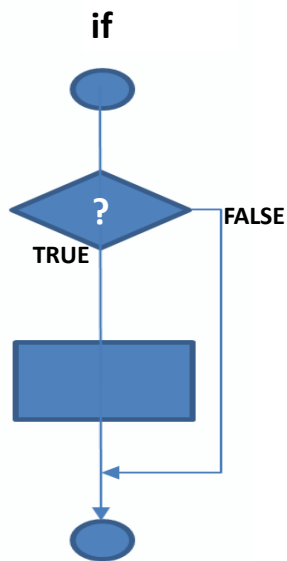


Repetition



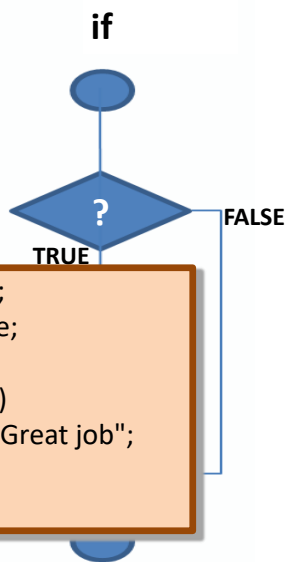
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# The if / else Statements

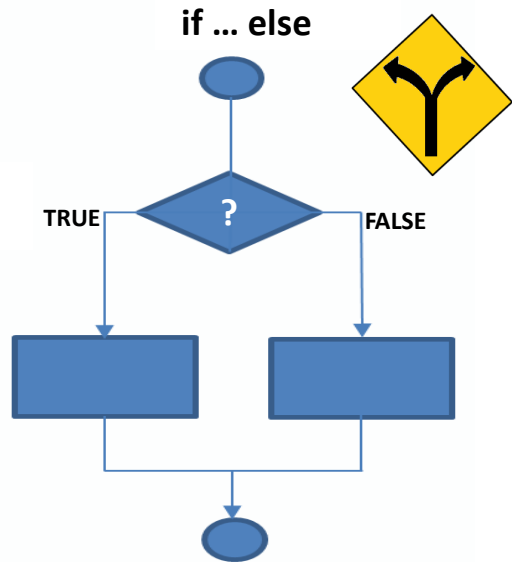


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# The if / else Statements

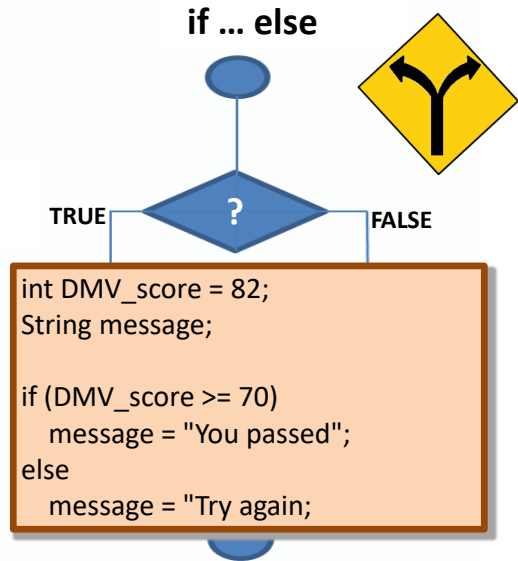
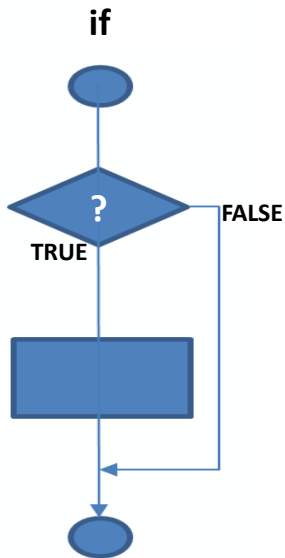


```
int score = 95;  
String message;  
  
if (score >= 90)  
    message = "Great job";
```



