ST CLEMENT'S SECONDARY SCHOOL

Programming and Pseudo Code Algorithms

GRADE 11

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PSEUDOCODE

- **Pseudocode** is a method of writing out computer code in the English language before creating it in a specific computer language.
- There is no standard way to write pseudocode
- Pseudo-code is an informal way to express the design of a computer program or an algorithm.
- The aim is to get the idea quickly and also easy to read without details.

EXAMPLE

- READ height of rectangle
- READ width of rectangle
- COMPUTE area as height times width
- Display the Area

EXAMPLE 2

If student's grade is greater than or equal to 50

Print "passed"

else

Print "failed"

endif

EXAMPLE 3

- READ HoursWorked
  READ NormalMax
  IF HoursWorked > NormalMax THEN
  Display overtime message
  ELSE
  Display regular time message
  ENDIF

EXERCISE

1. Write pseudo code that reads two numbers and multiplies them together and print out their product.

2 Write pseudo code that tells a user that the number they entered is not a 5 or a 6.

3 Write pseudo code that performs the following: Ask a user to enter a number. If the number is between 0 and 10, write the word blue. If the number is between 10 and 20, write the word red. if the number is between 20 and 30, write the word green. If it is any other number, write that it is not a correct colour option.

SOLUTION

1. Read num1 , num2

Set multi to num1*num2

Write multi

2. Read isfive If(isfive = 5) Write "your number is 5“

Else if (isfive = 6)

Write "your number is 6"

Else Write "your number is not 5 or 6"

3. Write "Please enter a number"

Read colornum

If (colornum >0 and colornum <= 10)

Write blue

else If (colornum >0 and colornum <= 10)

Write blue

else If (colornum >0 and colornum <= 10)

Write "not a correct color option"

Loops and decision making

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CONDITIONS AND ITERATIONS STATEMENTS

- Loop: a part of a program that may execute > 1 time (*i*.e., it repeats)
- Loops are a programming element that repeat a portion of code a set number of times until the desired process is complete.
- Repetitive tasks are common in programming, and loops are essential to save time and minimize errors.

REAL WORLD EXAMPLES OF LOOP

- Software of the ATM machine is in a loop to process transaction after transaction until you acknowledge that you have no more to do.
- Software program in a mobile device allows user to unlock the mobile with 5 password attempts.
- After that it resets mobile device.

TYPES OF LOOPS

- *Repeat … until*
- *if … then …else*
- *endif*
- *case…of …*
- *otherwise … endcase*
- *while… do …*
- *endwhile*
- *for … end for*

CONDITIONAL STATEMENT

IF STATEMENTS

- *if … then …else*
- *endif*

EXAMPLE 1

ZANACO uses internet baking. This pseudocode checks the PIN

```
c ← 0
INPUT PIN
x ← PIN
REPEAT
x ← x/10
c ← c + 1
UNTIL x < 1
IF c <> 5
THEN
PRINT " Wrong PIN"
ELSE
PRINT "Correct PIN"
ENDIF
```

EXAMPLE

Read the following program code that inputs 20 numbers and then outputs the largest.

```
1 h = 0
2 c = 0
3 REPEAT
4 READ x
5 IF x > h THEN x = h
6 c = c +1
7 PRINT h
8 UNTIL c < 20
```

QUESTIONS

(a)Locate three errors and suggest a corrected piece of code.

1.....

2.....

3.....

