



FACULTY OF COMPUTING AND INFORMATICS

TCP1101 PROGRAMMING FUNDAMENTALS

TRIMESTER 2 2020/2021

Assignment#1

Report

Lecture Section: TC1V

Tutorial Section: TT4V

INSTRUCTOR'S NAME: Dr. Sharaf El-Deen Sami Mohammed Al- Horani

Student ID	Name	Email Address	Phone No.
1191102340	Ahmed Hassan Mohammed Salem	1191102340@student.mmu.edu.my	0173480200

Contents

- 1-Introduction – page 3
- 2-Screenshots – page 4
- 3-User manual – page 6
- 4-Flowcharts – page 10
- 5-Structure chart – page 22
- 6-References – page 23
- 7-Assignment Submission Declaration – page 24

Introduction

Trigonometry, a term that most people who studied basic mathematics are familiar with it. It is basically all about triangles and finding the missing angle and sides of a triangle. When we were studying in secondary school, if we want to solve any problem related to trigonometry, we would easily use our calculators to carry out sin, cos and tan functions and get our answer! However, the calculator does not do some kind of magic to get you the answers, in fact it carries out a process of calculations before it delivers to you the answer.

For students to understand how such values are computed , in this program I have developed sine, cosine and tangent functions by implementing the Taylor series and have shown how the Taylor series compute the values until the accurate result, depending on the precision of the user. The sine and cosine function will take the angle (converted to radian) and use the Taylor series (given below):

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \frac{x^9}{9!} - \dots$$

$$\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \dots$$

The program compute the most accurate result depending on the precision (which is by default 10, but the user can adjust it). Each term is calculated by using the formula: $\text{power}(x,c) / \text{factorial}(c)$, where x is the angle in radians and c is the counter. The new term then is added to the previous term by using the formula $\text{termOld} + (\text{termNew} * \text{sign})$ and the sum of this is stored in a variable called "result", then termOld is set to be the termNew , after that the counter is incremented by 2 and the termNew is calculated, the process repeats until the difference between the termOld and termNew is less than the precision (for example 0.000001), then the computation will stop and the final result will be printed out with the computation that was carried out by the sine and cosine functions and how it was derived to illustrate to the students how the Taylor series is actually implemented in a practical way. Therefore, the program helps the students to understand the Taylor series practically rather than looking at the formula and imagining how it is implemented Adding to that, the program provides the option for the user to calculate the area of triangle using the formula, $(1/2) * \text{hypotenuse} * \text{adjacent} * \sin(\text{opposite})$ which helps the students in their assignments to calculate the accurate areas of triangle.

ScreenShots

Sample Run :

1

```
+-----+
| Trigonometry program |
+-----+
Mode(Degree or radian?) = degree
Precision = 10
+-----+
Select:
1 => Switch Degree/Radian mode
2 => Set decimal precision
3 => Display results
4 => Triangle Area Calculator
5=> More info
Q => Quit
+-----+

Choice => 1
Mode(Degree or radian?) = radian
Press any key to continue...
```

2

```
+-----+
| Trigonometry program |
+-----+
Mode(Degree or radian?) = radian
Precision = 10
+-----+
Select:
1 => Switch Degree/Radian mode
2 => Set decimal precision
3 => Display results
4 => Triangle Area Calculator
5=> More info
Q => Quit
+-----+

Choice => 3
Angle value in radians => 6
```

3

```
computing sine..

1 => -30.00000000
2 => 34.80000000
3 => -20.74285714
4 => 7.028571429
5 => -2.060259740
6 => 0.03716283716
7 => -0.3223953190
8 => -0.2748067395
9 => -0.2798160636
10 => -0.2793866930
11 => -0.2794172411
12 => -0.2794154082
13 => -0.2794155022
14 => -0.2794154980
15 => -0.2794154982
16 => -0.2794154982
17 => -0.2794154982
```

4

```
computing cosine..

1 => -17.00000000
2 => 37.00000000
3 => -27.80000000
4 => 13.85714286
5 => -2.805714286
6 => 1.738701299
7 => 0.8398059084
8 => 0.9746402169
9 => 0.9587773571
10 => 0.9602801543
11 => 0.9601630533
12 => 0.9601706903
13 => 0.9601702673
14 => 0.9601702875
15 => 0.9601702866
16 => 0.9601702867
17 => 0.9601702867
18 => 0.9601702867
RESULTS:
x = 6.0000000000
sin(x) = -0.2794154982
cos(x) = 0.9601702867
tan(x) = -0.2910061914
Press any key to continue...
```

5

```

Precision = 10
+-----+
| Select: |
| 1 => Switch Degree/Radian mode |
| 2 => Set decimal precision |
| 3 => Display results |
| 4 => Triangle Area Calculator |
| 5=> More info |
| Q => Quit |
+-----+
Choice => 4
-----Area Caclulator-----
Hypotenuse => : 40
Adjacent   => : 50
Opposite   => : 60
Value of sine is needed to calculate area...
computing sine..

1 => 0.8558007816
2 => 0.8662952838
3 => 0.8660212717
4 => 0.8660254451
5 => 0.8660254035
6 => 0.8660254038
7 => 0.8660254038
8 => 0.8660254038
Area is: 866.0254038 cm^2
Press any key to continue...

```

6

```

+-----+
| Trigonometry program |
+-----+
Mode(Degree or radian?) = radian
Precision = 10
+-----+
| Select: |
| 1 => Switch Degree/Radian mode |
| 2 => Set decimal precision |
| 3 => Display results |
| 4 => Triangle Area Calculator |
| 5=> More info |
| Q => Quit |
+-----+
Choice => Q
Thank you for using MMU trigonometric Calculator

```

User Manual

1. Select your choice from home screen

```
+-----+
|  Trigonometry program  |
+-----+
Mode(Degree or radian?) = degree
Precision = 10
+-----+
|  Select:                |
|  1 => Switch Degree/Radian mode |
|  2 => Set decimal precision  |
|  3 => Display results       |
|  4 => Triangle Area Calculator |
|  5=>  More info            |
|  Q => Quit                  |
+-----+
Choice =>
```

2. Choose option 1 and change mode to radian then press any key to continue

```
+-----+
|  Trigonometry program  |
+-----+
Mode(Degree or radian?) = degree
Precision = 10
+-----+
|  Select:                |
|  1 => Switch Degree/Radian mode |
|  2 => Set decimal precision  |
|  3 => Display results       |
|  4 => Triangle Area Calculator |
|  5=>  More info            |
|  Q => Quit                  |
+-----+
Choice => 1
Mode(Degree or radian?) = radian
Press any key to continue...
```

3. After that, choose option 2 and change the precision to 5 (or any value you desire) then press any key to continue

Degree switched to radian!

```
+-----+
|  Trigonometry program  |
+-----+
Mode(Degree or radian?) = radian
Precision = 10
+-----+
|  Select:               |
|  1 => Switch Degree/Radian mode
|  2 => Set decimal precision
|  3 => Display results
|  4 => Triangle Area Calculator
|  5=> More info
|  Q => Quit
+-----+

Choice => 2
decimal precision => 5
Press any key to continue...
```

Precision switched to 5!

