Declaring Variables

type variableName = value;

- string a="Hello";
- string b;
- b = "World!";
- int intValue1=80;
- int intValue2;
- intValue2 =20;
- const int Days = 365;
- int sum = intValue1+ intValue2;
- char myLetter = 'D';
- double myDoubleNum = 5.99D;
- double d = 1.2d;
- decimal dec = 389.5M;
- decimal m = 2m;
- bool myBool = true;
- float f = 1.2f;
- long l = 2L;

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Conditional Operators

- For any flow control statements, we must be able to use conditional operators. These operators compare the values of two variables. These operators are:

C# Operators	Meaning
==	Equal to
>	Greater than
<	Less than
>=	Greater than or equal to
<=	Less than or equal to
!=	Not equal to

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Exercise: True or False

- int i1 = 10;
- int i2 = 5;
- (i1 == i2)
- (i1 > i2)
- (i1 < i2)
- (i1 >= i2)
- (i1 <= i2)
- (i1 != i2)

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Exercise: True or False

- int i1 = 10;
- int i2 = 10;
- (i1 == i2) true
- (i1 > i2) false
- (i1 < i2) false
- (i1 >= i2) true
- (i1 <= i2) true
- (i1 != i2) false

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Logical Operators

- We can make more complicated comparisons by using logical operators. These operators are:

C# Operators	Meaning
&&	And: Both must be true
||	Or: Either must be true
^	Xor : One but not both must be true
!	Not: Reverses Condition

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Evaluating AND expressions

- An AND expression only evaluates to true if BOTH of the sub-expressions also evaluate to true. Otherwise, it evaluates to false.
- false **AND** false = false
- false **AND** true = false
- true **AND** false = false
- true **AND** true = true

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AND – More examples

- A is true, B is false, C is true, D is true
- (A && B) && (C && D)

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Evaluating OR expressions

- An OR expression only evaluates to true if EITHER of the sub-expressions also evaluate to true. Otherwise, it evaluates to false.
- false **OR** false = false
- false **OR** true = true
- true **OR** false = true
- true **OR** true = true

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OR – More examples

- Assume: A is true, B is false, C is true, D is true
- What does the expression A || B evaluate to?
- What does the expression C || D evaluate to?
- What does (A || B) || (C || D) evaluate to?

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Evaluating NOT expressions

- An NOT expression simply evaluates to the inverse value of the expression.
- **NOT** false = true
- **NOT** true = false

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NOT - Example

- Assume: A is true and B is false
- What does the expression !A evaluate to?
- What does the expression !B evaluate to?

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Order of Operations

- First, any expression in **parenthesis**
- Then the AND
- Then the OR
- Examples:

```
bool result;
result = true || true && false; // --> true
result = (true || true) && false; // --> false
result = true || (true && false); // --> true
```

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Exercise: True or False

- int i1 = 10;
- int i2 = 5;
- int i3 = 5;

1. ((i1 == i2) && (i1 == i3))
2. ((i1 > i2) &&(i1 > i3))
3. ((i1 > i2) &&(i2 == i3))
4. ((i1 > i2) || (i1 > i3))
5. ((i1 > i2) ^ (i1 > i3))
6. ((i1 > i2) ^ (i2 > i3))
7. !((i1 > i2) && (i1 > i3))

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Exercise: True or False

- int i1 = 10;
- int i2 = 5;
- int i3 = 5;

1. ((i1 == i2) && (i1 == i3)) false
2. ((i1 > i2) &&(i1 > i3)) true
3. ((i1 > i2) &&(i2 == i3)) true
4. ((i1 > i2) || (i1 > i3)) true
5. ((i1 > i2) ^ (i1 > i3)) false
6. ((i1 > i2) ^ (i2 > i3)) true
7. !((i1 > i2) && (i1 > i3)) false

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If statements

- int i1 = 10;
- int i2 = 5;

```
if (i1 == i2)
{
    Console.Write("i1 is equal to i2!");
}
if (i1 > i2)
{
    Console.Write("i1 is greater than i2!");
}
if (i1 < i2)
{
    Console.Write("i1 is less than i2!");
}
```

- Equal? Greater? Less?

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Why using if, else-if statement instead of multiple if statements?

```
int i1 = 10;
int i2 = 5;
if(i1 == i2) {
  Console.Write (“Equal”);
}
if(i1 > i2) {
  Console.Write (“Greater”);
}
if(i1 < i2) {
  Console.Write (“Less”);
}
```

```
int i1 = 10;
int i2 = 5;
if(i1 > i2) {
  Console.Write (“Greater”);
} else if(i1 < i2) {
  Console.Write (“Less”);
} else {
  Console.Write (“Equal”);
}
```

- Efficiency
- Readability

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If/Else statements

```
int i1 = 10;
int i2 = 5;
if(i1 == i2) {
        Console.Write(“??”);
} else {
        Console.Write(“??”);
}
```

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If/Elseif statements

```
int i1 = 10;
int i2 = 5;
```

```
if (i1 == i2)
{
    Console.Write("i1 is equal to i2!");
}else if (i1 > i2)
{
    Console.Write("i1 is greater than i2!");
}else
{
    Console.Write("i1 is less than i2!");
}
```

