Lesson 2: Introduction to Object-Oriented Programming

1. You are developing code for a method that calculates the discount for the items sold. You name the method `CalculateDiscount`. The method defines a variable, `percentValue` of the type `double`. You need to make sure that `percentValue` is accessible only within the `CalculateDiscount` method. What access modifier should you use when defining the `percentValue` variable?

a) `private`
b) `protected`
c) `internal`
d) `public`

2. You are developing code that defines an `InitFields` method. The method takes two parameters of data type `double` and does not return any value to the calling code. Which of the following code segments would you use to define the `InitFields` method?

a)
```
public double InitFields(double l, double w)
{
    length = l;
    width = w;
    return length * width;
}
```

b)
```
public void InitFields(double l, double w)
{
    length = l;
    width = w;
}
```

c)
```
public void InitFields(double l)
{
    length = l;
    width = l;
    return;
}
```

d)
```
public double InitFields(double l, double w)
{
    length = l;
    width = w;
}
```

3. You created a class named `GeoShape`. You defined a method called `Area` in the `GeoShape` class. This method calculates the area of a geometric shape. You want the derived classes of `GeoShape` to supersede this functionality to support the area calculation of additional geometric shapes. When the method `Area` is invoked on a `GeoShape` object, the area should be calculated based on the runtime type of the `GeoShape` object. Which keyword should you use with the definition of the `Area` method in the `GeoShape` class?

a) `abstract`
b) `virtual`
c) `new`
d) `overrides`

4. Suppose that you defined a class `Scenario` that defines functionality for running customized pivot transform on large data sets. You do not want the functionality of this class to be inherited into derived classes. What keyword should you use to define the `Scenario` class?

a) `sealed`
b) `abstract`
c) `private`
d) `internal`

5. You need to provide printing functionality to several of your classes. Each class's algorithm for printing will likely be different. Also, not all the classes have an "is-a" relationship with each other. How should you support this functionality?

a) Add the print functionality to a base class with the `public` access modifier.
b) Have all classes inherit from an abstract base class and override the base-class method to provide their own print functionality.
c) Have all the classes inherit from a base class that provides the print functionality.
d) Create a common interface that all classes implement.

6. You are writing code for a class named `Book`. You should be able to get a list of all books sorted by the author's last name. You need to write code to define this behavior of a class. Which of the following class elements should you use?

a) method
b) property
c) event
d) delegate

7. Suppose that you are writing code for a class named `Product`. You need to make sure that the data members of the class are initialized to their correct values as soon as you create an object of the `Product` class. The initialization code should always be executed. What should you do?
a) Create a static method in the `Product` class to initialize data members.
b) Create a constructor in the `Product` class to initialize data members.
c) Create a static property in the `Product` class to initialize data members.
d) Create an event in the `Product` class to initialize data members.

8. You are creating a new class named `Sphere` derived from the `Shape` class. The `Shape` class has the following code:

```
class Shape
{
    public virtual void Area()
    {
        // additional code...
    }
}
```

The `Area` method in the `Shape` class should provide new functionality but also hide the `Shape` class implementation of the `Area` method. Which code segment should you use to accomplish this?

a)
```
class Sphere : Shape
{
    public override void Area()
    {
        // additional code ...
    }
}
```

b)
```
class Sphere : Shape
{
    public new void Area()
    {
        // additional code ...
    }
}
```

c)
```
class Sphere : Shape
{
    public virtual void Area()
    {
        // additional code ...
    }
}
```

d)
```
class Sphere : Shape
{
    public static void Area()
    {
        // additional code ...
```

```
    }
}
```

9. You are creating a new class named `Polygon`. You write the following code:

```
class Polygon : IComparable
{
    public double Length { get; set; }
    public double Width { get; set; }

    public double GetArea()
    {
        return Length * Width;
    }

    public int CompareTo(object obj)
    {
        // to be completed
    }
}
```

You need to complete the definition of the `CompareTo` method to enable comparison of the `Polygon` objects. Which of the following code segments should you use?

a)
```
public int CompareTo(object obj)
{
    Polygon target = (Polygon)obj;
    double diff = this.GetArea() - target.GetArea();

    if (diff == 0)
        return 0;
    else if (diff > 0)
        return 1;
    else return -1;
}
```

b)
```
public int CompareTo(object obj)
{
    Polygon target = (Polygon)obj;
    double diff = this.GetArea() - target.GetArea();

    if (diff == 0)
        return 1;
    else if (diff > 0)
        return -1;
    else return 0;
}
```

c)
```
public int CompareTo(object obj)
{
    Polygon target = (Polygon)obj;

    if (this == target)
```

```
            return 0;
        else if (this > target)
            return 1;
        else return -1;
    }
```

d)
```
    public int CompareTo(object obj)
    {
        Polygon target = (Polygon)obj;

        if (this == target)
            return 1;
        else if (this > target)
            return -1;
        else return 0;
    }
```