3. Choose option 3 then input the angle value in radians

```
+-----+
|  Trigonometry program  |
+-----+
Mode(Degree or radian?) = radian
Precision = 5
+-----+
|  Select:               |
|  1 => Switch Degree/Radian mode
|  2 => Set decimal precision
|  3 => Display results
|  4 => Triangle Area Calculator
|  5=> More info
|  Q => Quit
+-----+

Choice => 3
Angle value in radians => 1
```

Computation of sine

Computation of cosine

Results displayed

```
computing sine..
```

```
1 =>    0.83333  
2 =>    0.84167  
3 =>    0.84147  
4 =>    0.84147  
5 =>    0.84147  
6 =>    0.84147
```

```
computing cosine..
```

```
1 =>    0.50000  
2 =>    0.54167  
3 =>    0.54028  
4 =>    0.54030  
5 =>    0.54030  
6 =>    0.54030
```

```
RESULTS:
```

```
    x  = 1.00000  
sin(x) = 0.84147  
cos(x) = 0.54030  
tan(x) = 1.55741  
Press any key to continue...
```

**4. Choose
option 4**

```
+-----+  
|  Trigonometry program  |  
+-----+  
Mode(Degree or radian?) = radian  
Precision = 5  
+-----+  
|  Select:                |  
|  1 => Switch Degree/Radian mode  
|  2 => Set decimal precision  
|  3 => Display results  
|  4 => Triangle Area Calculator  
|  5=> More info  
|  Q => Quit               |  
+-----+  
Choice => 4
```


5. Input the values for calculating area of triangle

RESULT

```
Choice => 4
-----Area Calculator-----
Hypotenuse => : 30
Adjacent   => : 40
Opposite   => : 50
Value of sine is needed to calculate area...
computing sine..
```

```
1 => 0.76190
2 => 0.76612
3 => 0.76604
4 => 0.76604
5 => 0.76604
Area is: 459.63 cm^2
Press any key to continue...
```

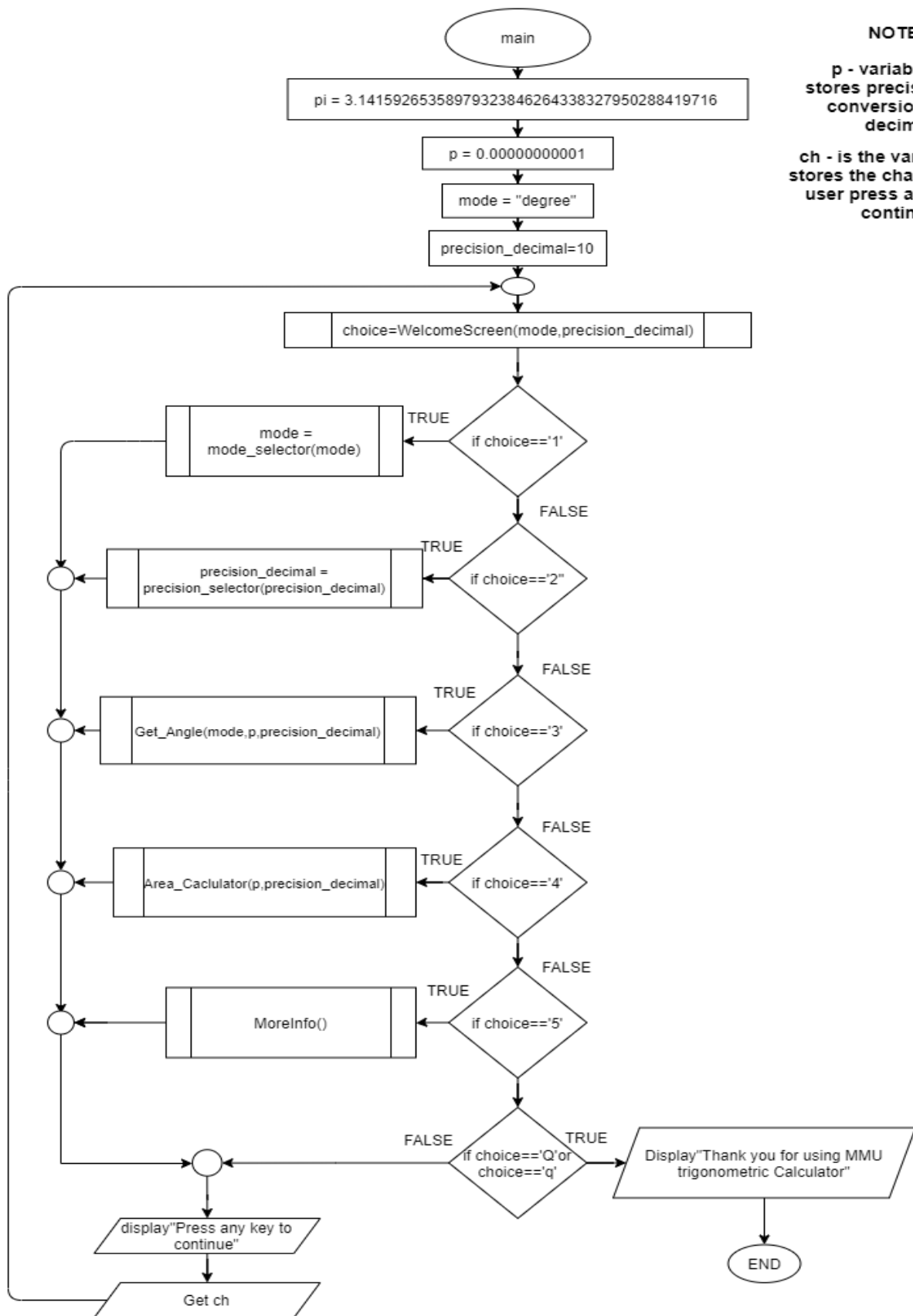
6. Type Q , if you wish to quit while in homescreen

```
+-----+
| Trigonometry program |
+-----+
Mode(Degree or radian?) = radian
Precision = 5
+-----+
| Select:               |
| 1 => Switch Degree/Radian mode |
| 2 => Set decimal precision  |
| 3 => Display results        |
| 4 => Triangle Area Calculator |
| 5=> More info              |
| Q => Quit                  |
+-----+
```

```
Choice => Q
Thank you for using MMU trigonometric Calculator
```

