



Module 1 Day 6

Introduction to Objects

What makes an application?

- Program Data

- ✓ Variables & .NET Data Types
- ✓ Arrays
- ❑ More Collections (list, dictionary, stack, queue)
- ❖ Classes and objects (OOP)

- Program Logic

- ✓ Statements and expressions
- ✓ Conditional logic (if)
- ✓ Repeating logic (for, foreach, do, while)
- ✓ Methods (functions / procedures)
- ❖ Classes and objects (OOP)
- ❑ Frameworks (MVC)

- Input / Output

- User
 - ✓ Console read / write
 - ❑ HTML / CSS
 - ❑ Front-end frameworks (HTML / CSS / JavaScript)
- Storage
 - ❑ File I/O
 - ❑ Relational database
 - ❑ APIs

Abstraction

- From dictionary.com ([abstract](#)):
 - Adj., thought of apart from concrete realities, specific objects, or actual instances: *an abstract idea*.
 - Noun, a summary of a text, scientific article, document, speech, etc.; *epitome*.
 - Noun, something that concentrates the essential qualities of anything more extensive or more general, or of several things; *essence*.
- The essence of abstraction is preserving information that is relevant in a given context, and forgetting information that is irrelevant in that context

Abstraction, cont'd

- Closely related to Modelling
 - any model is an abstraction (CAD, blueprint, model airplane, model railroad)
- Sometimes referred to as one of the pillars of OO
 - Encapsulation, Inheritance, Polymorphism
 - Really, it's a feature of ALL programming
- Allows us the “think at a higher level”
 - Think about our use of *Console* so far in this course

Object-Oriented Programming

- Objects are a further level of abstraction
- Combine Data (variables) and Behavior (logic / flow) into an abstraction of a real-world “thing”
- e.g., Car
 - Data (State) - describes it - adjectives
 - Make, model, color, Engine State, Gear
 - Behavior – what it can do - verbs
 - Start, Change Gear, Speed Up, Slow Down, Turn
- e.g., Contact
 - Data
 - First Name, Last Name, Birthday, Email Address, Phone
 - Behavior
 - Send Mail, Call, Text

Class

- Until now, we've used Data Types available to us
 - int, double, string, Console, Array
- Now we are going to write our own Data Types
 - These are called Classes in OO parlance
 - Classes and Types are synonymous in C#/.NET

```
// Data Type to represent a person's contact information
class Contact
{
    public string FirstName;
    public string LastName;
    public DateTime BirthDate;
    public string EmailAddress;
    public string PhoneNumber;
}
```


Creating Objects from Classes

- Remember that a Class is just another word for a Type
- To use a type we Declare, Allocate and Assign (as always)

```
// **Declare** a place to hold a Contact **object**  
Contact contact;  
  
// **Allocate** memory to hold a contact and assign default values  
contact = new Contact();  
  
// **Assign** new data into the contact's **instance variables**  
contact.FirstName = "Mike";  
contact.LastName = "Morel";
```

- The “contact” variable holds an ***instance of*** the Contact class, also known as an ***object***

