Programming Fundamental

Week 10 –
Selective control Structures in the C Programming Language

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Weekly Learning Outcomes for Subjects (Sub-CPMK):

Sub-CPMK 0614: Students are able to create simple programs with elements of selection control, repetition control, functions or procedures, and implement arrays and pointers in the C programming language (C6).

Outline

1. IF…
2. Nested IF
3. Switch Case

Control Structures

- Control the flow of execution in a program or function
- Combine individual instructions into a single logical unit with one entry point and one exit point
- Instructions are organized into 3 kinds of control structures to control execution flow
  - Sequence
  - Selection
  - Repetition

Sequential Flow

- A compound statement is used to specify sequential flow
- A compound statement is written as a group of statements bracketed by { and }
- Control flows from $statement_1$ to $statement_2$, and so on

```
{
        statement1;
        statement2;
            .
            .
            .
        statementn;
}
```

Selection Control Structures

- A selection control structure chooses which alternative to execute

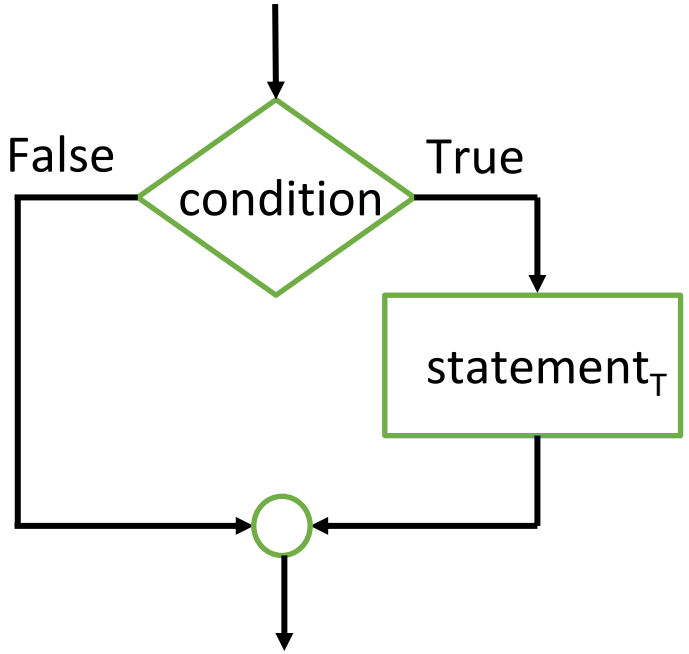
  - if statement
  - switch statement

- A program chooses among alternative statements by testing the value of key variables
- A **condition** establishes a criterion for either executing or skipping a group of statements
- A **condition** is an expression that is either false (represented by 0) or true (usually represented by 1)

If Statement with One Alternative

```
if(condition)
        statement_T;
```

- Executes **only when the condition is true**




```c
#include <stdio.h>

int main()
{
    int grade;

    printf("Grade: ");
    scanf("%d",&grade);
    if(grade >= 55)
        printf("Passed\n");

    return 0;
}
```

F:\if.exe

```
Grade: 55
Passed

Process returned 0 (0x0)
execution time : 1.532 s
Press any key to continue.
```

F:\if.exe

```
Grade: 45

Process returned 0 (0x0)
execution time : 1.108 s
Press any key to continue.
```

If Statement with Two Alternatives

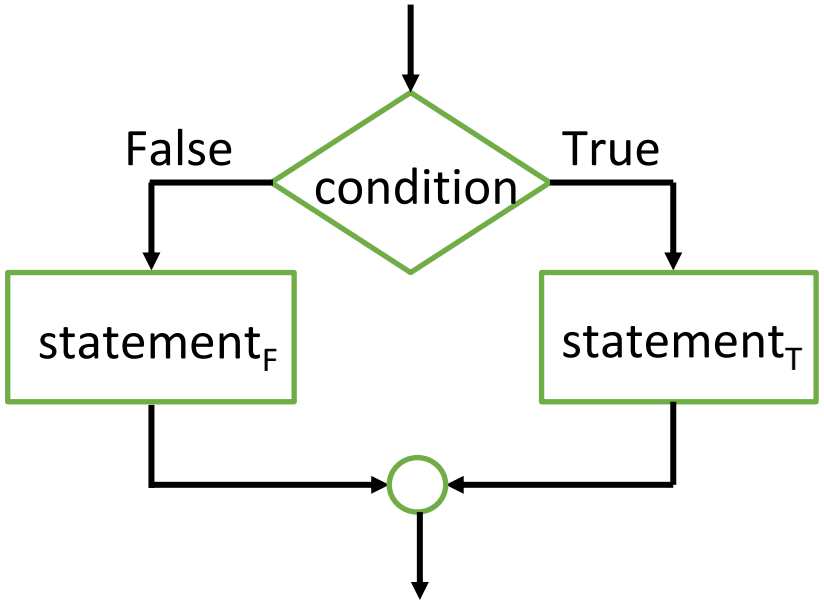
```
if(condition)
        statement_T;
else
        statement_F;
```