Flowcharts

Main function Flowchart

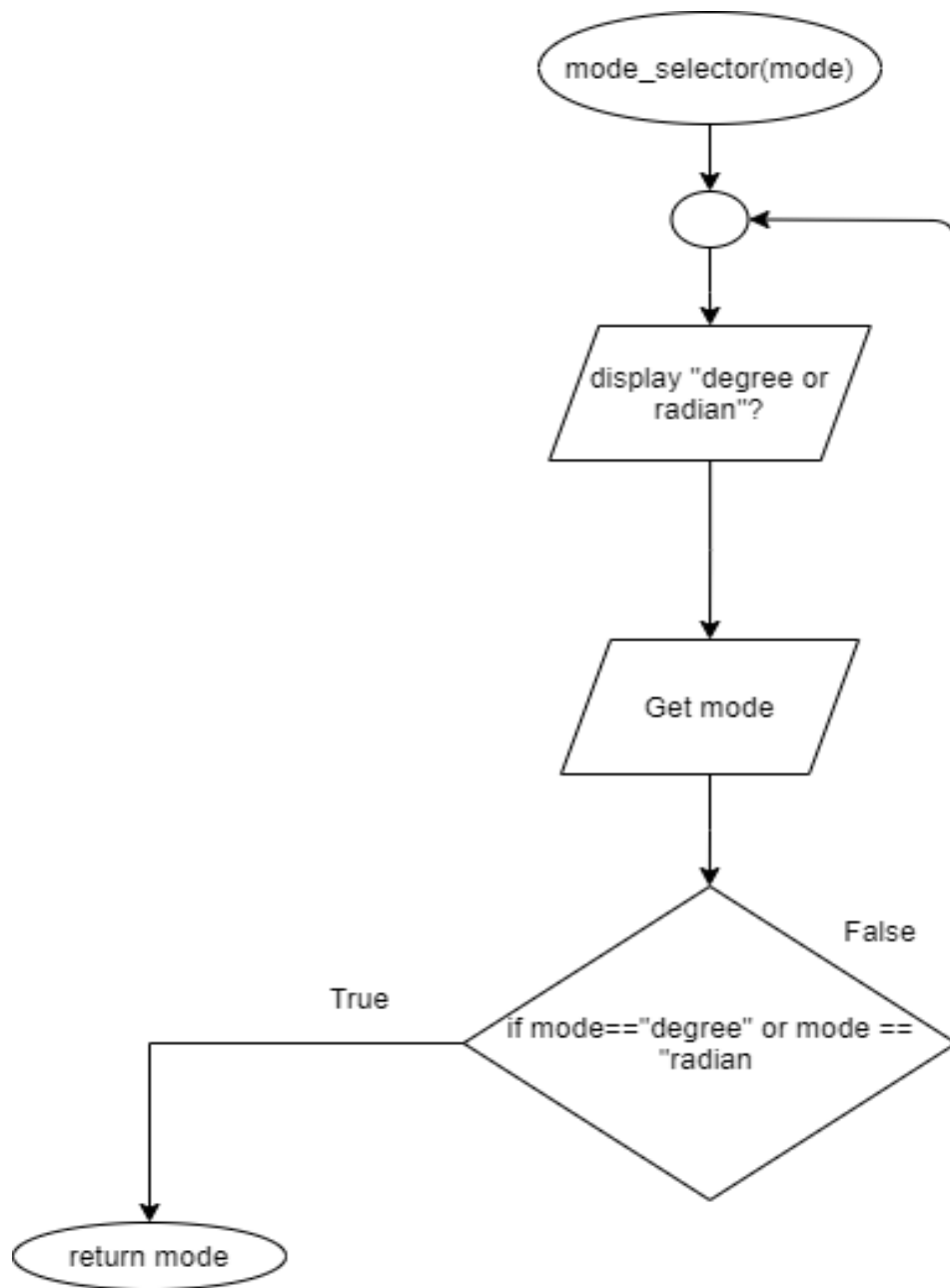


NOTE:

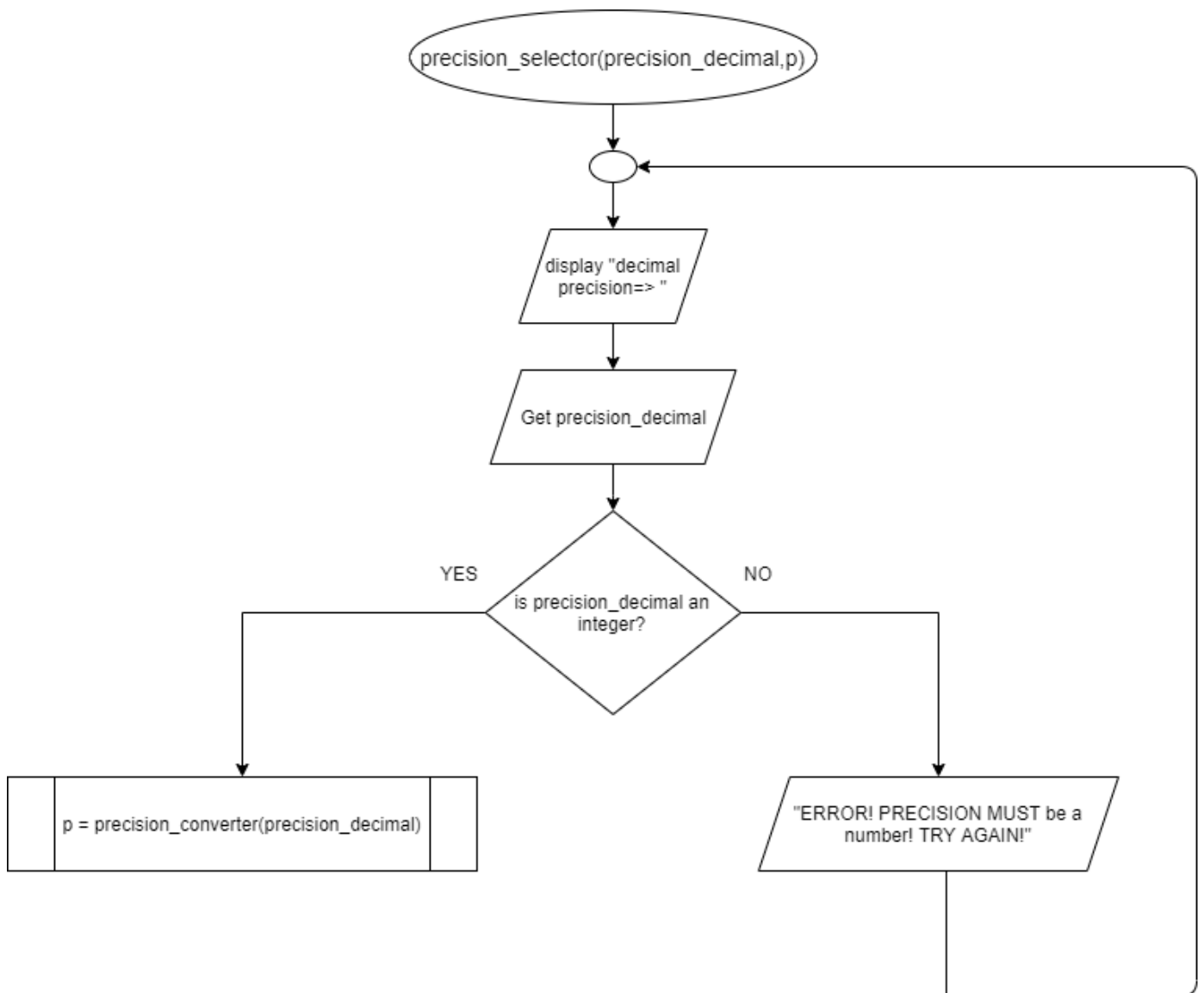
p - variable that stores precision after conversion from decimal

ch - is the variable that stores the character after user press any key to continue

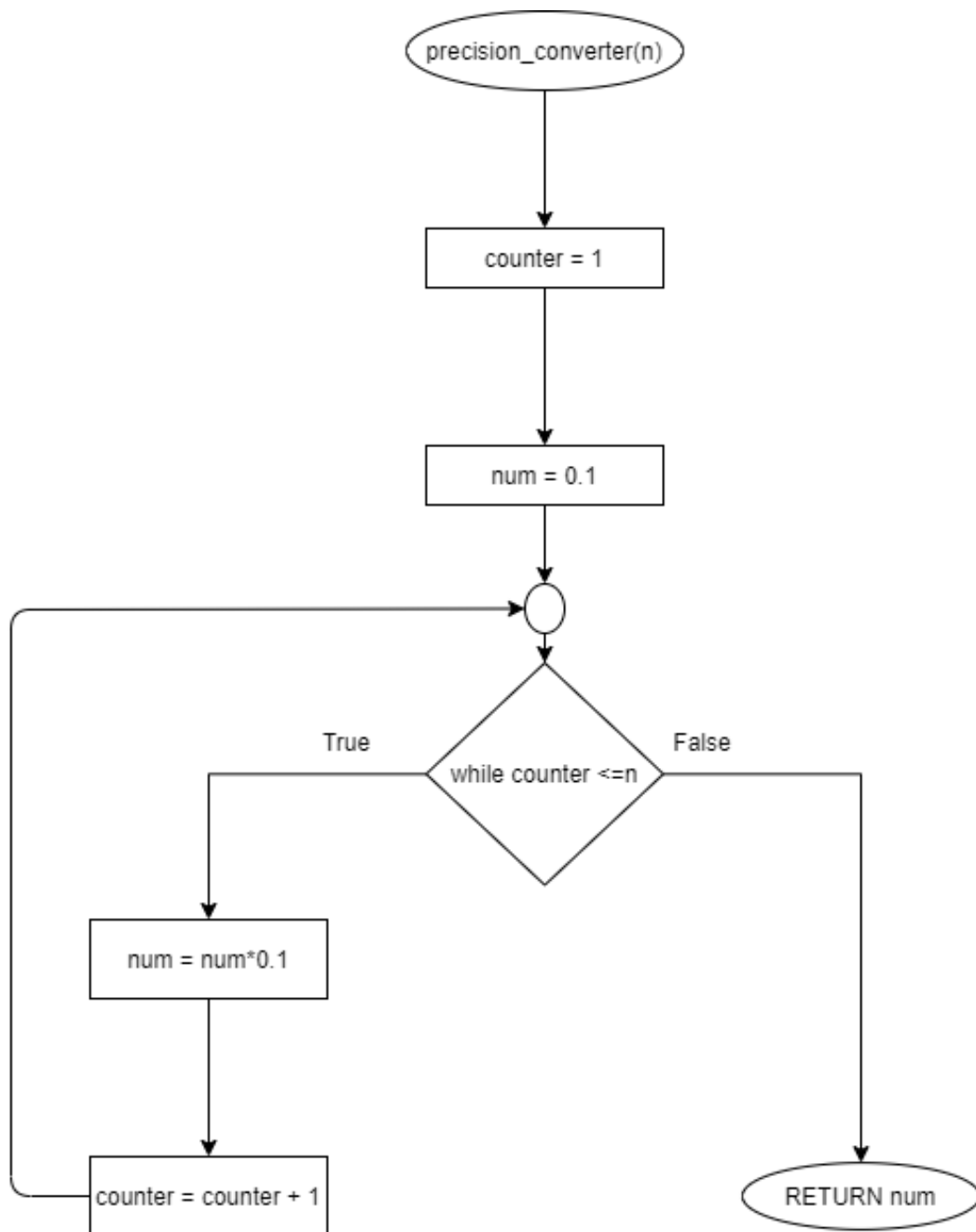
mode_selector Function (called by Main) Flowchart



