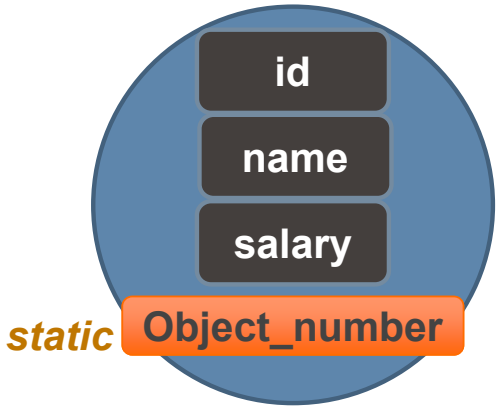
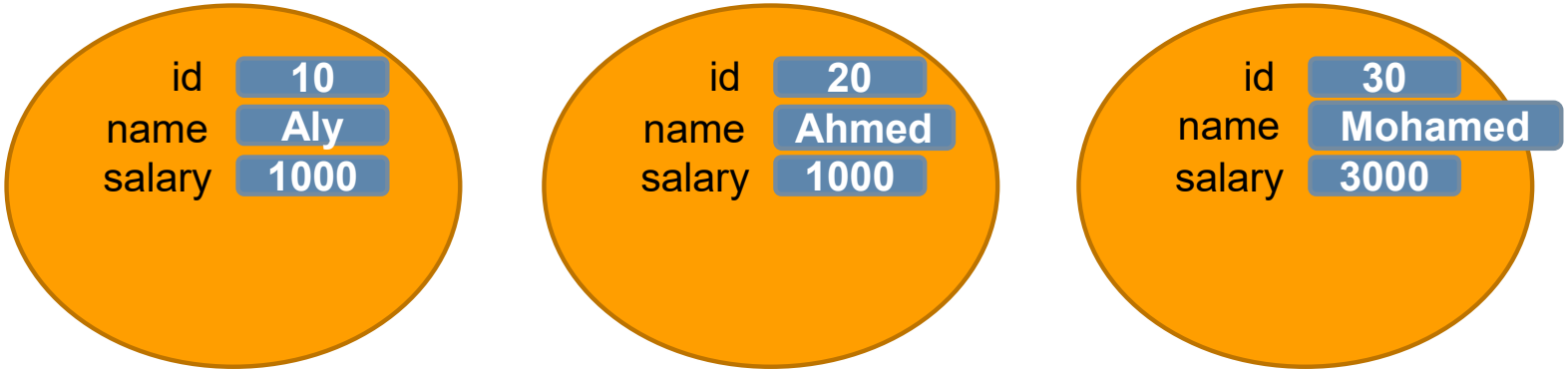
Static Modifier

Static Modifier

- Static member variable
  - Single copy of the variable Reside within the class
  - Ex: number of Objects



Class Employee



Emp1 Emp2 Emp3

Static Modifier

- Static member methods / properties
  - Access only static variables
- Static Constructor
  - Used for initialize static fields
  - No access modifiers allowed

Static Modifier

- Static class
  - Used as a container for related static methods
    - Ex: Math class
    - Ex: Console class
  - Creating an Object of static class is NOT allowed
  - Used as a Container for Extension Method

Extension Methods

- Used for extend the functionality of a class
- Used in LINQ

```
class ExClass
 {
   public static int ConvertStringToInt(string s)
    {
            int r = int.Parse(s);
            return r;
    }
 }
```

```
string s =10;
int x= ExClass.ConvertStringToInt(s);
```

Extension Methods

- Defining and calling Extension Method

```
static class ExClass
 {
   public static int ConvertStringToInt(this string s)
    {
            int r = int.Parse(s);
            return r;
    }
 }
```

```
string s =10;
int x= s.ConvertStringToInt();
```

Other Modifiers

- *const* keyword
  - Used for constant variable
  - EX: Math.PI
  - Initialized on Declaration (Design Time)
  - Used through class name (like static)
- *readonly* keyword
  - Once its value initialized it could not be changed
  - Ex: flight Takeoff Time
  - Initialized on Constructor (Run Time) or object initializer
- partial keyword
  - Used to indicate that the class defined in separate Files

Assignment

- In Menu Program:
- Modify Employee Class to achieve
  - Employee ID Auto Incremented (like primary key in database)
  - modify Gender as *readonly* field
- Write an Extension Method that extended an array of Employees to print its elements

Overload Operators (Design-time) Polymorphism

Overload Operator

- Redefine operator to take parameters other than it was predefined with
  - Ex: operator + takes 2 complex

```
class complex
{
 public float real;
 public float img;
}
```

```
static complex AddComplex(complex c1, complex c2)
{
   complex total=new complex() ;
   total.real = c1.real + c2.real;
   total.img = c1.img + c2.img;
   return total;
}
```

```
complex total= AddComplex(cx,cy);
```