Let's
Code

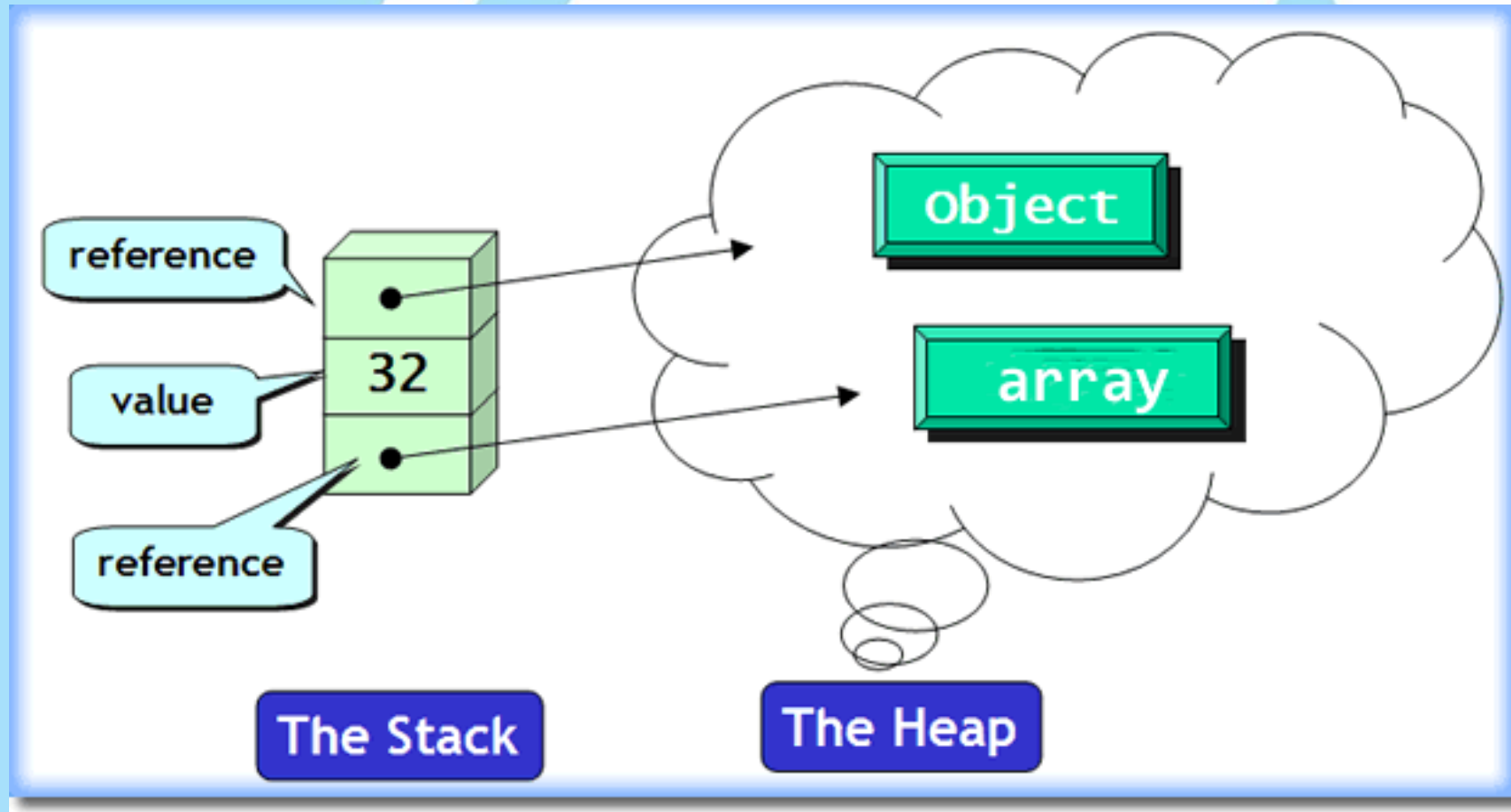
Class vs. Object

Class (Type)	Object (Instance)
int	3 21
string	"The quick brown fox" "Ohio"
int[]	[1,4,7,12,3] [10,20]
Car	1965 Ford Mustang with VIN 12345 2015 Toyota Corolla with VIN 99988
Person	Mike Morel, mike@techelevator.com

Stack and Heap Memory

- Stack Page
 - *Fixed* memory allocation (size known at compile-time)
 - Created when a method is invoked, destroyed when the method exits
 - Fast access
 - Runtime maintains a Stack (LIFO) of these as your program runs
 - **C# Value types** are stored here
- Heap
 - *Dynamic* memory allocation (determined at run-time)
 - Global in scope
 - Slower access as it can fragment
 - **C# Reference types** are allocated (**new**) here, and their address stored in Stack memory
- Assignment (=), Comparison (==) and parameter-passing all work on Stack memory!!!

Stack and Heap Memory



Strings

- String is a reference type:
 - Memory is allocated on the Heap
 - Address of memory is placed into stack variable
- However, string is “special” in a couple ways
 - You don't *have to* use new() to allocate string memory (" does it)
 - Strings are ****immutable**** (you can't change it in place)
 - You can compare strings using ==
 - Sometimes you'll hear "C# strings have 'value' *semantics*"

String Methods

- Length (Property)
- Substring
- Contains
- StartsWith / EndsWith
- IndexOf
- Replace
- ToUpper / ToLower
- Split / Join
- Trim



Let's
Code