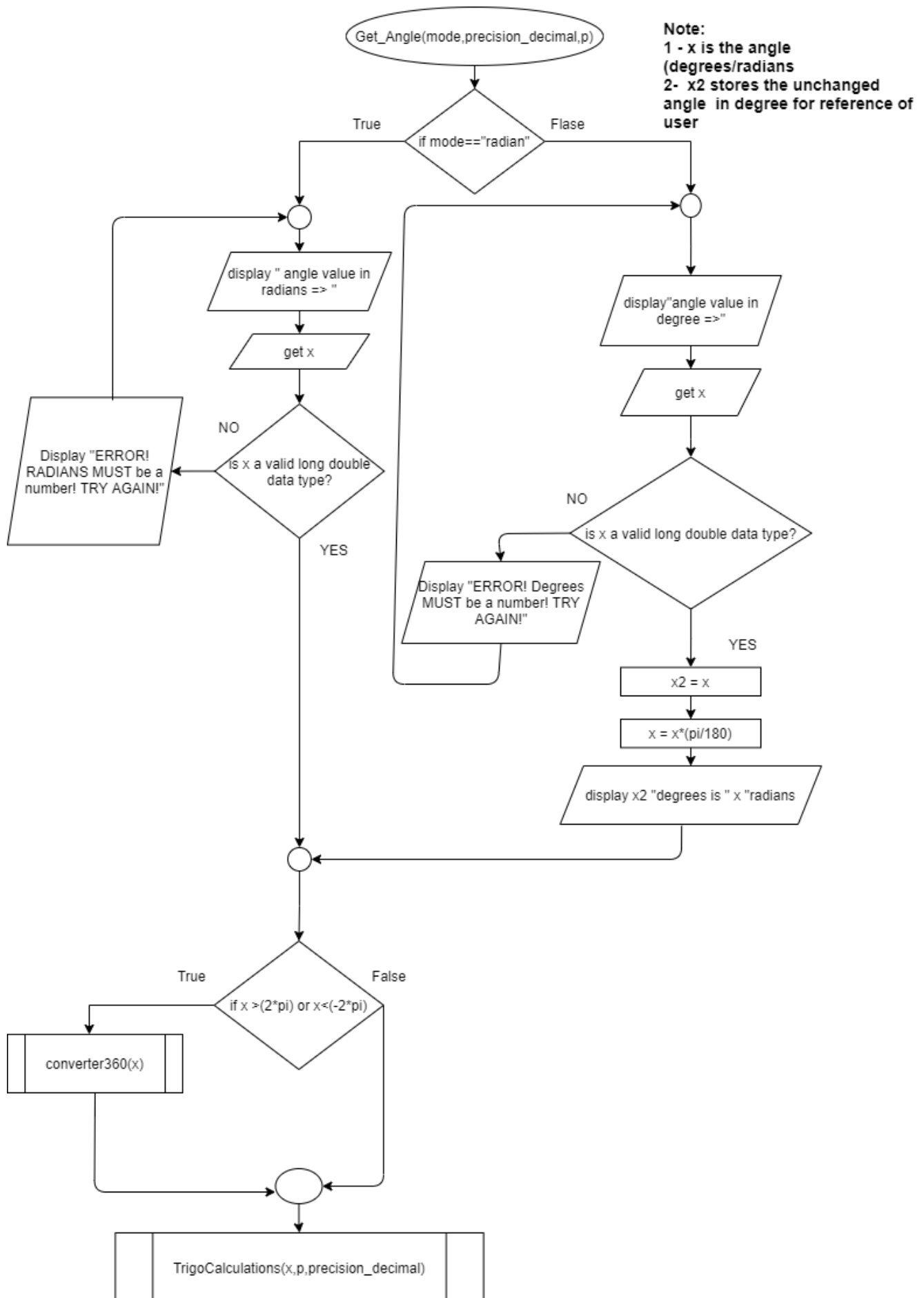
precision_selector Function (called by Main)



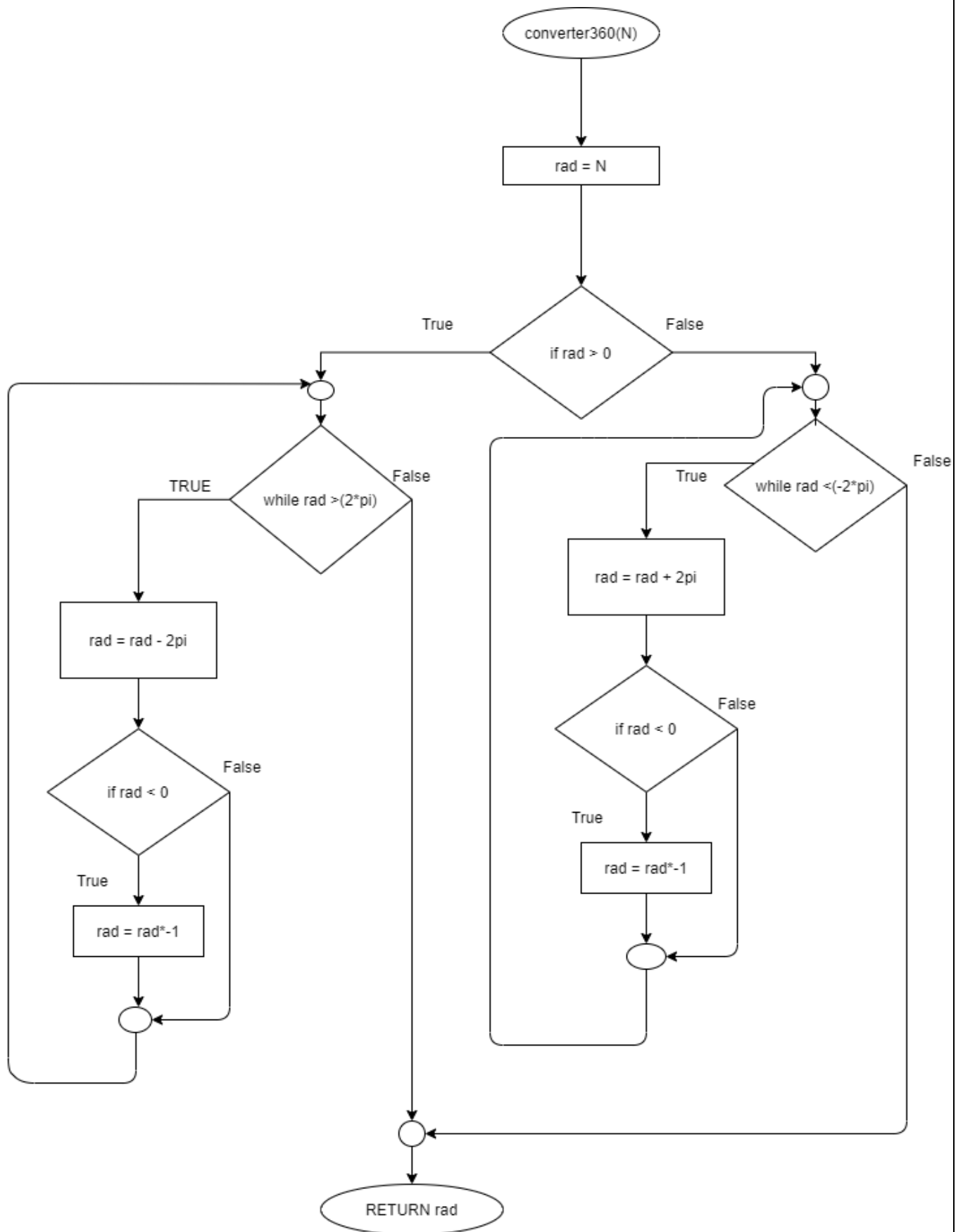
precision_converter function (called by precision_selector)