Overload Operator

- Define and calling Operator
  - Operator must be public and static
  - Operator method could not use ref , out , in

```
class complex
{
 public float real;
 public float img;
 public static complex operator +( complex c1,complex c2)
  {
   complex total=new complex() ;
   total.real = c1.real + c2.real;
   total.img = c1.img + c2.img;
   return total;
  }
}
```

```
complex total=cx + cy;
```

Overload Operator

Operators	Description
+, -, !, ~, ++, --	These unary operators take one operand and can be overloaded
+, -, *, /, %	These binary operators take two operand and can be overloaded.
==, !=, <, >, <=, >=	The comparison operators can be overloaded
&&, ||	The conditional logical operators **cannot** be overloaded directly. (overload true and false operators, &,| ops)
+=, -=, *=, /=, %=	The assignment operators **cannot** be overloaded directly (overloading + implicitly overload += operator)
=, ., ?:, =>, new, is, sizeof, typeof	These operators **cannot** be overloaded.

Overload Operator

- Operator +=

```
complex c1=new complex { Real=10,Img=10 };
c1 += 5; // c1 = c1 + 5
```

```
 public static complex operator +(complex c1,int x)
{
  c1.Real += x;
  c1.Img += x;
  return c1;
}
```

Overload Operator

- Indexer [ ]
- Indexers provide a natural syntax for accessing elements in a class or struct that encapsulate a collection of values(array, list ,dictionary).
- Could be considered as a special property
  - Ex: access the elements of stk array within Stack class
- Declare and use indexer

```
Stack S1=new Stack();
S1[2]=10;
int x=S1[0];
```

```
class Stack
{
  …
 public int this[int index]
 {
   get { return stk[index];}
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   }
}
```

Type Conversion

- Implicit Casting


```
int x=100;
float f=x;
```

Type Conversion

- Explicit Casting


```
float f=15.5f;
int x=(int) f;
```

Type Conversion

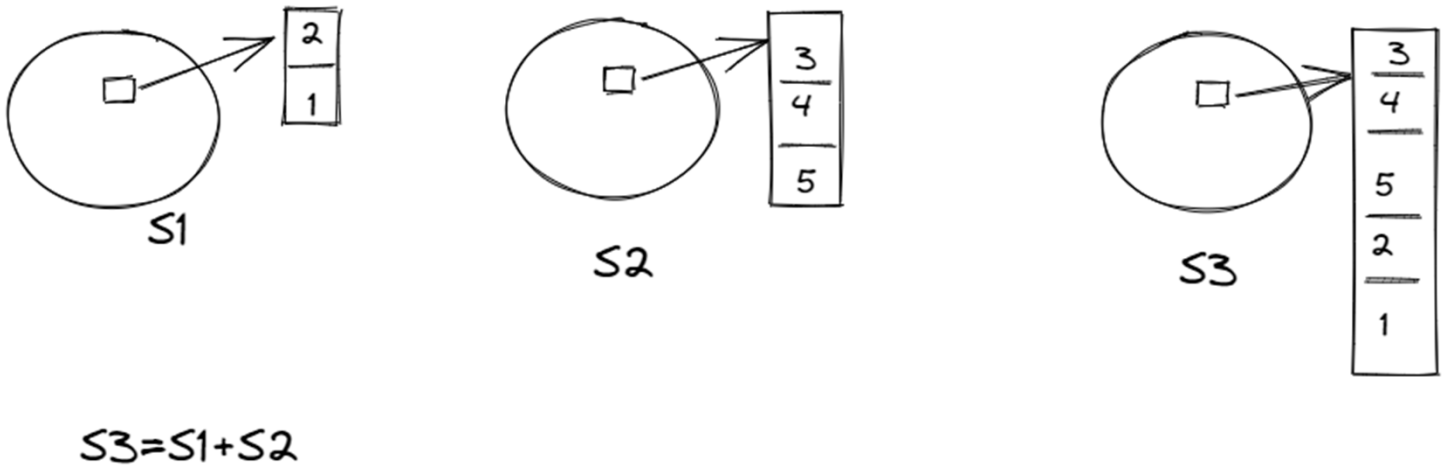
- User-defined Casting

```
class test1
 {
      public int x;
      public test1()
      { }
      public test1(int l)
      { x = l; }
      public static implicit operator int(test1 t)
      { return t.x; }
      public static explicit operator test1(int z)
      { return new test1(z); }
 }
```

```
test1 t = new test1();
int g = t;             //Implicit
test1 t2 = (test1)g; //Expilict
```

Assignment

- Modify class stack to add overload operator +



- Adding indexer [] to stack class for retrieve data Only(reading only)
- User defined casting between array and stack

