**Experiment: 3**

PART A

(PART A: TO BE REFERRED BY STUDENTS)

**Aim:** Implementing programs using conditional/Decision making/selection statements

**Learning Outcomes:** The learner would be able to

1. Identify appropriate decision-making statement
2. Understand the syntax of decision-making statements
3. Use decision-making statements to solve problems by writing programs
4. Work with nested decision-making statements

**Theory:**

**C++ Control Constructs/Structure/Statements**

* Control statements are used to alter the flow of program execution.
* Control statements evaluate the condition (uses relational and/or logical operators) & control the flow of execution.
* C++ control constructs/statements are as follows.

|  |  |  |
| --- | --- | --- |
| **Decision Making Statements**  **or**  **Conditional Statements**  **Or**  **Selection Statements** | **Loop Control Statements**  **or**  **Iterative Statements** | **Jump Control Instructions or**  **Branching Statement** |
| * if | * for | * break |
| * if-else | * while | * continue |
| * Nested if-else | * do-while | * return |
| * else if Ladder |  |  |
| * switch-case |  |  |

**if**

* if - is a decision-making statement.
* “if” is the keyword used to decide to control the flow of execution.

**Syntax:-**

1. **‘if’ with single statement**

if(condition)

true\_statement;

* In the above syntax, the condition is evaluated first; if the condition is evaluated as true, then true\_statement is executed.
* The default scope of ‘if’ is a single statement; that’s why there is no need to use curly braces.

**‘if’ with multiple statement.**

if(condition){

true\_statement 1;

true\_statement 2;

…….

true\_statement n;

}

Using curly braces increased(multiple statements) the scope of the ‘if’ statement.

**if-else**

* If-else is a decision-making statement.
* The else clause is an extension to the if clause & contains a false part.
* “if” & “else” are keywords used to decide to control the flow of execution.
* **The else block should have matching if, otherwise, mismatch else error will occur.**
* As per syntax, no condition is required with the else block.

|  |  |
| --- | --- |
| **Syntax:-**   1. **if-else with single statement**   if(condition)  true\_statement;  else  false\_statement; | **Flowchart:-** |

In the above syntax, if (condition) is evaluated first, if the condition is evaluated as true, then true\_statement is executed. If the condition is evaluated as false, then false\_statement is executed.

|  |  |
| --- | --- |
| 1. **if-else with multiple statement.**   if(condition){  true\_statement 1;  true\_statement 2;  …….  true\_statement n;  }  else{  true\_statement 1;  true\_statement 2;  …….  true\_statement n;  } | **Flowchart:-** |

Using curly braces shows the increased scope of the ‘if’ & ‘else’ clauses. If the condition is evaluated as true, then true\_statements are executed; otherwise, false\_statements are executed.

**Nested if-else**

* It is a complex decision-making statement if and/or else clause can be nested one inside another (as per syntax of else).
* If clause may have if-else and/or its chain in nested if-else. Similarly, the else clause may have if-else and/or its chain or both if & else clauses have sub if-else clause/block.
* Complex nested if-else (Multiple decision-making) statements may cause problems maintaining the program.

**Syntax:-**

if(condition){

if(condition){

statements;

}

else{

statements;

}

}

else{

if(condition){

statements;

}

else{

statements;

}

}

In the above syntax, the inner if and/or else clauses may have if-else clauses in one another. It may confuse; that’s why to be careful when nesting if-else. Nested if-else is nothing but chained with one another.

**else-if ladder**

* It is a common programming construct used to make multiple decisions. Sometimes, we may call this as if-else-if ladder.
* It is different than that of nested if-else & less confusing than that of nested if-else.

**Syntax:-**

if(condition){

statements:

}

else if(condition){

statements;

}

else if(condition){

statements;

}

:

:

else{

statements;

}

In above format, condition is evaluated from top to down.

**switch case**

* It is a multiple-branching statement.
* It checks for equality, not condition.