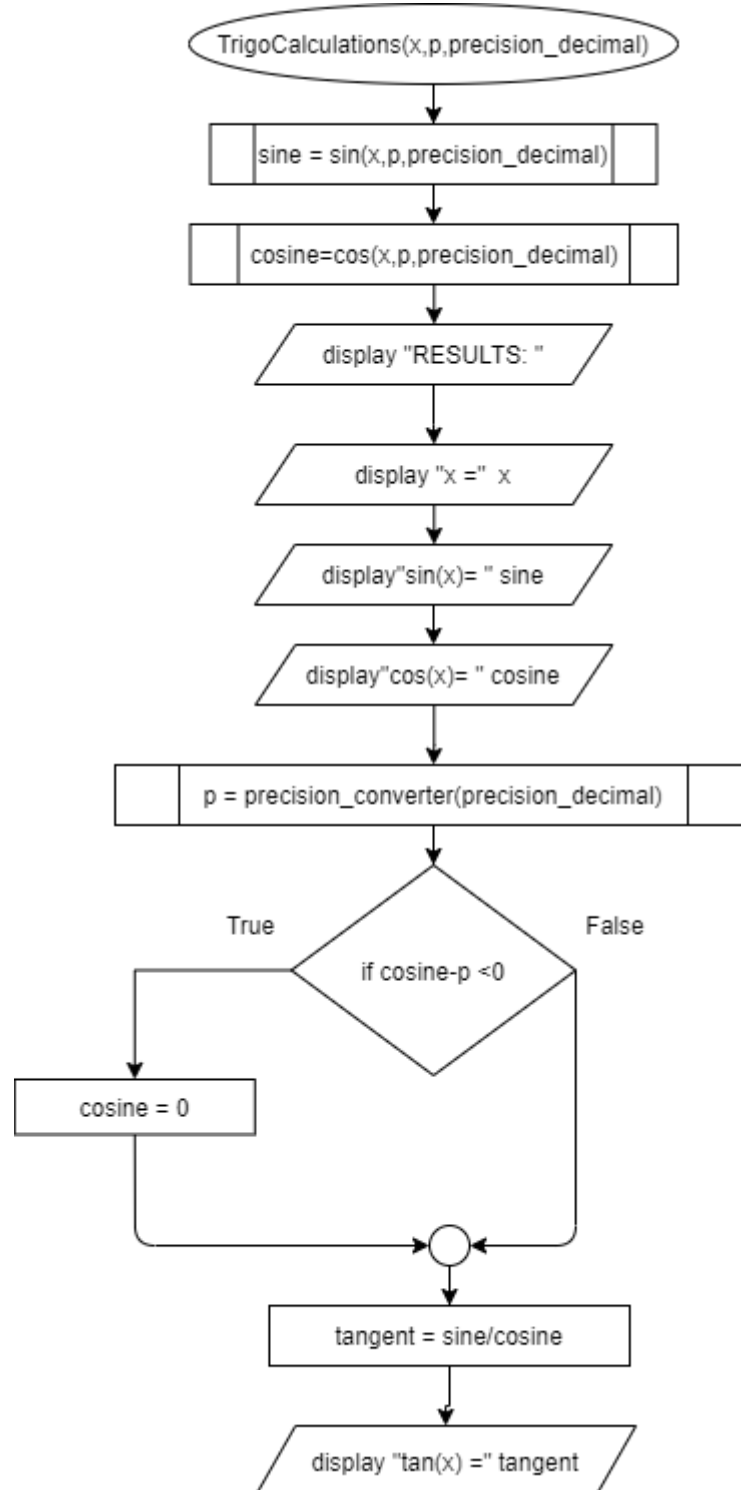
Get_Angle Function (called by Main) Flowchart



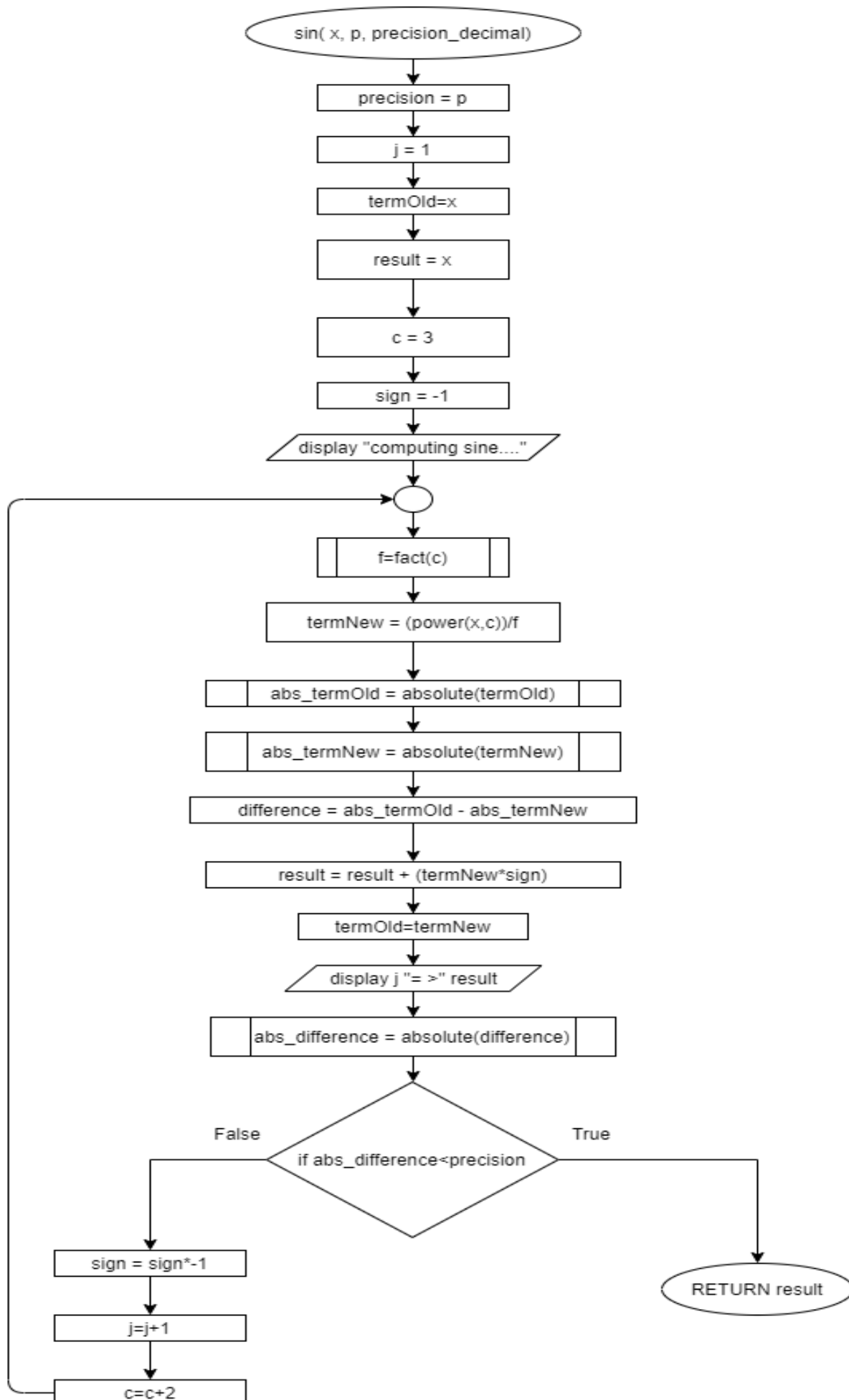
converter360 function (called by Get_Angle) flowchart