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# The if / else Statements

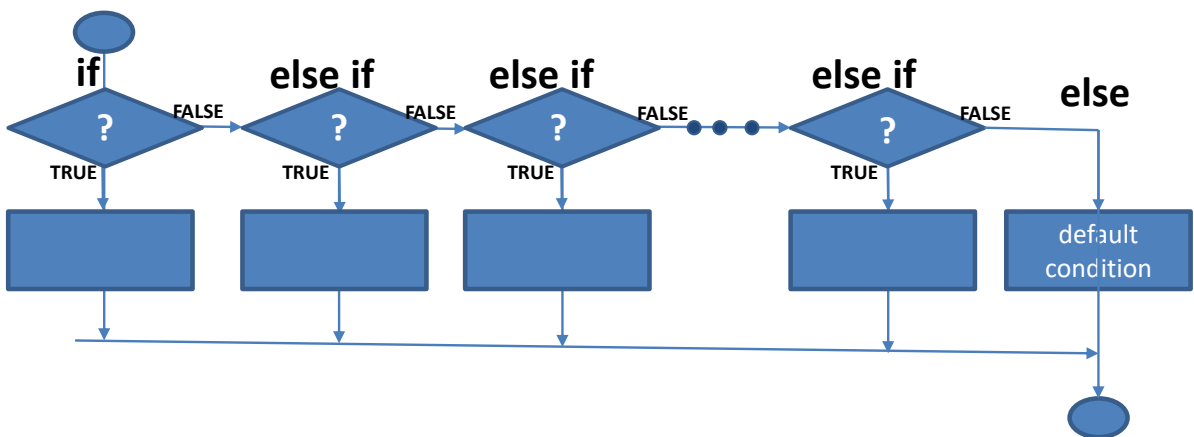


```
int DMV_score = 82;
String message;

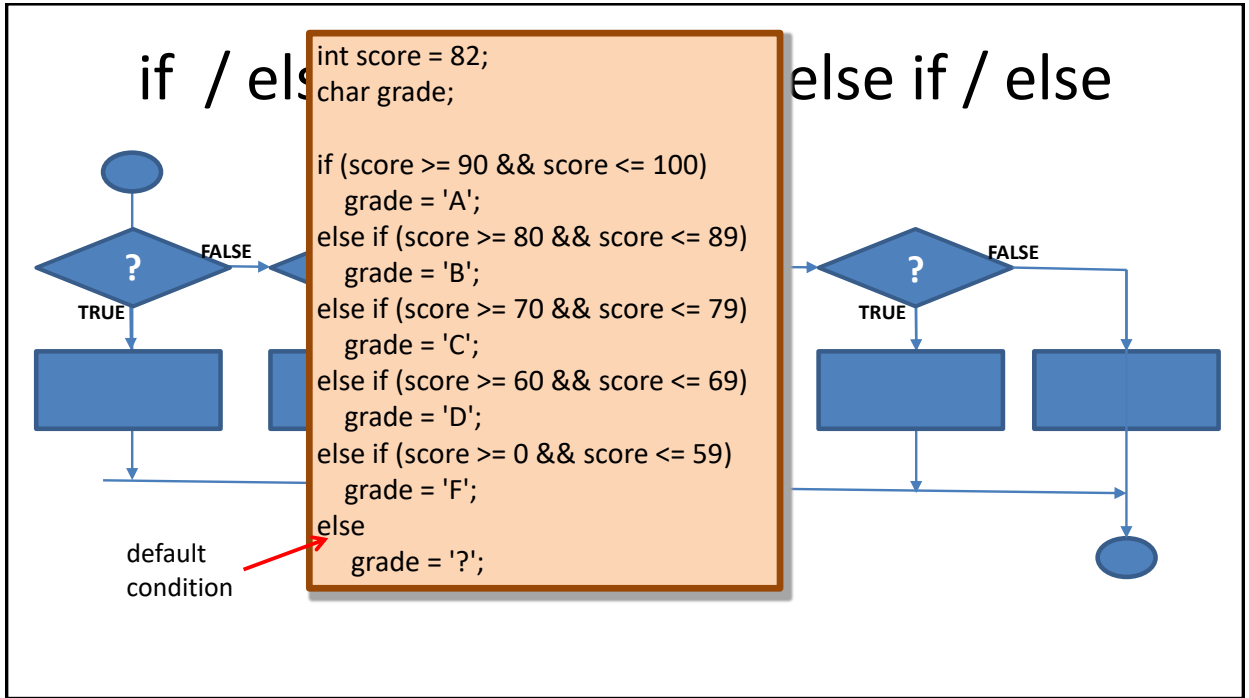
if (DMV_score >= 70)
    message = "You passed";
else
    message = "Try again";
```