- Selects the statement following the parenthesized condition ($statement_T$) if the condition evaluates to 1 (true)
- Selects the statement following *else* ($statement_F$) if the condition evaluates to 0 (false)

```
if(grade >= 55)
    printf("Passed\n");
else
    printf("Failed\n");
```

```
F:\if.exe
Grade: 55
Passed

Process returned 0 (0x0)
execution time : 1.079 s
Press any key to continue.
```

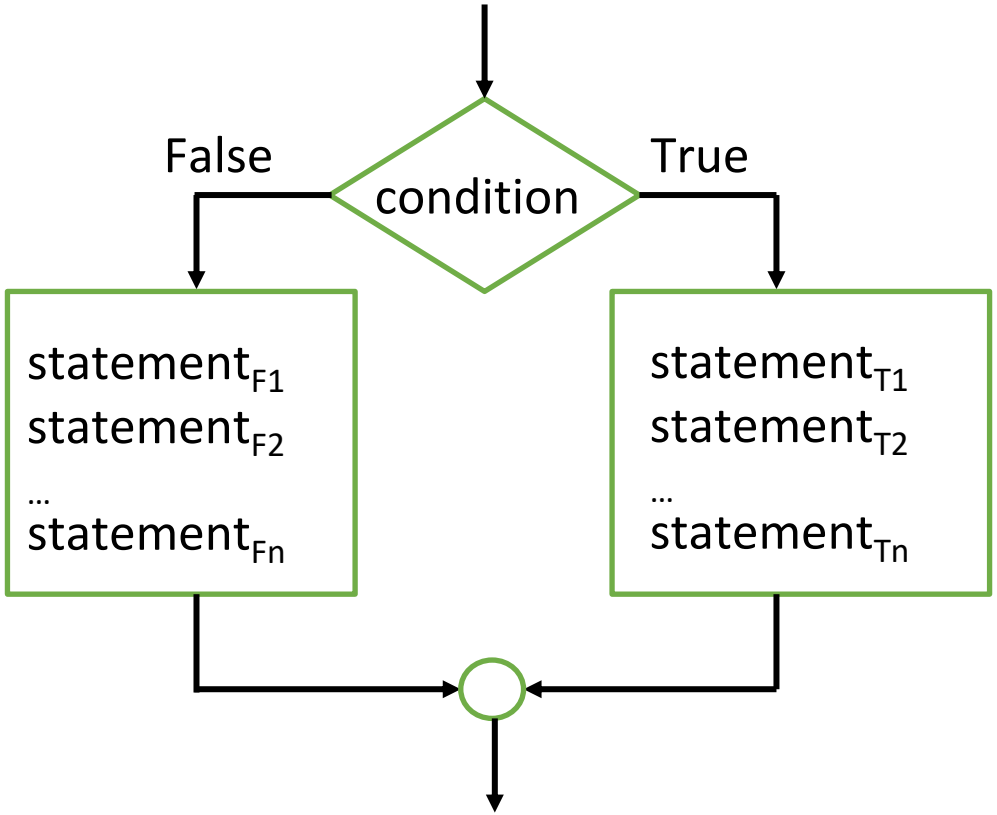
```
F:\if.exe
Grade: 45
Failed

Process returned 0 (0x0)
execution time : 1.322 s
Press any key to continue.
```



If Statement with Compound Statements

```
if(condition)
{
        statement_T1;
        statement_T2;
        ...
        statement_Tn;
}
else
{
        statement_F1;
        statement_F2;
        ...
        statement_Fn;
}
```