**Advantages:-**

* Easy to use
* Easy to find out errors(if any) & debug.
* Complexity of the program is minimized.

**Syntax:**

switch(equality\_constant or variable or expression){

case constant1:

statement1;

break;

case constant2:

statement2;

break;

**:**

**:**

case constant\_n:

statement2;

break;

default:

default\_statement;

}

In above syntax:

* equality\_constant or variable or expression should be of type int or char.
* default is optional

**Nested switch case:**

* outer switch block may contain inner switch block, i. e. switch with in a switch.
* The inner and/or outer switch may contain same equality constant.

**Syntax:-**

switch(equality\_constant or variable or expression){

case constant1: statement1; break;

case constant2: statement2; break;

**:**

case constant\_n: statement2; break;

default: default\_statement;

switch(equality\_constant or variable or expression){

case constant1: statement1; break;

case constant2: statement2; break;

**:**

case constant\_n: statement2; break;

default: default\_statement;

}

}

**Instructions: - All the students are informed to write all executed code in workbook in following sequence and format.**

* + - 1. Problem Statement
      2. Input and Output
      3. Test Cases
      4. Flowchart
      5. Program (with color codes)

1. Red – Directives
2. Blue – Keywords, constants values
3. Green – Comments, messages
4. Black – {variables, functions, class, object} name, operators, punctuation
   * + 1. Trace Table (additional columns may require in some concepts)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Var-1 | Var-2 | …. | Var-n | Condition | Output |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

**Tasks:**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sr. No.** | **Problem Statement** | I/O | Test Cases | Flow chart | Program- with color codes | Trace Table |
| **1** | Develop a program that accepts sales amount; if the sales amount is more than 5000, then the discount is 12% of the sales amount; otherwise, it is 7%—display the total discount and amount to be paid after the discount. | **✓** |  | **✓** | **✓** |  |
| **2** | Write a program to test whether a given character is a capital or small letter and change small letters to capital letters and vice versa. | **✓** |  | **✓** | **✓** |  |
| **3** | Implement a program to accept a year as input and print whether it is a leap. A year is a leap if divisible by 4, and centennial years (years divisible by 100) are leap years only when divisible by 400. | **✓** | **✓** | **✓** | **✓** | **✓** |
| **4** | Develop a program to perform divisibility tests by 3 and 5. If the entered number is divisible by three and not by five print “THREE”; if the number is divisible by five and not by three print “FIVE”; if divisible by both 3 & 5 print “BOTH” otherwise, print “NOT” | **✓** |  | **✓** | **✓** |  |
| **5** | Vitamin D3 is recommended as the best indicator of vitamin D's nutritional status. If any patient is undergone a Vitamin D3 test, its value ranges from 0 <= to >100 nm/ML. Scott is a Pathologist, and he is doing a vitamin D3 test on his patient. You have to help him automate this process to know the status/level of vitamin D3 depending on its values in nm/mL. Write a program to help Scott to tell the status/level to patients as given in the table below.   |  |  | | --- | --- | | **D3 in nm/ML** | **Status** | | <20 | Deficiency | | 20-30 | Insufficiency | | 30-100 | Sufficiency | | >100 | Toxicity | | **✓** | **✓** | **✓** | **✓** |  |
| **6** | Write a program that takes three coefficients (a,b,and c) of a quadratic equation; ax2+bx+c=0 as input, compute all possible roots, and print them with appropriate messages.  Calculation of roots of a quadratic equation | **✓** | **✓** | **✓** | **✓** | **✓** |
| **7** | Using a switch case, write a program to check whether the entered character is a vowel or consonant. | **✓** |  |  | **✓** |  |
| **8** | Write a program that takes an arithmetic operator (+, -, \*, or /) and two operands from the user. Perform corresponding arithmetic operations on the operands using switch case. | **✓** | **✓** | **✓** | **✓** |  |
| **9** | Implement a menu-driven program to calculate the area of a triangle, rectangle, circle, and sphere. | **✓** |  |  | **✓** |  |