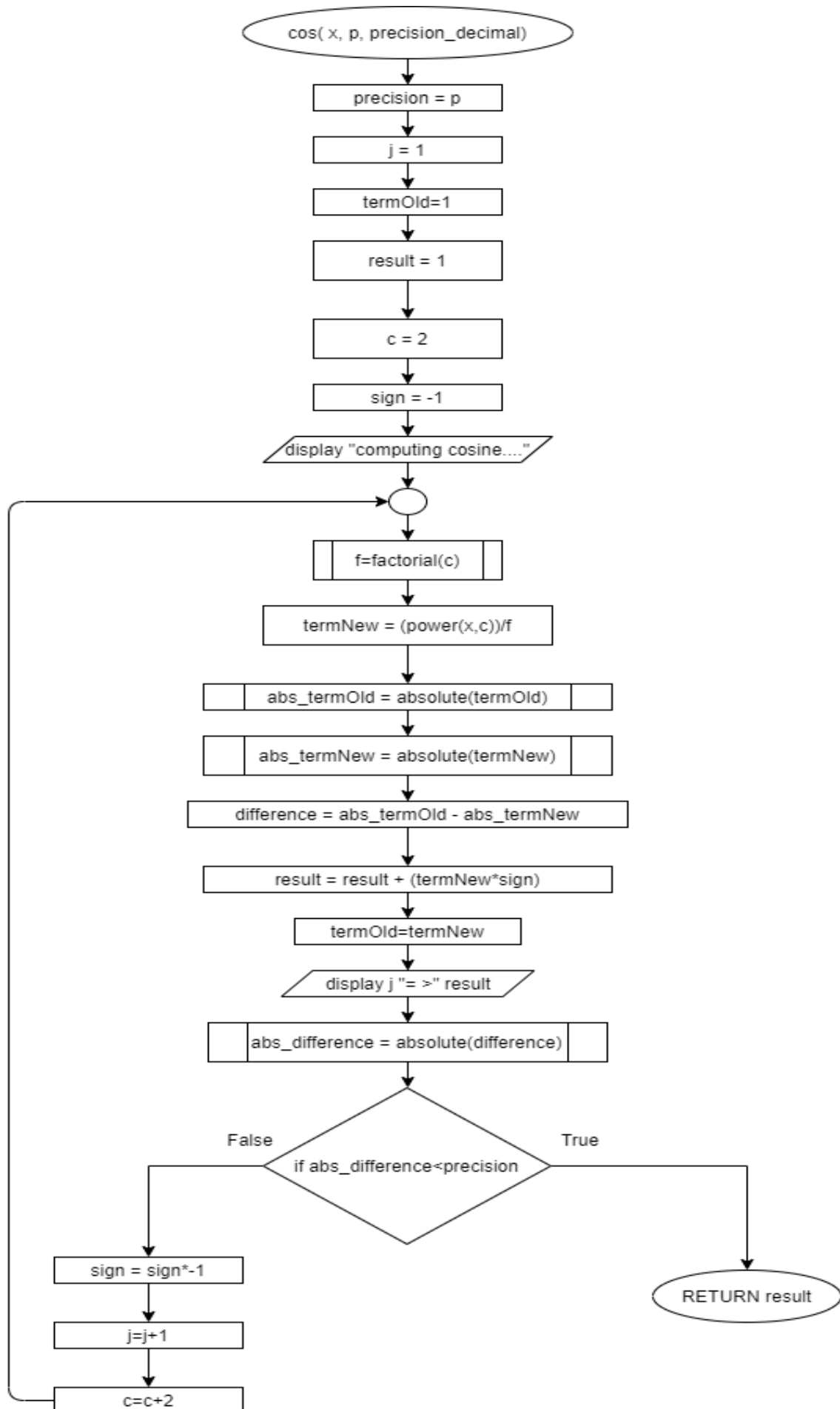
TrigoCalculations function (called by Get_Angle) Flowchart



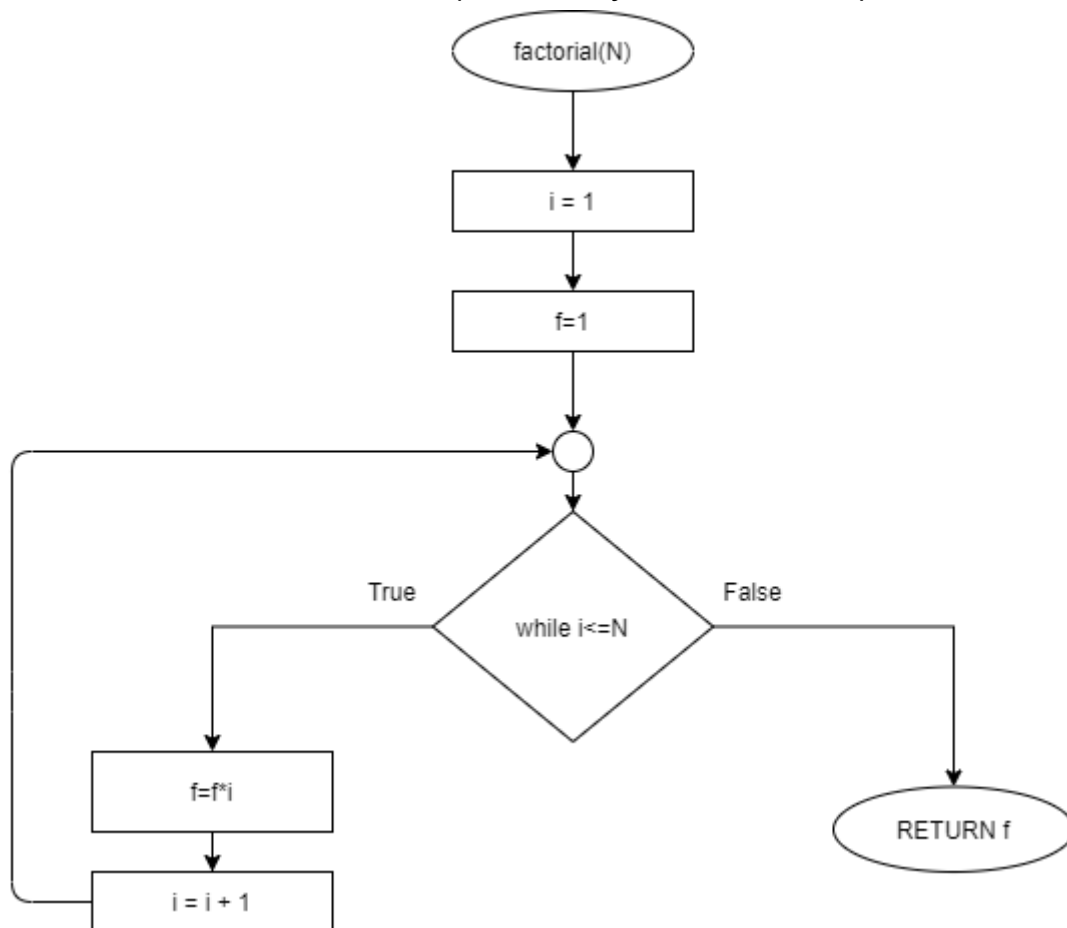
sin function (called by TrigoCalculations & Area calculator)