- When the symbol **{** follows the condition or *else*, the C compiler either executes or skips **all statements** through the matching **}**



If Statement with Compound Statements

```
if(condition)
{
        statement_T1;
        statement_T2;
        ...
        statement_Tn;
}
else
{
        statement_F1;
        statement_F2;
        ...
        statement_Fn;
}
```

```
if(grade >= 55)
    printf("Passed\n");
else
{
    printf("Failed\n");
    printf("You must take this course again\n");
}
```

F:\if.exe

```
Grade: 55
Passed

Process returned 0 (0x0)
execution time : 1.250 s
Press any key to continue.
```

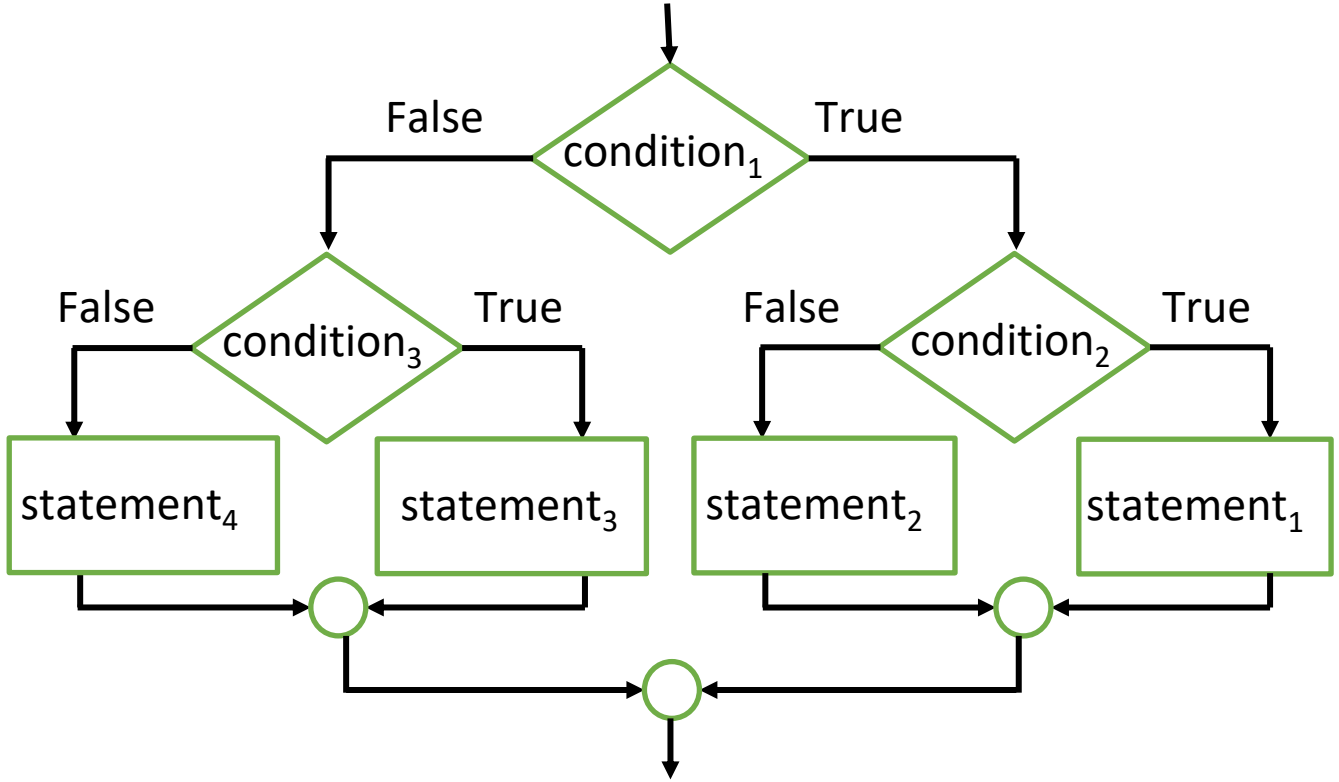
F:\if.exe

```
Grade: 45
Failed
You must take this course again

Process returned 0 (0x0)   execution time : 1.330 s
Press any key to continue.
```

Nested If Statement

```
if(condition1)
{
        if(condition2)
                statement1;
        else
                statement2;
}
else
{
        if(condition3)
                statement3;
        else
                statement4;
}
```