SOLUTION

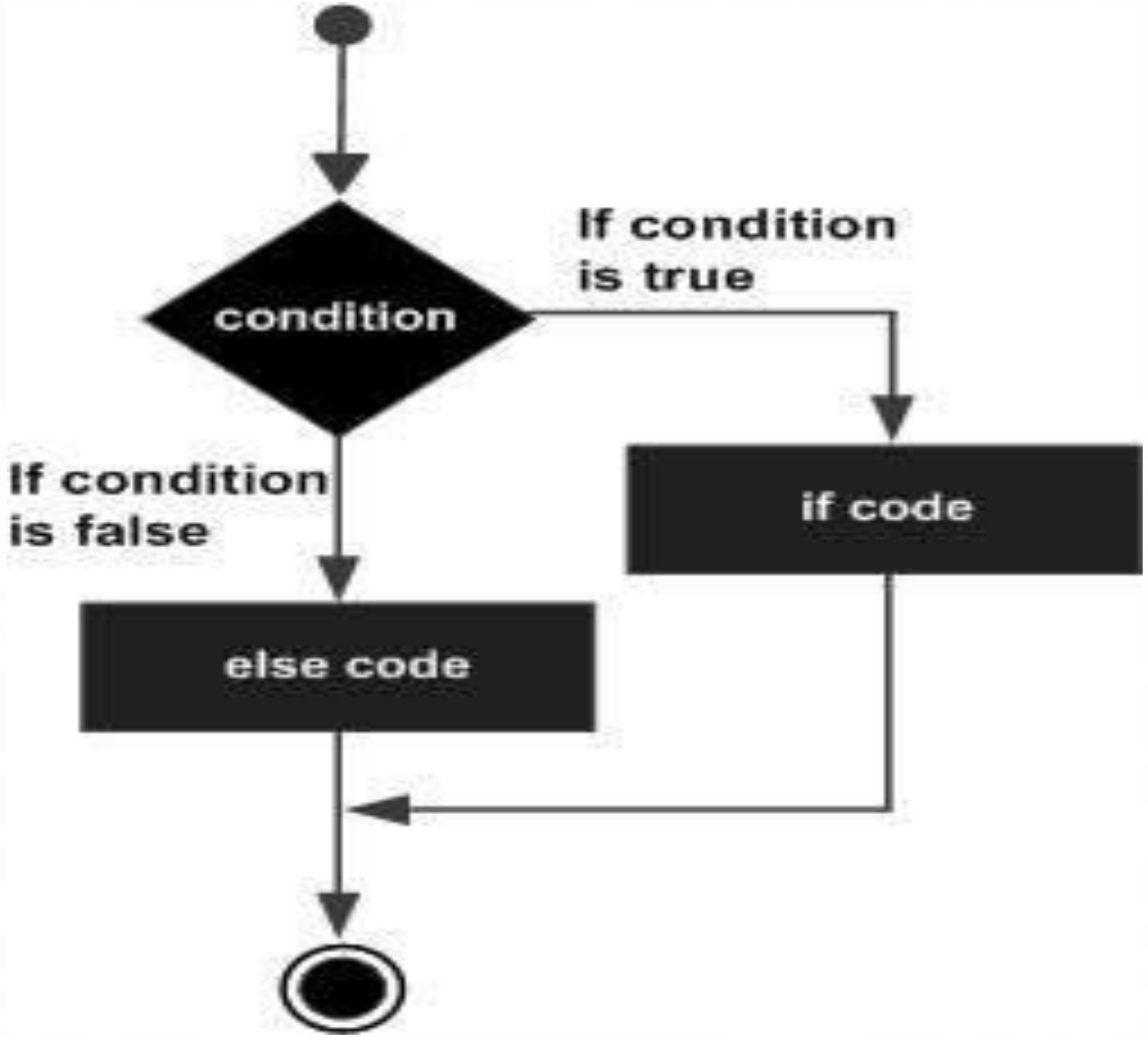
1. Line 5 correction: IF x > h, THEN h = x
2. Line 7 correction PRINT should come after the end of the repeat loop
3. Line 8 UNTIL c = 20

IF … THEN …ELSE

- if statement tests a condition and then completes an action based on whether a result is true or false.

IF condition
THEN S1;
ELSE S2;
END IF;

Where, *S1* and *S2* are different sequence of statements. In the **IF-THEN-ELSE statements**, when the test condition is TRUE, the statement *S1* is executed and *S2* is skipped; when the test condition is FALSE, then *S1* is bypassed and statement *S2* is executed.


condition
If condition
is true
if code
If condition
is false
else code

EXAMPLE

Customers can withdraw cash from ATM.

- Withdraw is refused if the amount entered > current balance
- Withdraw is refused if amount entered > daily limit
- If current balance is < K500, then charge 2% is made
- If current balance > K500, no charge is made

Write an algorithm which inputs a request for a sum of money, decides if a withdrawal can be made and calculates any charges. Appropriate output should be included.