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# if / else if / else if / ... / else if / else



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## if / else if / else

The following discussion shows examples using the **if** statement, the **else if** statement and the **else** statement

The sample code is only provided as 'code fragments', not full working programs. The code below could be placed in the PROCESSING section of a program that INPUTS some type of data that is used by the **if / else if / else** statements, followed by some type of OUTPUT to display the results of the **if / else if / else** statements.

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# Using the code in a program

C++ Program	C Program	Java Program
<pre>#include &lt;iostream&gt; #include &lt;string&gt; ... int score; string message1; char grade = ' ';  cout &lt;&lt; "Enter score: "; cin &gt;&gt; score;  if / else if / else code goes here  cout &lt;&lt; "Your grade is " &lt;&lt; grade; cout &lt;&lt; message1 &lt;&lt; endl; cout &lt;&lt; message2 &lt;&lt; endl;</pre>	<pre>#include &lt;stdio.h&gt; ... int score; char *message1 = ""; char grade = ' ';  printf ("Enter score: "); scanf ("%d", &amp;score);  if / else if / else code goes here  printf ("Your grade is %c", grade); printf ("%s\n", message1); printf ("%s\n", message2);</pre>	<pre>import java.util.Scanner; ... int score; String message1; char grade = ' '; Scanner input = new Scanner(System.in);  System.out.printf ("Enter score: "); score = input.nextInt();  if / else if / else code goes here  System.out. printf ("Your grade is %c", grade); System.out. printf ("%s\n", message1); System.out. printf ("%s\n", message2);</pre>

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# Syntax of the IF Statement

## PSEUDO CODE

```
IF condition THEN
    statement
END IF
```

## C / C++ / Java / etc.

```
if (condition)
    statement;
```

## NOTES:

1. The word **if** is in lower case
2. Only one statement as part of the **if**
3. Semicolon at the end of the statement

## SAMPLE PROGRAM

```
// Need at least 70 to pass the DMV test
if (score >= 70)
    message1 = "You passed";
```

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# The Compound IF Statement

## PSEUDO CODE

```
IF condition THEN
  statement1
  statement2
END IF
```

## C / C++ / Java / etc.

```
if (condition)
{
  statement1;
  statement2;
}
```

## NOTES:

1. **One or more** statements as part of the **if**
2. A **BLOCK OF CODE** is enclosed in curly braces
3. Semicolon at the end of each statement
4. No semicolon after the closing curly brace

## SAMPLE PROGRAM

```
// Need at least 70 to pass the DMV test
if (score >= 70)
{
  message1 = "Congratulations";
  message2 = "You passed the written test";
}
```

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# Syntax of the IF...ELSE Statement

## PSEUDO CODE

```
IF condition THEN
  statement1
ELSE
  statement2
END IF
```

## C / C++ / Java / etc.

```
if (condition)
  statement1;
else
  statement2;
```

## NOTES:

1. If the condition evaluates to true, the first statement is executed
2. Otherwise, the statement after the **else** is executed

## SAMPLE PROGRAM

```
// Need at least 70 to pass the DMV test
if (score >= 70)
  message1 = "You passed the test";
else
  message1 = "Try again";
```

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# Compound IF...ELSE

## PSEUDO CODE

```
IF condition THEN
  statement1
  statement2
ELSE
  statement3
  statement4
END IF
```

## NOTES:

1. Curly braces define the block of code for the **if** and another set of curly braces define the block of code for the **else**

## C / C++ / Java / etc.

```
// Need at least 70 to pass the DMV test
if (score >= 70)
{
  message1 = "Congratulations";
  message2 = "You passed the test";
}
else
{
  message1 = "Sorry";
  message2 = "Try again";
}
```

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## Convert a Score to a Letter Grade