- An if statement with another if statement as its true task or its false task
- One if statement inside another



Nested If Statement

```
if(condition1)
{
        if(condition2)
                statement1;
        else
                statement2;
}
else
{
        if(condition3)
                statement3;
        else
                statement4;
}
```

```
if(systolicBloodPressure > 140)
    printf("Hypertension\n");
else
{
    if(systolicBloodPressure > 120)
        printf("Pre-hypertension\n");
    else
    {
        if(systolicBloodPressure > 90)
            printf("Normal\n");
        else
            printf("Hypotension\n");
    }
}
```

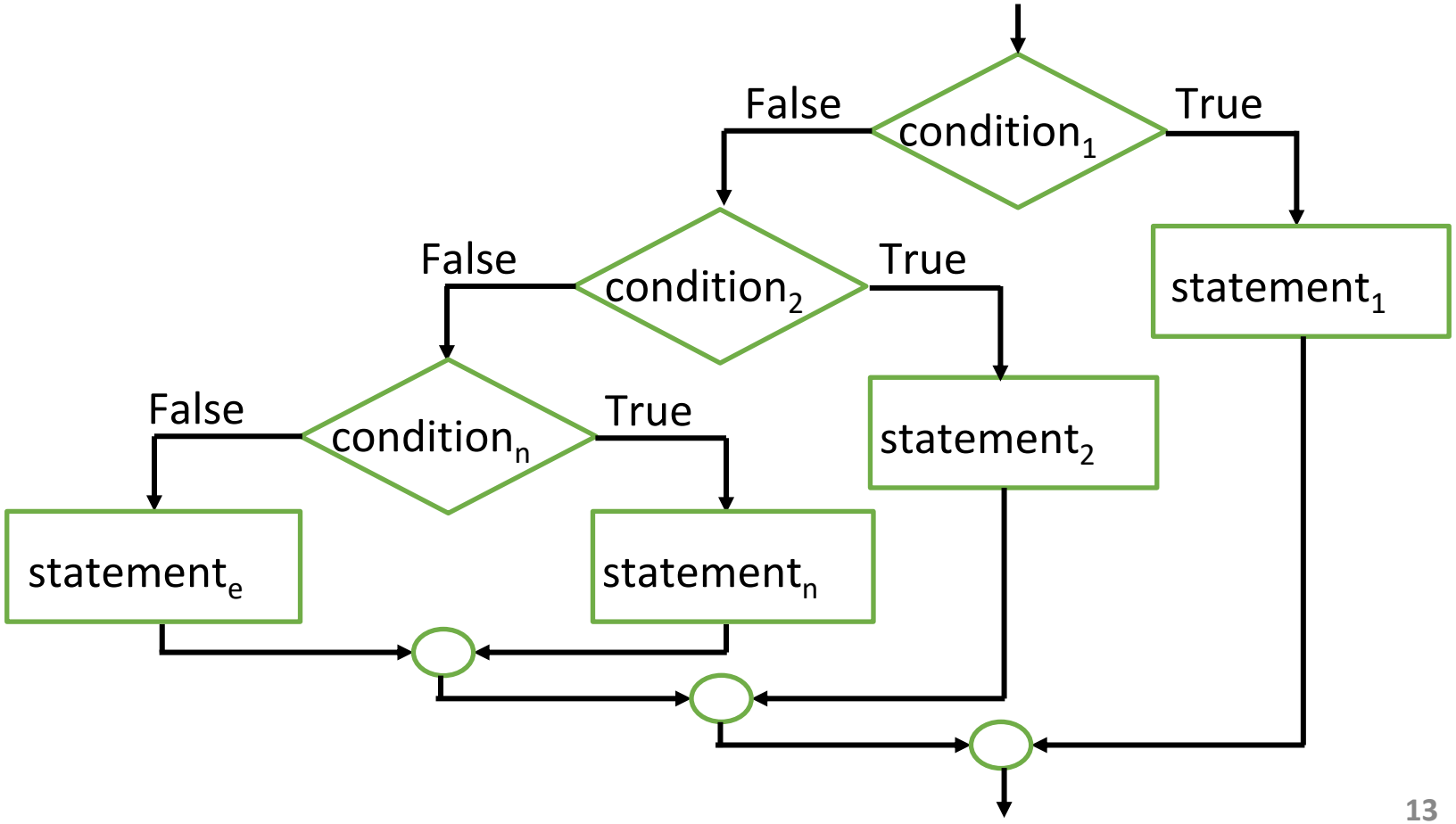
F:\if.exe

```
Systolic Blood Pressure: 80
Hypotension

Process returned 0 (0x0)   execution time : 1.395 s
Press any key to continue.
```