Inheritance I

Inheritance

- A class inherits from another class to
- *Reuse*
  - use the actions or attributes of the original class
- *Extend*
  - adding action(s) or attributes to the original class
- *Modify*
  - change its action(s) the original class

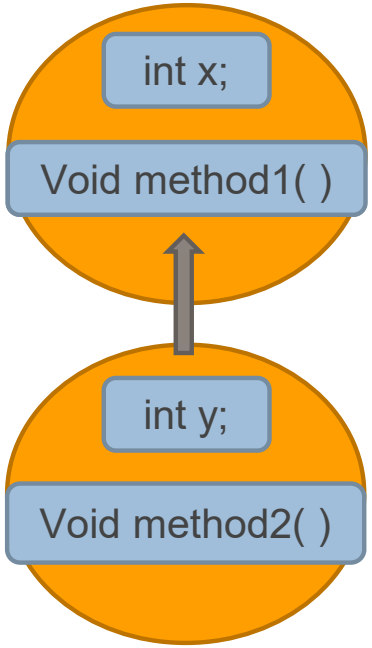
Inheritance

```
public class Class1
{ public int x;
  public void method1()
  {
    Console.WriteLine("x={0}", x);
  }
}
```

```
public class class2:Class1
{ public int y;
  public void method2()
  {
    Console.WriteLine("y={0}", y);
     method1();
  }
}
```

Class1
(base)
(parent)
(super class)

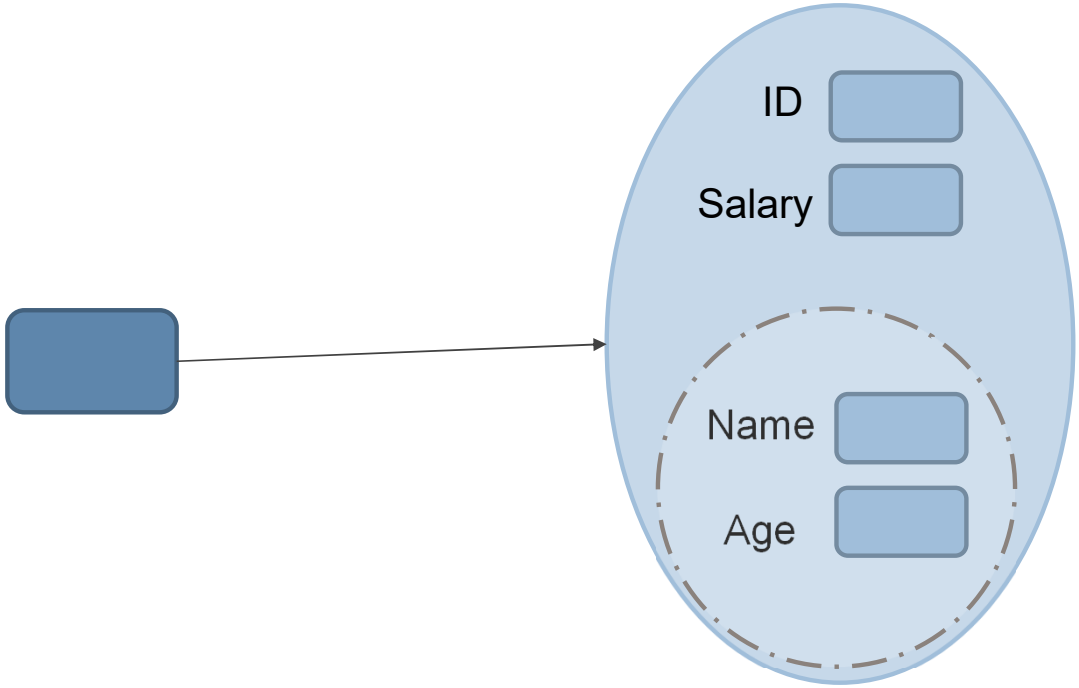
Class2
(derived)
(child)
(sub class)