SOLUTION

input amount

if amount > balance or amount > daily limit then

Print “Withdrawal not allowed”

else

If the balance < 500 then

Print “charges = K”, amount * 0.02

else

Print “ Charges = K0”

endif

endif

EXERCISE

Write an algorithm, using pseudocode which,

- Inputs three numbers
- Outputs the **largest** of the three numbers

SOLUTION

Input a, b, c

If a > b and b > c

Print a

Else

If b > c then

Print b

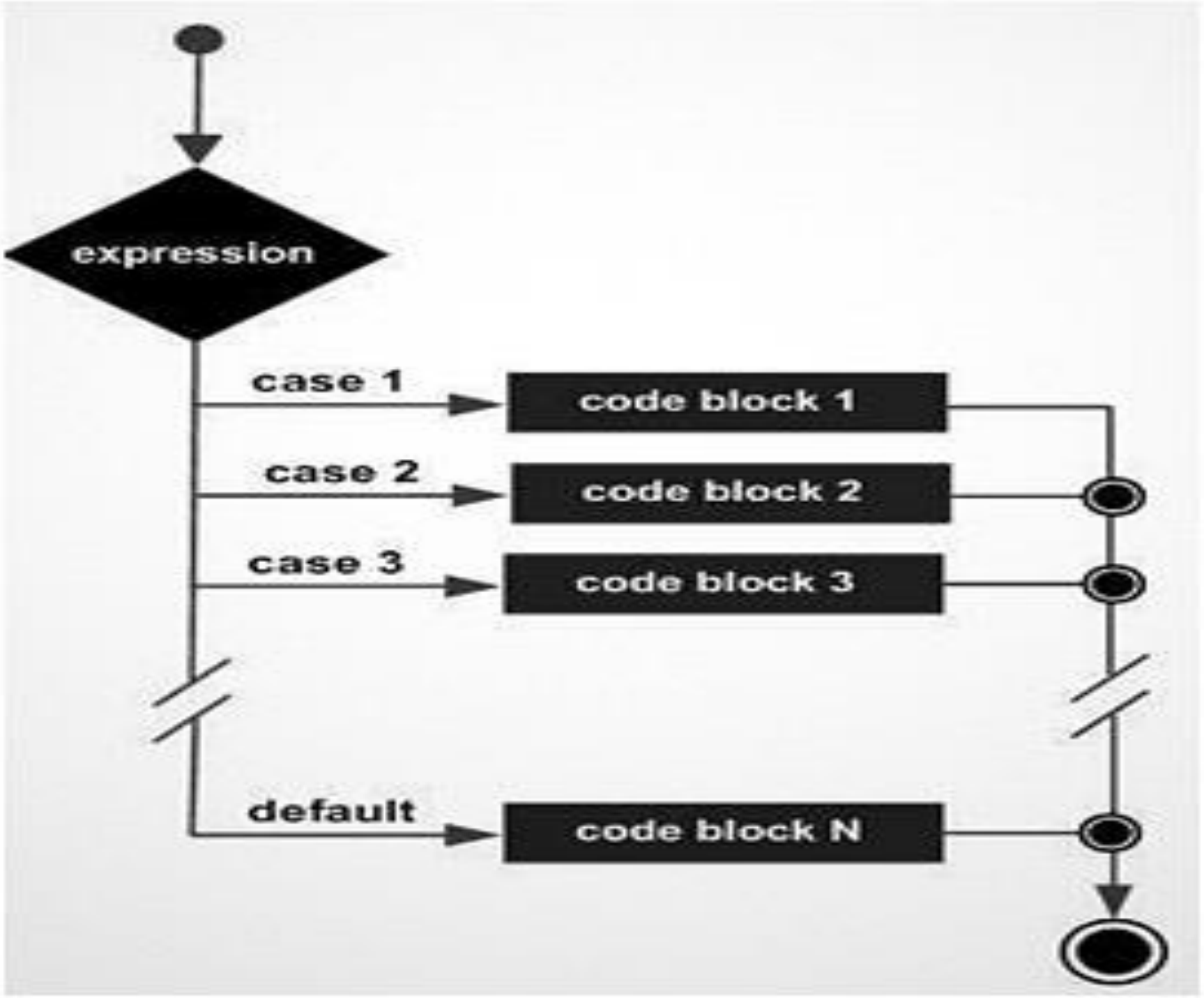
Else

Print c

CASE STATEMENTS

1. *case…of …*
2. *otherwise … endcase*

- This statement evaluates an expression against multiple potential cases and executes a block of code if the expression matches that block's corresponding case.


expression
case 1
code block 1
case 2
code block 2
case 3
code block 3
default
code block N

EXERCISE

Study the algorithm below and answer the questions that follow

BEGIN

ENTER amount invested as amount

ENTER a value (between 1 and 100)

SELECT CASE VALUE of

Case 1 to 3

Interest = 6

Case 4 to 7

Interest = 8

Case 9 to 10

Interest = 10

END SELECT

Final balance = AMOUNT = (interest/100)*AMOUNT

END

QUESTIONS

(a)Estimate the final balance if the following data is input

AMOUNT = 170

Value = 9

(b) What is the purpose of this algorithm?