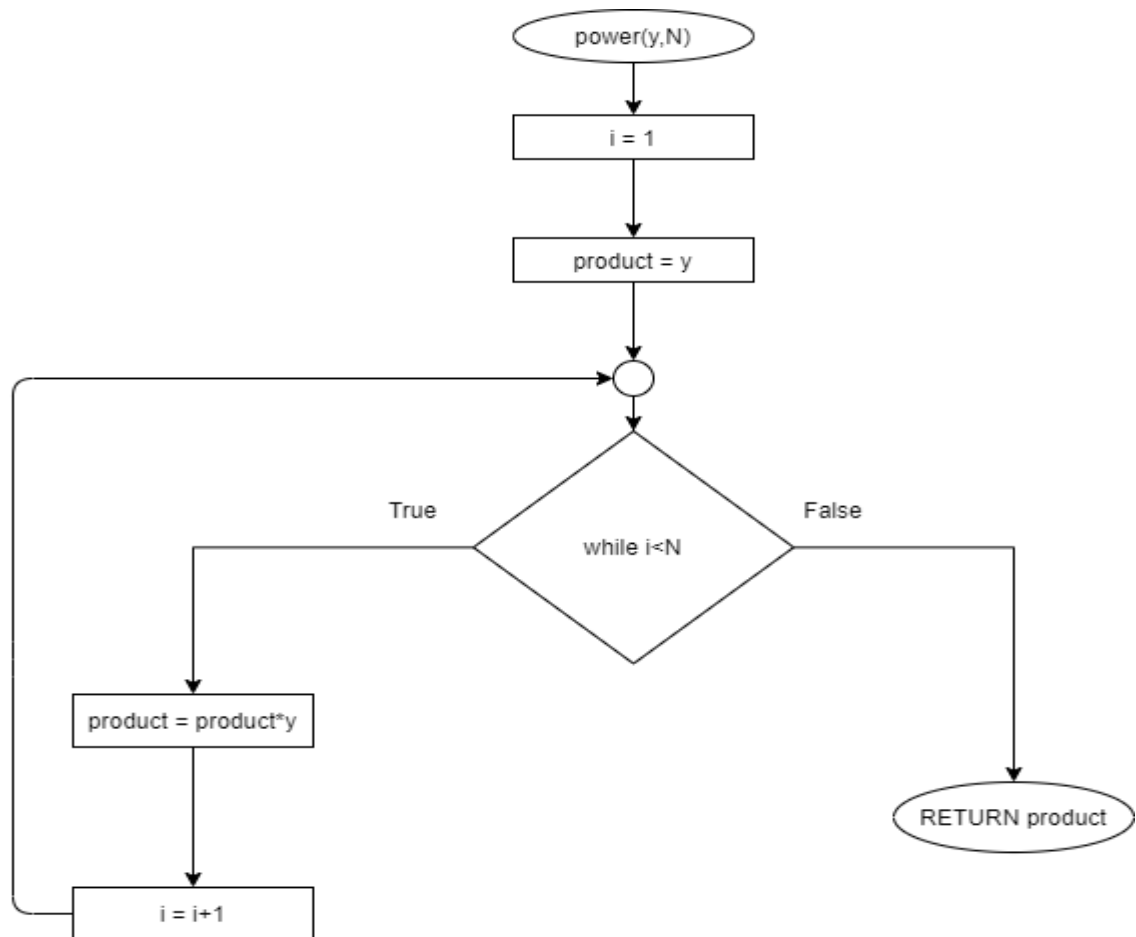
cos function (called by TrigoCaclulation) flowchart



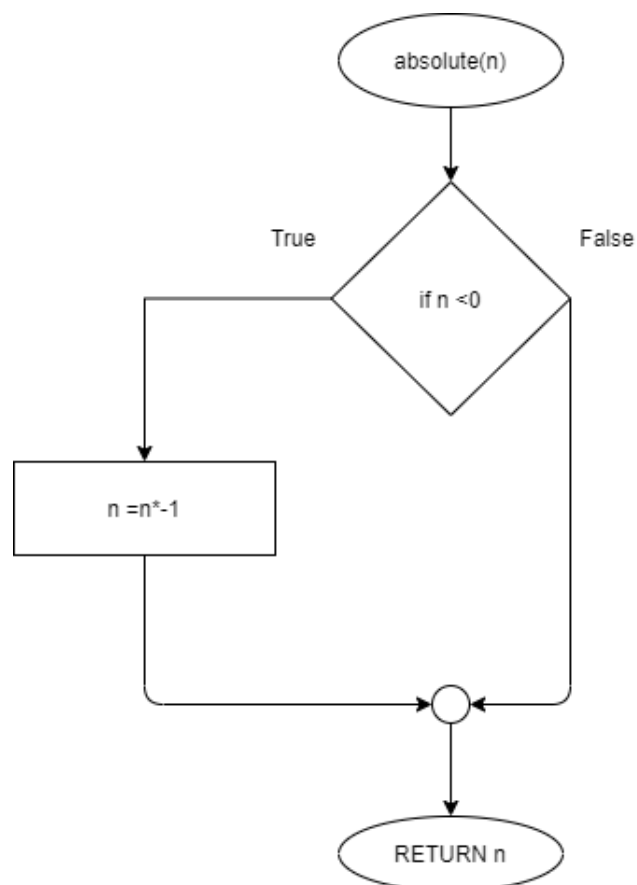
Factorial function (called by cos and sin) flowchart



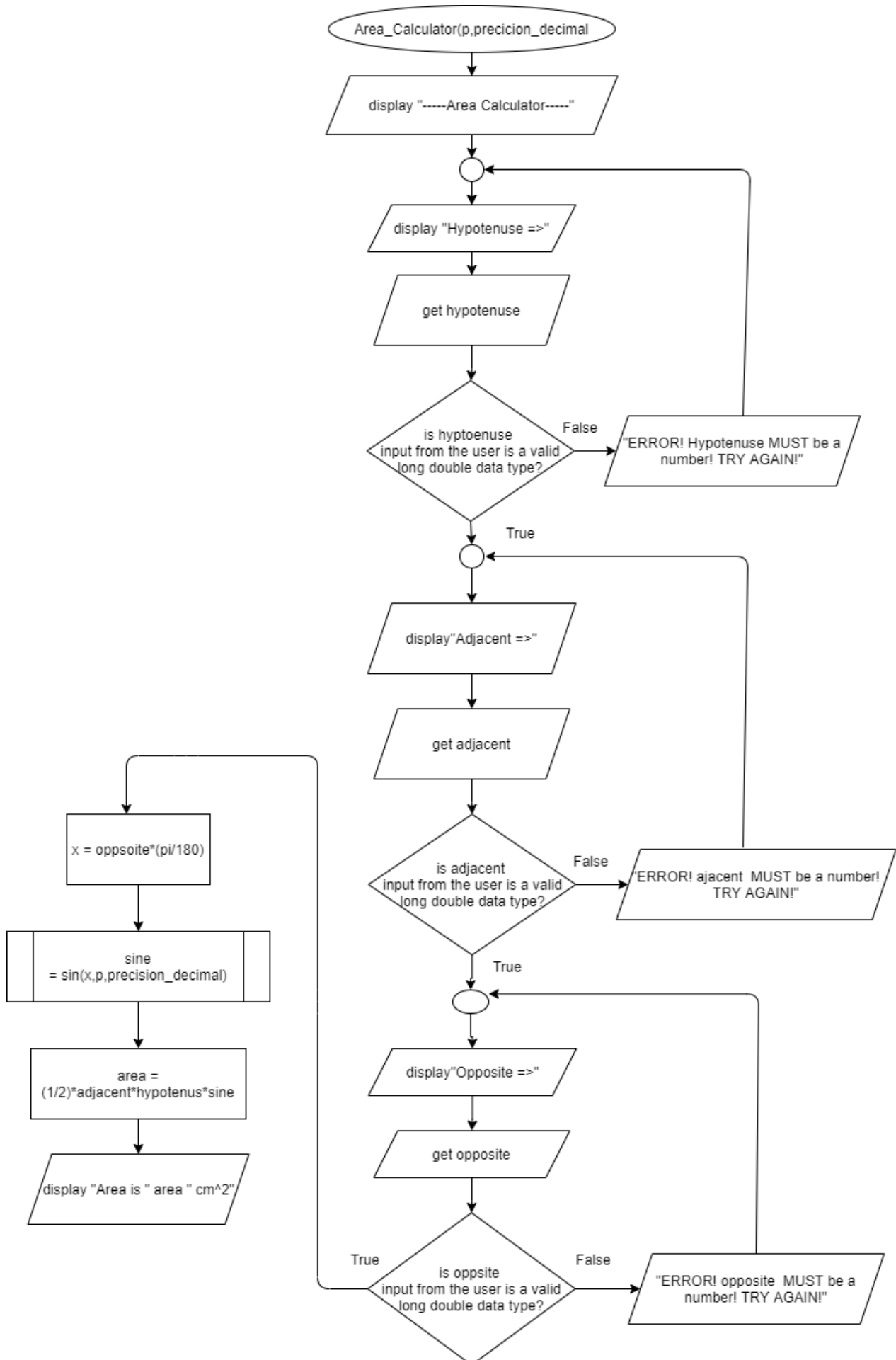
Power Function (called by sin and cos) flowchart