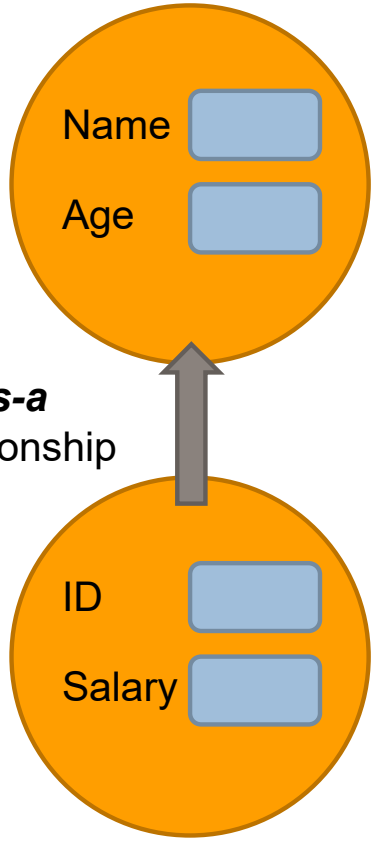
Structure does not support inheritance

Inheritance

- EX: Employee Inherits Human
- Employee *is a* human



Class Human



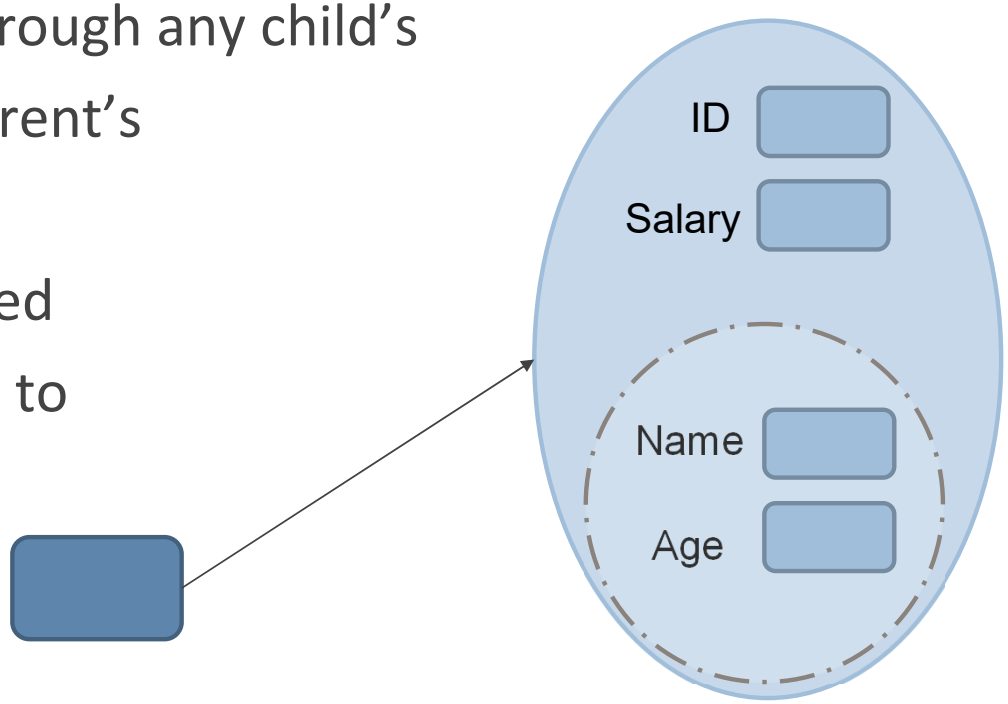
Class Employee

Inheritance and Access Modifier

- *public* Access Modifier
  - Has no effect (all members are inherited and accessible from within child class and anywhere else)
- *private* Access Modifier
  - All members are inherited but not accessible through child members
- *protected* Access Modifier
  - All members are inherited and accessible through child members but not accessible outside the child class

Inheritance and constructors

- Creating an Object of child class type cause creating an object of parent class type within it
- Creating an Object of child through any child's Constructor would call the parent's *default constructor*
- This behavior could be changed Using *base* keyword to direct to Specific constructor
- Demo



Inheritance

- *base* Keyword
  - Used for identify base class *method* or *constructor*
- *sealed* Keyword
  - Prevent a class to be a parent for another class
  - Prevent members(method , property) from being overridden in child class

Inheritance and Type Conversion

- Child to Parent
  - The child class data type is – a parent class data type with extra (field or methods)
  - The relation between derived class and base class is-a relation
  - The child object could be referred as a parent
    - Ex: every Employee is-a Human

```
Employee emp = new Employee{Age=30};
Human h=emp;
Human h2= new Employee{Age=40};
```

  - Conversion from child to parent achieved using ***implicit casting***

Inheritance and Type Conversion

- Parent to Child
  - Conversion from parent to child must be achieved through ***Explicit casting*** since not every human is an employee (he could be engineering or merchant , etc..)

```
Engineer eng = new Engineer{Age=30,Dept="Elect"};
Human h= eng;
h= new Employee{Age=40};

Employee emp=(Employee)h;
```

Is operator , *as* operator

- *is* operator
  - Used for test if the object is a certain type or not

```
Human h = new Employee();
if (h is Employee)
   Console.WriteLine("True");
else
   Console.WriteLine("false");
```

- *as* operator
  - Used for explicit casting and evaluate to null if casting fails instead throwing exception

```
Employee emp = new Employee{Age=30};
Human h=emp;
```

```
//Employee emp = (Employee) h;
Employee emp = h as Employee;
```