- o Input a score (0-100)
- o Convert score to a letter grade and message
- o Display the grade and a message

score	grade	message
90-100	A	Outstanding
80-89	B	Exceeds Expectations
70-79	C	Acceptable
60-69	D	Poor
0-59	F	Dreadful

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## int score; Conversion using only if statements

```
int score;
...
if (score >= 90 && score <= 100)
    grade = 'A';
if (score >= 80 && score <= 89)
    grade = 'B';
if (score >= 70 && score <= 79)
    grade = 'C';
if (score >= 60 && score <= 69)
    grade = 'D';
if (score >= 0 && score <= 50)
    grade = 'F';
```

score	grade	message
90-100	A	Outstanding
80-89	B	Exceeds Expectations
70-79	C	Acceptable
60-69	D	Poor
0-59	F	Dreadful

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## int score; Conversion using only if statements

```
int score;
...
if (score >= 90 && score <= 100)
    grade = 'A';
    message1 = "Outstanding";
if (score >= 80 && score <= 89)
    grade = 'B';
    message1 = "Exceeds Expectations";
if (score >= 70 && score <= 79)
    grade = 'C';
    message1 = "Acceptable";
if (score >= 60 && score <= 69)
    grade = 'D';
    message1 = "Poor";
if (score >= 0 && score <= 59)
    grade = 'F';
    message1 = "Dreadful";
```

If the score is 85, what is:  
grade?  
message1?

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# Conversion using only if statements

```
int score;  
...  
if (score >= 90 && score <= 100)  
{  
    grade = 'A';  
    message1 = "Outstanding";  
}  
if (score >= 80 && score <= 89)  
{  
    grade = 'B';  
    message1 = "Exceeds Expectations";  
}  
if (score >= 70 && score <= 79)  
{  
    grade = 'C';  
    message1 = "Acceptable";  
}
```

```
if (score >= 60 && score <= 69)  
{  
    grade = 'D';  
    message1 = "Poor";  
}  
if (score >= 0 && score <= 59)  
{  
    grade = 'F';  
    message1 = "Dreadful";  
}
```

If the score is 85, what is:  
grade?  
message1?

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```
int score;  
...
```



```
if (score >= 90 && score <= 100)  
{  
    grade = 'A';  
    message1 = "Outstanding";  
}  
if (score >= 80 && score <= 89)  
{  
    grade = 'B';  
    message1 = "Exceeds Expectations";  
}  
if (score >= 70 && score <= 79)  
{  
    grade = 'C';  
    message1 = "Acceptable";  
}
```

```
if (score >= 60 && score <= 69)  
{  
    grade = 'D';  
    message1 = "Poor";  
}  
if (score >= 0 && score <= 59)  
{  
    grade = 'F';  
    message1 = "Dreadful";  
}
```

If the score is 105, what is:  
grade?  
message1?  
How about if the score is -5?

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**double score;**  
...