10. You are writing code for a new method named `Process`:

```
    void Draw(object o)
    {

    }
```

The code receives a parameter of type `object`. You need to cast this object into the type `Polygon`. At times, the value of `o` that is passed to the method might not be a valid `Polygon` value. You need to make sure that the code does not generate any `System.InvalidCastException` errors while doing the conversions. Which of the following lines of code should you use inside the `Draw` method to accomplish this goal?

a) `Polygon p = (Polygon) o;`
b) `Polygon p = o is Polygon;`
c) `Polygon p = o as Polygon;`
d) `Polygon p = (o != null) ? o as Polygon : (Polygon) o;`

11. You are writing code to handle events in your program. You define a delegate named `PolygonHandler` like this:

```
    public delegate void PolygonHandler(Polygon  p);
```

You also create a variable of the `PolygonHandler` type as follows:

```
    PolygonHandler handler;
```

Later in the program, you need to add a method named `CalculateArea` to the method invocation list of the `handler` variable. The signature of the `CalculateArea` method matches the signature of the `PolygonHandler` method. Any code that you write should not affect any existing event-handling code. Given this restriction, which of the following code lines should you write?

a) `handler = new PolygonHandler(CalculateArea);`
b) `handler = CalculateArea;`
c) `handler += CalculateArea;`
d) `handler -= CalculateArea;`

12. You are developing a C# application. You create a class of the name `Widget`. You use some third-party libraries, one of which also contains a class of the name `Widget`. You need to make sure that using the `Widget` class in your code causes no ambiguity. Which C# keyword should you use to address this requirement?
a) `namespace`
b) `override`
c) `delegate`
d) `class`

13. You are reviewing a C# program that contains the following class:

```
public class Rectangle
{
    public double Length {get; set;}
    public double Width { get; set; }
}
```

The program executes the following code as part of the `Main` method:

```
Rectangle r1, r2;
r1 = new Rectangle { Length = 10.0, Width = 20.0 };
r2 = r1;
r2.Length = 30;
Console.WriteLine(r1.Length);
```

What will be the output when this code is executed?

a) 10
b) 20
c) 30
d) 40

14. You are reviewing a C# program. The program contains the following class:

```
public struct Rectangle
{
    public double Length {get; set;}
    public double Width { get; set; }
}
```

The program executes the following code as part of the `Main` method:

```
Rectangle r1, r2;
r1 = new Rectangle { Length = 10.0, Width = 20.0 };
r2 = r1;
r2.Length = 30;
Console.WriteLine(r1.Length);
```

What will be the output when this code is executed?

a) 10
b) 20
c) 30
d) 40

15. You are developing a C# application. You need to decide whether to declare a class member as static. Which of the following statements is true about static members of a class?
a) You can use the `this` keyword reference with a static method or property.
b) Only one copy of a static field is shared by all instances of a class.
c) Static members of a class can be used only after an instance of a class is created.
d) The `static` keyword is used to declare members that do not belong to individual objects but to a class itself.

16. Suppose that you are a new C# developer and are reviewing object-oriented programming fundamentals. Which of the following statements is not true?
a) A class is a concrete instance of an object.
b) A class defines the template for an object.
c) A class is a definition of a new data type.
d) A constructor is used to initialize the data members of the object.

17. You are C# developer who is developing a Windows application. You develop a new class that must be accessible to all the code packaged in the same assembly. Even the classes that are in the same assembly but do not directly or indirectly inherit from this class must be able to access the code. Any code outside the assembly should not be able to access the new class. Which access modifier should you use to declare the new class?
a) `public`
b) `protected`
c) `private`
d) `internal`

18. You are C# developer who is developing a Windows application. You need to provide a common definition of a base class that can be shared by multiple derived classes. Which keyword should you use to declare the new class?
a) `virtual`
b) `sealed`
c) `interface`
d) `abstract`

19. You are C# developer who is developing a Windows application. You write the following code:

```
Object o;
```

Later in the code, you need to assign the value in the variable `o` to an object of `Rectangle` type. You expect that at runtime the value in the variable `o` is compatible with the `Rectangle` class. However, you need to make sure that no exceptions are raised when the value is assigned. Which of the following code should you use?
a) `Rectangle r = (Rectangle) o;`
b) `Rectangle r = o;`
c) `Rectangle r = o as Rectangle;`
d) `Rectangle r = o is Rectangle;`

20. You are C# developer who is developing a Windows application. You need to provide derived classes the ability to share common functionality with base classes but still define their own unique behavior. Which object-oriented programming concept should you use to accomplish this functionality?
a) encapsulation
b) abstraction
c) polymorphism
d) inheritance