Multiple-Alternative Decisions

Nested if statements can become quite complex.
If there are more than 3 alternatives and indentation is not consistent, it may be difficult to determine the logical structure of the if statement

```
if(condition1)
        statement1;
else if(condition2)
        statement2;
              .
              .
              .
else if(conditionn)
        statementn;
else
        statemente;
```



Multiple-Alternative Decisions

```
if(condition1)
      statement1;
else if(condition2)
      statement2;
            .
            .
            .
else if(conditionn)
      statementn;
else
      statemente;
```

```
if(systolicBloodPressure > 140)
    printf("Hypertension\n");
else if(systolicBloodPressure > 120)
    printf("Pre-hypertension\n");
else if(systolicBloodPressure > 90)
    printf("Normal\n");
else
    printf("Hypotension\n");
```

```
F:\if.exe
Systolic Blood Pressure: 110
Normal

Process returned 0 (0x0)   execution time : 1.290 s
Press any key to continue.
```

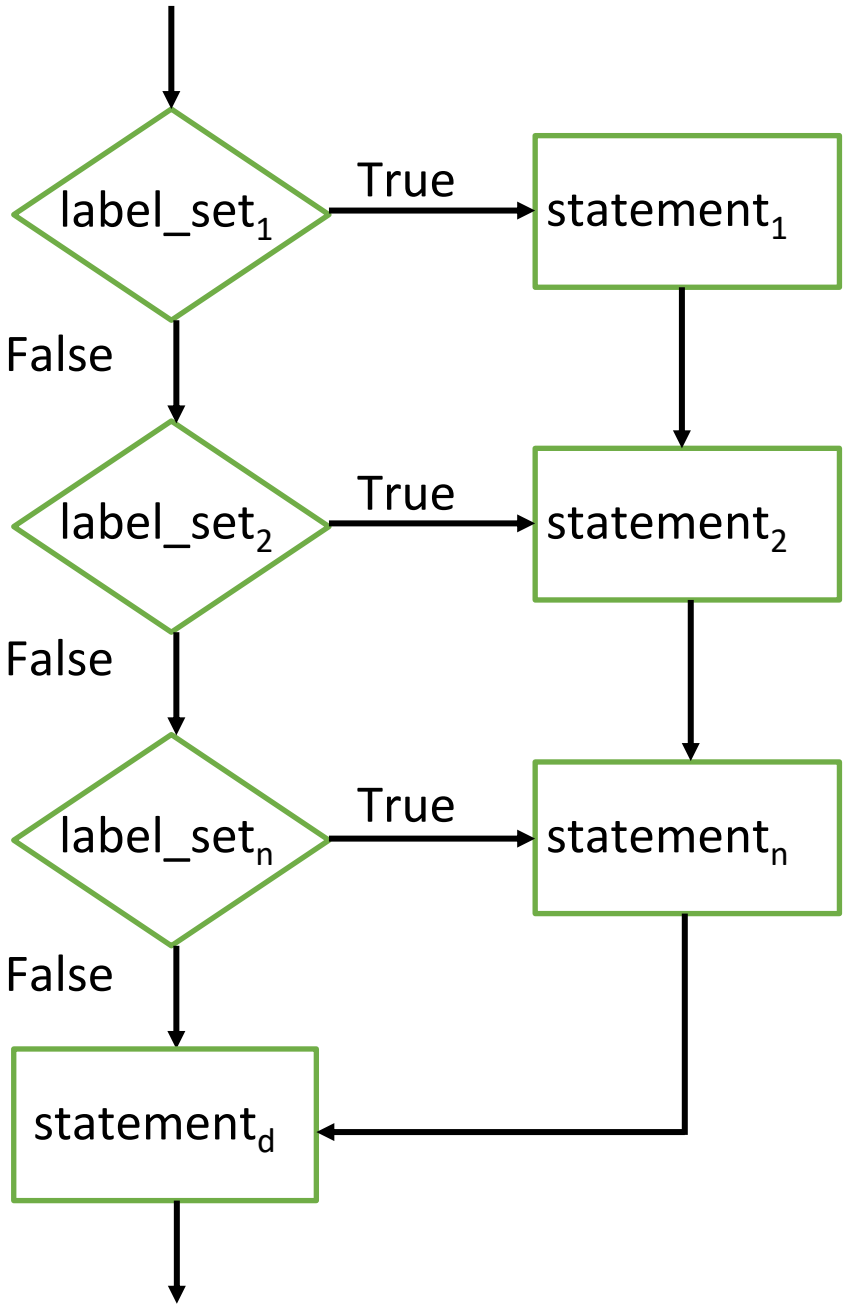
Switch Statement

- The **switch** statement may also be used in C to select one of several alternatives