```

if (score >= 90 && score <= 100)
{
    grade = 'A';
    message1 = "Outstanding;
}
if (score >= 80 && score <= 89)
{
    grade = 'B';
    message1 = "Exceeds Expectations";
}
if (score >= 70 && score <= 79)
{
    grade = 'C';
    message1 = "Acceptable;
}
if (score >= 60 && score <= 69)
{
    grade = 'D';
    message1 = "Poor;
}
if (score >= 0 && score <= 59)
{
    grade = 'F';
    message1 = "Dreadful";
}

```

If the score is 89.5, what is:  
grade?  
message1?  
How about if score is -5?

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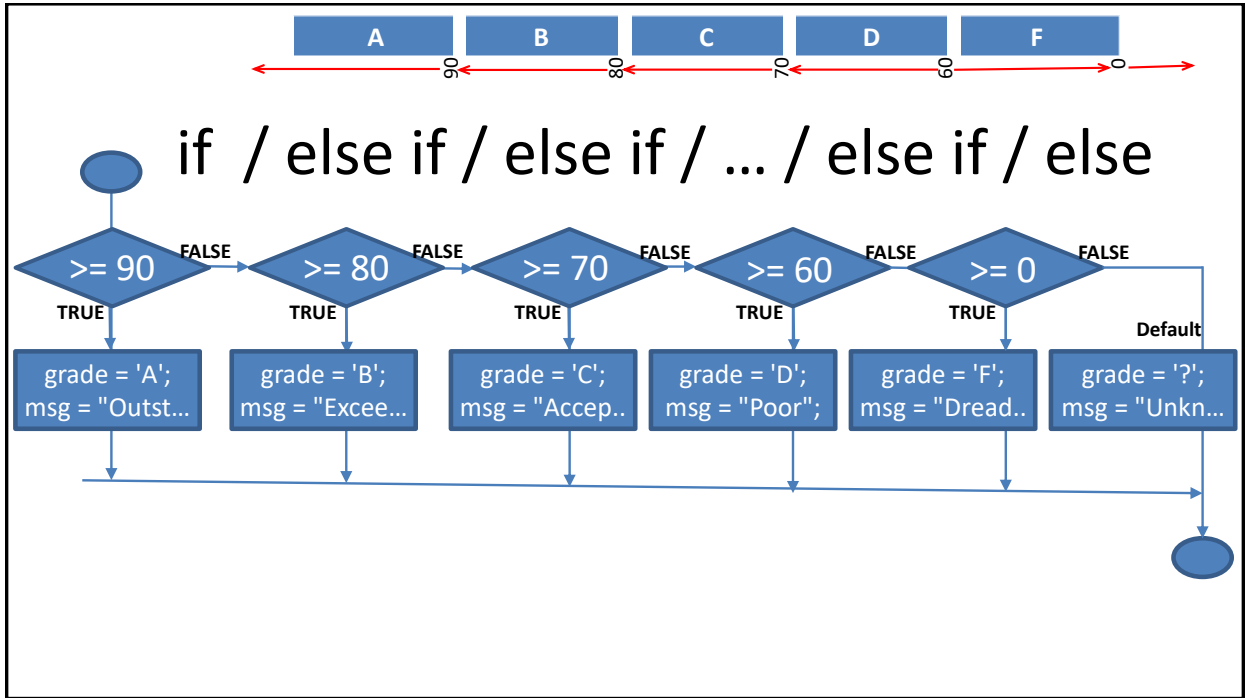
## Is it OK to modify the requirements?

score	grade	message
90-100	A	Outstanding
80-89	B	Exceeds Expectations
70-79	C	Acceptable
60-69	D	Poor
0-59	F	Dreadful

score	grade	message
>= 90	A	Outstanding
>= 80	B	Exceeds Expectations
>= 70	C	Acceptable
>= 60	D	Poor
>= 0	F	Dreadful

Extra credit scores over 100 are now OK  
How about if score is -5?

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```

double score;
...
if (score >= 90)
{
    grade = 'A';
    message1 = "Outstanding;
}
else if (score >= 80)
{
    grade = 'B';
    message1 = "Exceeds Expectations";
}
else if (score >= 70)
{
    grade = 'C';
    message1 = "Acceptable;
}
else if (score >= 60)
{
    grade = 'D';
    message1 = "Poor;
}
else if (score >= 0)
{
    grade = 'F';
    message1 = "Dreadful;
}
else // default condition
{
    grade = '?';
    message1 = "Unknown";
}

```

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## How can we Round UP?

```
double score;
```

```
...
```

```
score += 0.5; // round up by .5 points
```

```
if (score >= 90)
```

```
{
```

```
    grade = 'A';
```

```
    message1 = "Outstanding";
```

```
}
```

```
else if (score >= 80)
```

```
{
```

```
    grade = 'B';
```

```
    message1 = "Exceeds Expectations";
```

```
}
```

```
else if (score >= 70)
```

```
{
```

```
    grade = 'C';
```

```
    message1 = "Acceptable";
```

```
}
```

```
else if (score >= 60)
```

```
{
```

```
    grade = 'D';
```

```
    message1 = "Poor";
```

```
}
```

```
else if (score >= 0)
```

```
{
```

```
    grade = 'F';
```

```
    message1 = "Dreadful";
```

```
}
```

```
else // default condition
```

```
{
```

```
    grade = '?';
```

```
    message1 = "Unknown";
```

```
}
```

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## Debugging a Program

- o Debug Messages

- o Breakpoints

- o Step

- o Continue

- o Watch

- o Hover

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