Identify two different conditional statements that you can use when writing pseudocode

ITERATIONS STATEMENTS

- *while… do …*
- *endwhile*
- *for … end for*

REPEAT … UNTIL

- The "sequence" in this type of loop is always performed at least once, because the test is performed after the sequence is executed.
- At the conclusion of each iteration, the condition is evaluated, and the loop repeats if the condition is false.
- The loop terminates when the condition becomes true.

QUESTIONS

(a)What value of c and what message would be output if the following PINs were entered?

(i) 51020 Value of c

(ii)Message

(iii)5120 value of c

(iv)Message

SOLUTION

(a

(i)Value of c is 5

(ii)Message: Correct PIN

(iii)Value of c is 4

(iv)Message: Wrong PIN

EXERCISE

Algorithm and programs use loops to control the number of times a particular procedure is used.

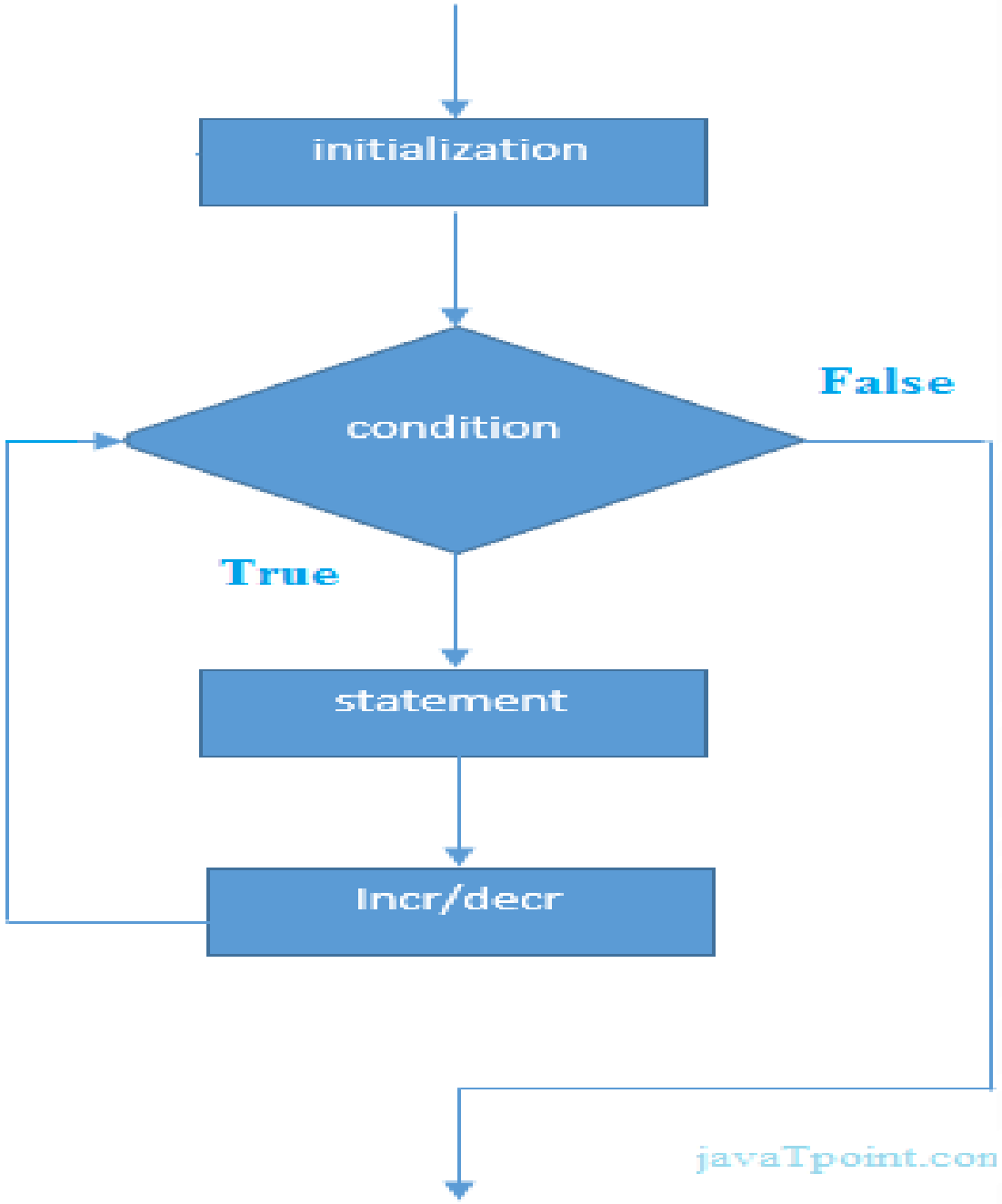
(a) Write a procedure using repeat …… until method to input 20 numbers into a variable called x