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if-elseif-else statements

```
if(condition1) {
    Statements;
} elseIf (condition2) {
    statements;
} else {
    Statements;
}
```

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If/Elseif statements

```
int i1 = 10;
int i2 = 5;
if(i1 > i2) {
        Console.Write (“??”);
} else if(i1 < i2) {
        Console.Write (“??”);
} else {
        Console.Write (“??”);
}
```

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Logical Operators && Examples

- bool b1= true;
- bool b2 = false;
- if (b1 && b2) {
  Console.WriteLine(" ???")
  }else{
  Console.WriteLine(“?? ?")
  }

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Logical Operators || Examples

- bool b1= true;
- bool b2 = false;
- if (b1 || b2) {
  Console.WriteLine("???")
  }else{
  Console.WriteLine(“?? ?")
  }

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nest an if statement

```
bool Condition1 = true;
bool Condition2 = true;
bool Condition3 = true;
bool Condition4 = true;

if (Condition1)
{
    // Condition1 is true.
}
else if (Condition2)
{
    // Condition1 is false and Condition2 is true.
}
else if (Condition3)
{
    if (Condition4)
    {
        // Condition1 and Condition2 are false. Condition3 and Condition4 are true.
    }
    else
    {
        // Condition1, Condition2, and Condition4 are false. Condition3 is true.
    }
}
else
{
    // Condition1, Condition2, and Condition3 are false.
}
```

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Which One Is Better?

Example 1	Example 2
(1)Error case. (2)Nominal case. (3)Nominal case. (4)Error case. (5)Nominal case. (6)Error case (7)Nominal case.	(1)Nominal case. (2)Nominal case. (3)Nominal case. (4)Nominal case. (5)Error case. (6)Error case. (7)Error case. (8)Error case.

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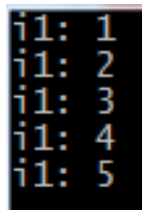
While Loops




```
int i1 = 0;
int i2 = 5;

while (i1 < i2)
{
    i1 += 1;
    Console.WriteLine("i1: " + i1.ToString());
}
```

How many times will the loop run?
What are the outputs?

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While Loops

```
int i1 = 0;
int i2 = 5;
while(i1 < i2) {
 i1 -= 1;
Console.WriteLine(i1.toString);
}
```

infinite:
i1 <i2
Loop
forever

How many times will the loop run?
What are the outputs?

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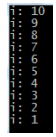
Do While

```
do {
     statements
}while (condition);
```

```
int i = 10;
do {
      Console.WriteLine("i: " + i.ToString());
      i = i - 1;
} while (i > 0);
```



How many times will the loop run?
What are the outputs?

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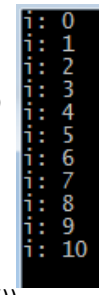
For Loops




```
for(int i = 0; i <= 10; i++)
{
     statements
}
```

```
for (int i = 0; i <= 10; i++)
{
      Console.WriteLine("i: " + i.ToString());
}
```

How many times will the loop run?
What are the outputs?

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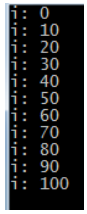
For Loops

```
for(int i = 0; i <= 100; i += 10){
      Console.WriteLine("i: " + i.ToString());
}
```



How many times will the loop run?
What are the outputs?

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Nested For loops

```
for ( init; condition; increment )
{
      for ( init; condition; increment ) {
            statement(s);
      }
      statement(s);
}
```

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Nested For loops:

```
for (int i = 0; i <= 2; i++){
    for (int j = 0; j <=2; j ++) {
        Console.WriteLine("i: " + i.ToString());
        Console.WriteLine("j: " + j.ToString());
    }
}
```

How many times will the loop run?
What are the outputs?

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```
public class Student {
   private string _name;
   private int _age;
   private int _id;

   public Student(string name, int age, int id = 0) {
      _name = name;
      _age  = age;
      _id   = id;
   }

   public string Name{get; set;}
   public string Age{get; set;}
   public string ID{get; set;}

   public string PrintAge() {
      return "Student " + _name + "(" + _id + ") is"+ _age + " years old";
   }

}
```

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University

A University class that uses the Student Class can be defined as follows:

```
public class University {
  private string _uniName;
  private Dictionary<int, Student> _students;

  public University(string uniName) {
    _uniName = uniName;
    _students = new Dictionary<int,Student>();
  }
}
```

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University

Each University will store a set of Students using a Dictionary.

Example of defining the behaviour to enrol a new Student in the University is as follows:

```
public void Enrol(Student newStudent) {
  _students.Add(newStudent.ID, newStudent);
  }
```

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University

The behaviour for printing out all the students and their ages is as follows:

```
public string Print() {
  string uniStudentRoll;
  uniStudentRoll = _UniName + "\n"
  foreach(Student s in _Students.Values ) {
     uniStudentRoll += s.PrintAge() +  "\n";
  }
  return uniStudentRoll ;
}
```

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University

A University object can be created and Students added to it one at a time:

```
University massey = new University("Massey");
massey.enrol(new Student("Tim", 25, 01234567);
massey.enrol(new Student("Tom", 23, 76543210);
Console.WriteLine(massey.Print());
```

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Exception Handling

Exceptions can be caught by the application using a **try/catch** block.

```
try {

} catch(exception variable) {

} finally {

}
```