- The switch statement is especially useful when the selection is based on the value of a single variable or of a simple expression
- Type int and char values may be used as case labels (the value of the expression), but strings and type double values cannot be used

```
switch(expression)
{
        case label_set1: statement1;
        case label_set2: statement2;
        ...
        case label_setn: statementn;
        [default: statementd;]
}
```

Switch Statement

```
switch(expression)
{
      case label_set1: statement1;
      case label_set2: statement2;
      ...
      case label_setn: statementn;
      [default: statementd;]
}
```



Switch Statement

```
switch(expression)
{
      case label_set1: statement1;
      case label_set2: statement2;
      ...
      case label_setn: statementn;
      [default: statementd;]
}
```

```
switch(ship)
{
    case 'B': printf("Battleship\n");
    case 'C': printf("Cruiser\n");
    case 'D': printf("Destroyer\n");
    default : printf("Unknown\n");
}
```

F:\switch.exe

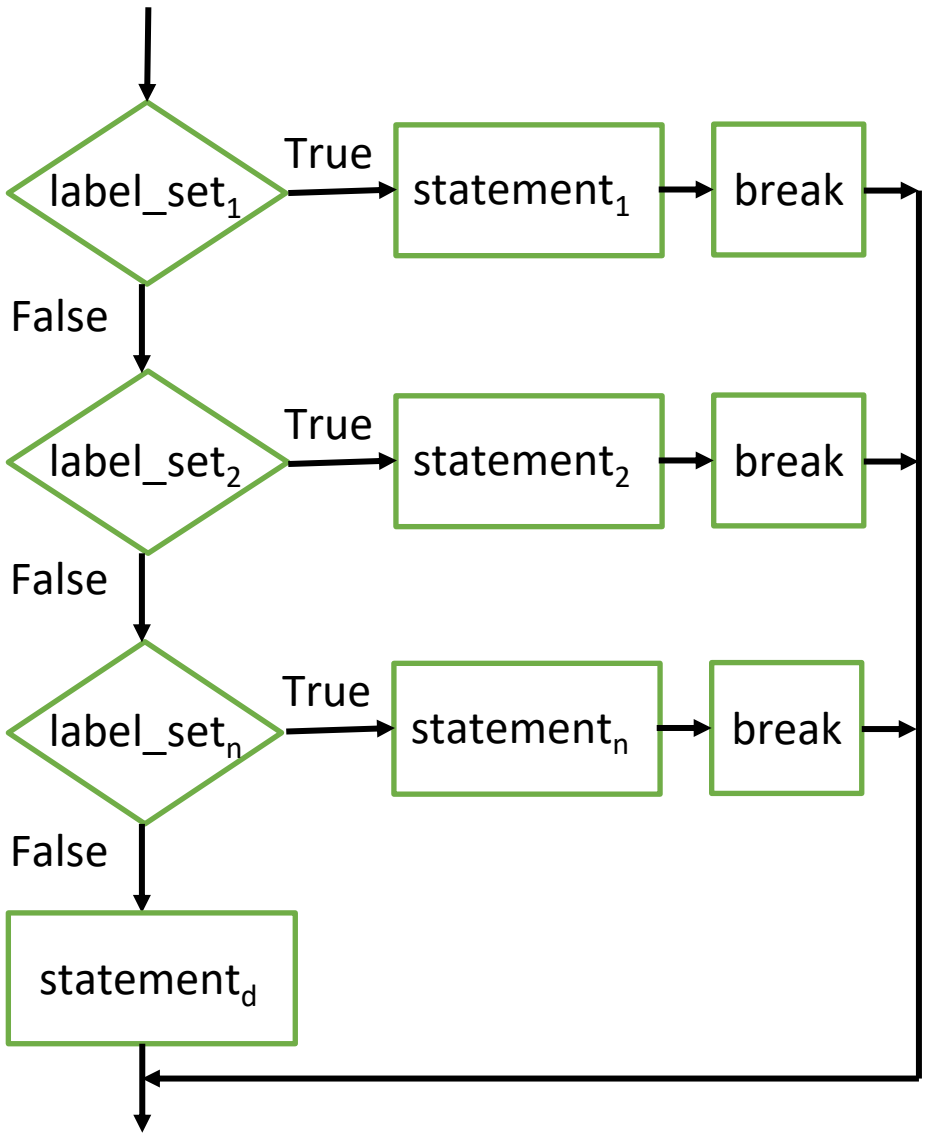
```
Ship: C
Cruiser
Destroyer
Unknown

Process returned 0 (0x0)
execution time : 1.344 s
Press any key to continue.
```