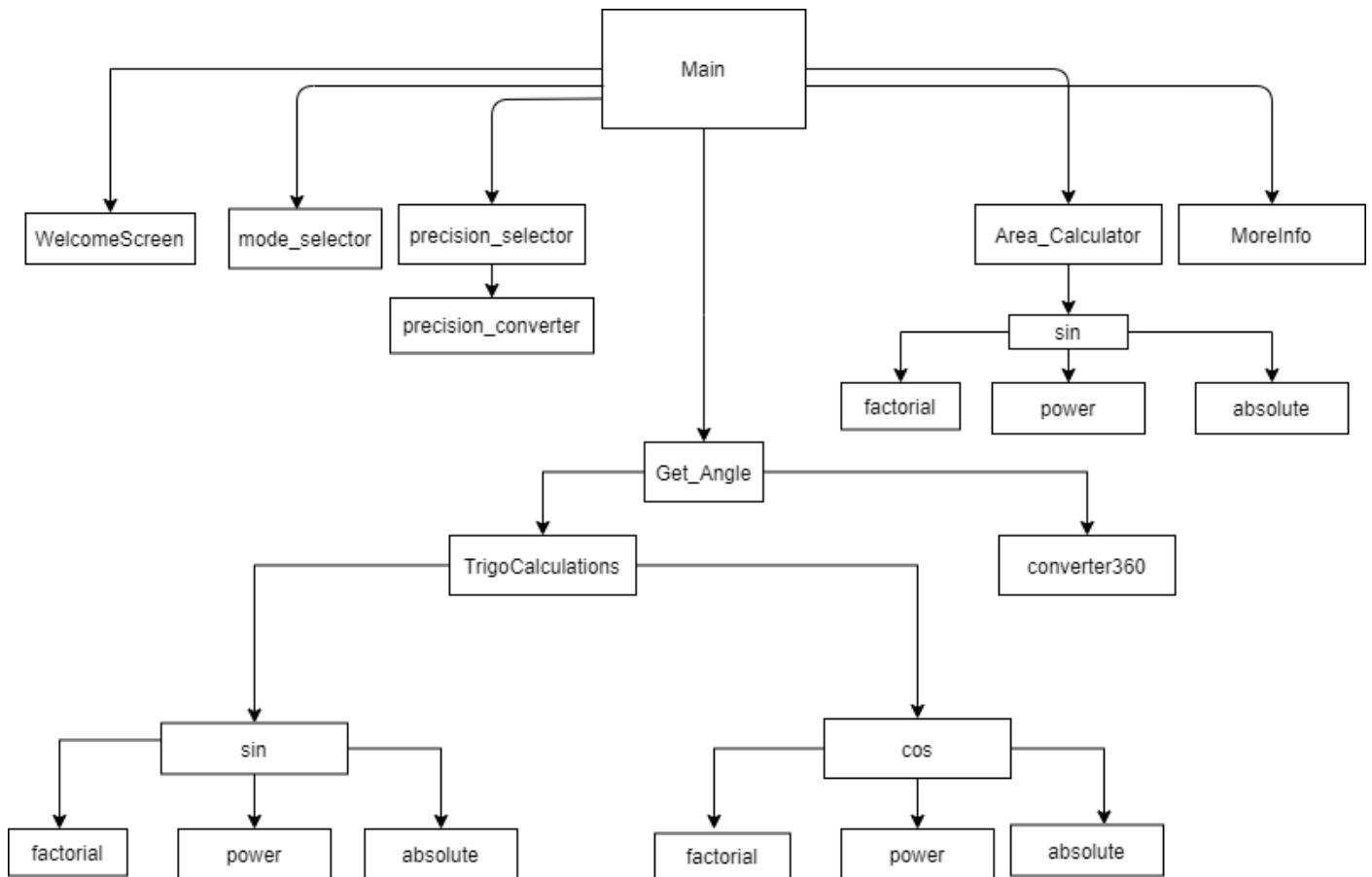
Absolute function (called by sin and cos) flowchart



Area_Calculator Flowchart (called by main function)



Structure Chart



References:

During my assignment, I conducted several research to know more about c++ functions and how to use them as part of my self-learning time. By doing these researches, I came up to know about several things that I can use them to make my program better , However I made sure that I understood them and then implement these concepts to make my program error free and more robust. Also I received guidance and support from Dr.Sharaf during the consultation time and I implemented the concepts delivered during labs and lectures to make my program better and more user friendly. Below are my references:

1- Cin.clear() function, cin.ignore() function, kbhit() function

Reference: Dr. Sharaf El-Deen Sami Mohammed Al- Horani (Professor & lecturer on MMU)

2- During validation of user input , I had to use a function to ignore the extra characters input by user and take the correct data type only. For this I used `cin.ignore(numeric_limits<streamsize>::max(),'\n');`

Reference: [What is the use of cin.ignore\(\) in C++? \(tutorialspoint.com\)](https://www.tutorialspoint.com/cplusplus/article/cin_ignore.htm)

3- Cin.fail() function: I used this function in a while loop to make my program more robust , error free and user friendly. I took the idea from a source from the internet, understood the concept and modified it to be suitable to be used in the program.

Link: [Validating user input in C++ | HackerEarth](https://www.hackerearth.com/practice/basic-programming/input-validation/algorithmic-problems/_introduction_1/)

Assignment#1 Submission Declaration

TCP1101 Programming Fundamentals

Trimester 2, Session 2020/2021


To be Filled by Each Student

Name	Ahmed Hassan Mohammed Salem		
ID	1191102340		
Lecture Section	TC1V	Tutorial Section	TT4V
Names and IDs of students which I have discussed regarding this assignment	Mohammed Ahmed 1191102491		
Number of hours I spent in doing this assignment	50		

I hereby declare that this assignment represents the work done by myself. I declare that no part of my work has been copied from other persons or by means of professional assistance.

I hereby declare, and I fully understood that, if I have copied any parts from any other persons OR if any other persons have copied from my work, I will get a mark of ZERO and I am fully responsible to ensure this does not happen.

I also hereby declare that every works or materials/codes that I may have borrowed, copied or modified from other sources are properly acknowledged in the report and the sources are listed in the ACKNOWLEDGEMENT or REFERENCES section. I will take full responsibility and understood that I would get a mark of ZERO if I failed to make proper acknowledgement.

Signature:  Date: 11/17/21

Note: No work shall be accepted unless it is accompanied by this submission declaration with all sections completed and it has been signed and dated. Please scan the document and include this to the softcopy of your report.