SOLUTION

```
count = 0

REPEAT

input  x

count = count +  1

UNTIL

count = 20

Display count
```

FOR … END FOR

- A "For" Loop is used to repeat a specific block of code a known number of times.
- For example, if we want to check the grade of every student in the class, we loop from 1 to that number.
- For loop consists of three parts: the keyword For that starts the loop, the condition being tested, and the EndFor keyword that terminates the loop.


initialization
condition
False
True
statement
Incr/decr
javaTpoint.com

TYPES OF STATEMENT IN FOR LOOP

- Assignment
- Iteration
- Input
- output

Statement type	example
Assignment	$x \leftarrow y + z$
Input	read x
Iteration	for $x \leftarrow 1$ to 10
Output	Print x

EXAMPLE

Write a routine using a **for ……. to** loop which part inputs 100 numbers and outputs how may of the numbers were negative

SOLUTION

Set negative = 0

for i = 1 to 100

input number

if number < 0 then

negative = negative + 1

endif

next i

Print negative

FOR LOOP IN C++

```
1.#include <iostream>
2.using namespace std;
3.int main() {
4.        for(int i=1;i<=10;i++){
5.            cout<<i <<"\n";
6.        }
7.   }
```

EXERCISE

Write an algorithm using pseudocode which:

- inputs 100 numbers
- finds the average of the input numbers
- outputs the average