F:\switch.exe

```
Ship: F
Unknown

Process returned 0 (0x0)
execution time : 1.328 s
Press any key to continue.
```

Switch Statement

```
switch(expression)
{
        case label_set1:   statement1;
                           break;
        case label_set2:   statement2;
                           break;
        ...
        case label_setn:   statementn;
                           break;
        [default: statementd;]
}
```



Switch Statement

```
switch(expression)
{
        case label_set1:   statement1;
                           break;
        case label_set2:   statement2;
                           break;
        ...
        case label_setn:   statementn;
                           break;
        [default: statementd;]
}
```

F:\switch.exe

```
Ship: C
Cruiser

Process returned 0 (0x0)
execution time : 1.343 s
Press any key to continue.
```

F:\switch.exe

```
Ship: F
Unknown

Process returned 0 (0x0)
execution time : 1.282 s
Press any key to continue.
```

```
switch(ship)
{
    case 'B': printf("Battleship\n");
              break;
    case 'C': printf("Cruiser\n");
              break;
    case 'D': printf("Destroyer\n");
              break;
    default : printf("Unknown\n");
}
```

Practice 1

- What does the following code print?

```
#include <stdio.h>

int main()
{
    int noise;

    scanf("%d",&noise);
    if(noise <= 50) printf("Quiet\n");
    if(noise <= 70) printf("Intrusive\n");
    if(noise <= 90) printf("Annoying\n");
    if(noise <= 110) printf("Very Annoying\n");
    else printf("Uncomfortable\n");

    return 0;
}
```

Input :

```
80
```

Practice 2

- What does the following code print?

```
#include <stdio.h>

int main()
{
    int grade;

    scanf("%d",&grade);
    if(grade >= 55)
        printf("Passed\n");
    else
        printf("Failed\n");
        printf("You must take this course again\n");

    return 0;
}
```

Input :

```
85
```

Practice 3

- What does the following code print?

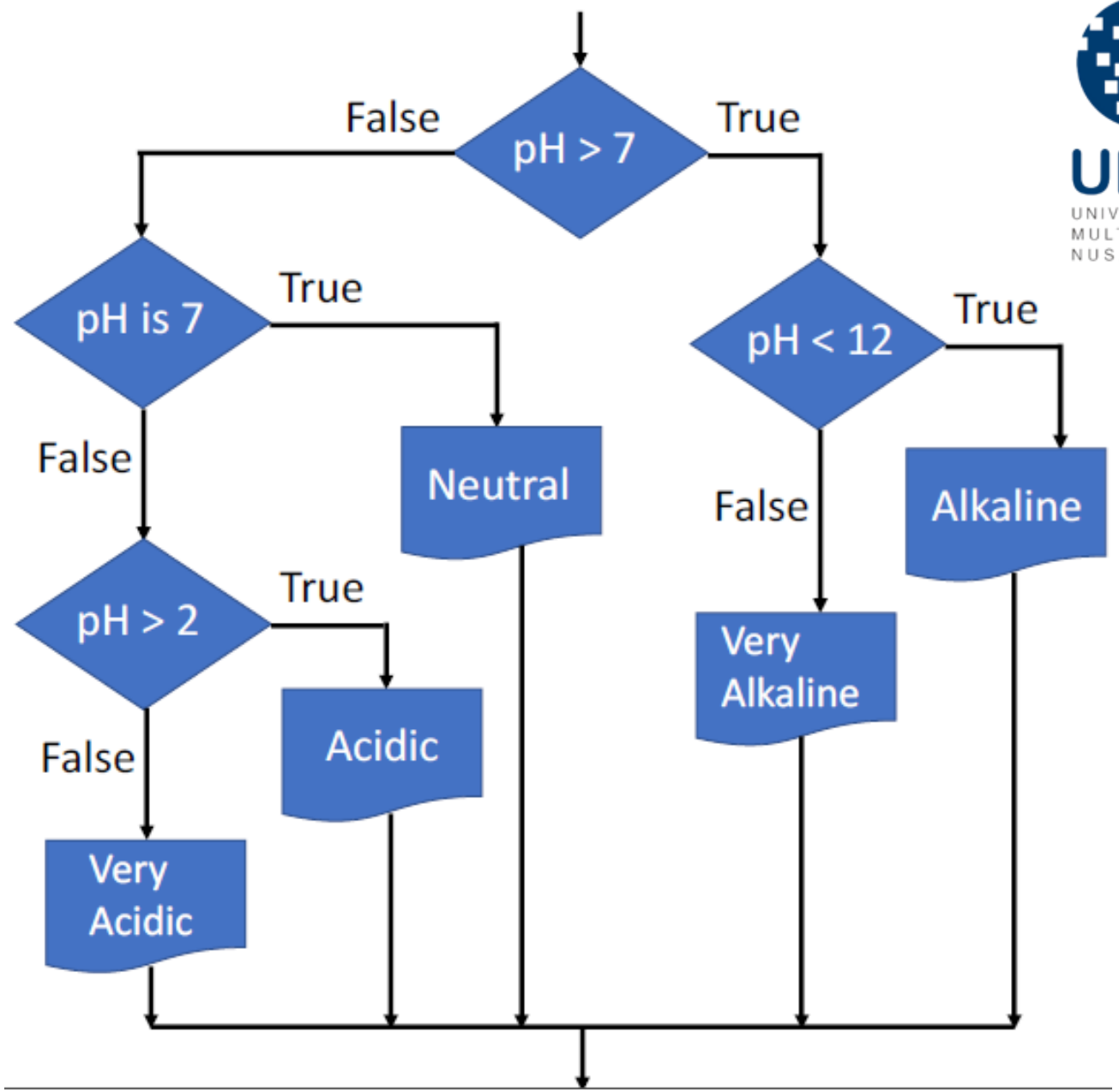
```c
#include <stdio.h>

int main()
{
    char color;

    color = getchar();
    switch(color)
    {
        case 'R': printf("Red\n");
        case 'G': printf("Green\n");
        case 'B': printf("Blue\n");
    }

    return 0;
}
```

Input :

```
R
```

Practice 4

- Write the **if statements** for the decision diagrammed in the accompanying flowchart.



Practice 5

- Write a switch statement that assigns to the variable **lumens** the expected brightness of a standard light bulb whose wattage has been stored in **watts**. Assign -1 to **lumens** if the value of **watts** is not in the table.

Watts	Brightness (in Lumens)
15	125
25	215
40	500
60	880
75	1000
100	1675

Practice 6

- Implement the following decision table using a **multiple-alternative if statement**. Assume that the wind speed is given as an integer. The screen dialogue should appear as follows:

Wind Speed (mph)	Category
Below 25	Not a strong wind
25 – 38	Strong wind
39 – 54	Gale
55 – 72	Whole gale
Above 72	Hurricane
Wind Speed (mph)	Category

```
Wind speed: 75

Category: Hurricane
```

```
Wind speed: 30

Category: Strong wind
```

NEXT WEEK'S OUTLINE

1. For
2. While…
3. Do…While…
4. Break
5. Continue

REFERENCES

- Hanly, Jeri R. and Koffman, Elliot B., 2013, Problem Solving and Program Design in C, Seventh Edition, Pearson Education, Inc.
- Deitel, Paul and Deitel, Harvey, 2016, C How to Program, Eighth Edition, Pearson Education, Inc.

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