SOLUTION

Total = 0

For x = 1 to 100

Input number

Total = Total +1

Next x

Average = Total/100

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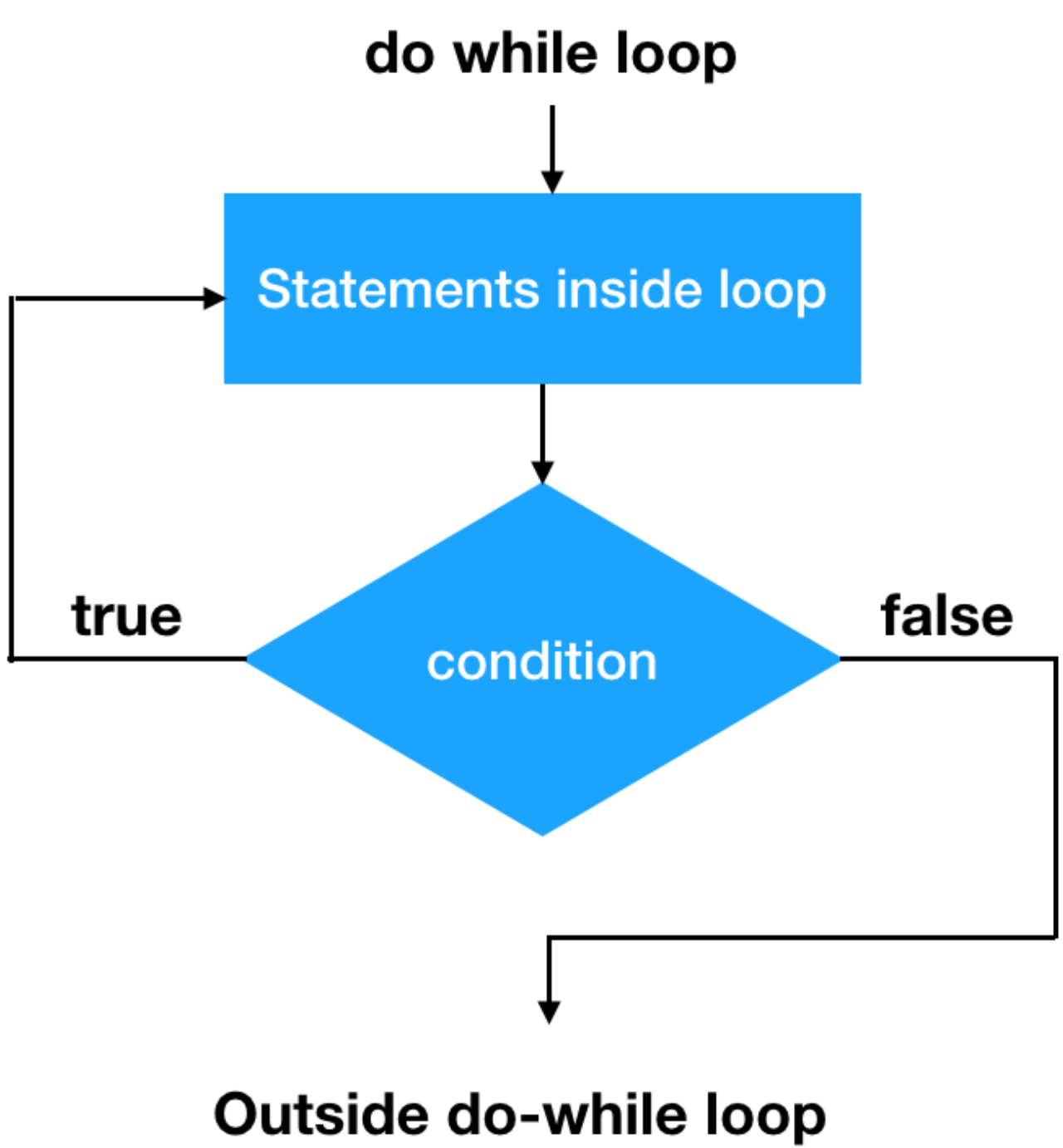
Print average

WHILE… DO

```
do {
 // the body of the loop
}
while (testExpression);
```

WHILE… DO

- The body of do...while loop is executed once. Only then the testExpression is evaluated.
- If testExpression is **true**, the body of the loop is executed again and testExpression is evaluated once more.
- This process goes on until testExpression becomes **false**.
- If testExpression is **false**, the loop ends.


do while loop
Statements inside loop
condition
true
false
Outside do-while loop

Dry run with a trace tables

TRACE TABLE

- A trace table is a technique used to test an algorithm and predict step by step how the computer will run the algorithm.
- Trace tables are used **to allow programmers to trace the value of variables as each line of code is executed.**
- The values of the variables are displayed in a table and assist the programmer in identifying any potential errors.

DRY RUN

- a dry run can be done using a technique known as trace tables
- Trace tables show how the variables change at each stage in the algorithm.
- Trace tables find the outputs for a given set of data to test if the flowchart or pseudocode gives expected results.
- Trace tables help determine what a given algorithm has been designed to do.

EXAMPLE

Write a trace table for the following algorithm

For x = 1 to 6

Y = x * 3

NEXT x

Output y

SOLUTION

x	y	Output
1	3	
2	6	
3	9	
4	12	
5	15	
6	24	24

EXERCISE

Write a trace table for the following algorithm

```
a = 4

y = 0

For x = 1 to a

y = y + ( x * a)

NEXT x

Output y
```

SOLUTION

a	x	y	output
4		0	
	1	4	
	2	12	
	3	24	
	4	40	40

EXERCISE

The algorithm below checks whether the entered PIN is correct or wrong. Study it carefully and answer the questions that follow.

```
c = 0
Input PIN
x = PIN
REPEAT
X = X/10
C = C +1
UNTIL X < 1
IF c <> THEN
PRINT “Wrong PIN entered”
ELSE
PRINT “Correct PIN”
ENDIF
```

Dry run the above algorithm and complete the missing values of x in the table below

x = 2560 is the input data and count c starting with 0

Input (PIN)	x	c
2560	2560	0
	256	1
	_____	2
	_____	3
	_____	4

Output .....

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