Lesson 1: Understanding 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. Which access modifier should you use when defining the `percentValue` variable?
a) `private`
b) `protected`
c) `internal`
d) `public`

Answer: a
Difficulty: Medium
Section Reference: Understanding Access Modifiers
The `private` modifier restricts the access to the class in which the member was defined. The `protected` modifier restricts the access to the containing class and to any class derived directly or indirectly from the containing class. The `internal` modifier restricts the access to the code in the same assembly. The `public` modifier does not restrict access.

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;
}
```

Answer: b
Difficulty: Medium
Section Reference: Methods
If a method does not intend to return any value, its return type is specified by the keyword `void`. As the method takes two parameters of data type `double`, the parameter list must declare two variables of type `double`.

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`

Answer: b
Difficulty: Medium
Section Reference: Understanding Polymorphism
Use the virtual keyword to define the `Area` method. When a virtual method is invoked, the runtime type of the object is checked for an overriding member. The overriding member in the most derived class is called, which might be the original member, if no derived class has overridden the member.

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`

Answer: a
Difficulty: Medium
Section Reference: Understanding Inheritance
Use the `sealed` keyword to define the `Scenario` class. When applied to a class, the `sealed` modifier prevents other classes from inheriting from it.

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.

Answer: d
Difficulty: Medium
Section Reference: Understanding Interfaces
You should create a common interface that is implemented by all classes. Interfaces are used to establish contracts through which objects can interact with each other without knowing the implementation details.

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

Answer: a
Difficulty: Medium
Section Reference: Understanding Object Oriented Programming
A method defines the behavior of a class. You can write a method that returns a list of all books sorted by the author's last name.

7. Suppose that you are writing code for a class named `Order`. 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 `Order` class. The initialization code should always be executed. What should you do?
a) Create a static method in the `Order` class to initialize data members.
b) Create a constructor in the `Order` class to initialize data members.
c) Create a static property in the `Order` class to initialize data members.
d) Create an event in the `Order` class to initialize data members.

Answer: b
Difficulty: Medium
Section Reference: Constructors
Constructors are special class methods that are executed when a new instance of a class is created. Constructors are used to initialize the object's 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 ...
    }
}
```

Answer: b
Difficulty: Medium
Section Reference: Understanding Polymorphism
The `new` keyword creates a new member of the same name in the derived class and hides the base class implementation. The `override` keyword is not the correct answer because it replaces a base class member in a derived class.

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;
    }
```

Answer: a
Difficulty: Medium
Section Reference: Understanding Interfaces
The return value of the `CompareTo` method indicates the result of comparing the given parameter with the current object. According to the documentation of the `CompareTo` method,

- If the instance is equal to the parameter, `CompareTo` returns 0.
- If the parameter value is less than the instance or if the parameter is null, a positive value is returned.
- If the parameter value is greater than the instance, a negative value is returned.
- If the parameter is not of the compatible type, an `ArgumentException` is thrown.

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

```
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;`

Answer: c
Difficulty: Medium
Section Reference: Understanding Inheritance
The `as` operator is similar to the cast operation but, in the case of `as`, if the type conversion is not possible, null is returned rather than an exception raised. An exception may be generated with the code in the other answer choices.

11. You are writing code for a class named `Book`. The class `Book` is instantiated by another class named `Library`. You need to write code to provide communication between the objects of the `Book` and the `Library` class when a book is checked-out and when a book is returned. Which of the following class elements should you use?
a) method
b) property

c) event
d) delegate

Answer: c
Difficulty: Medium
Section Reference: Understanding Object Oriented Programming
Events provide communication between the objects.

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`

Answer: a
Difficulty: Medium
Section Reference: Understanding Namespaces
Use the `namespace` keyword. A namespace is a language element that allows you to organize code and create globally unique class names.

13. You are writing a C# program that defines a class named `Product`. The class `Product` contains a data field, `discount`, which needs to be available to other classes. When a value is assigned to the `discount` data field, you need to include code for consistency and validity check. What should you do to accomplish this requirement?
a) Control data field initialization in the constructor of the `Product` class.
b) Create an event that fires when a value is assigned to the `discount` data field. Use an event handler to check for consistency and validity.
c) Define a property corresponding to the data field, `discount`. Include the code for consistency and validity check as part of the set accessor of the property.
d) Define a static method with code for consistency and validity check.

Answer: c
Difficulty: Medium
Section Reference: Properties
A property is a block of code that allows you to access a class data field in a safe and flexible way. A property's `set` and `get` accessors can include code for checking data consistency or validity.

14. You are writing a C# program that defines a class named `Product`. The class `Product` contains a private data field, `discount`, which needs to be available to other classes. Before a value is assigned to the `discount` data field, you need to execute code for consistency and validity check. Any solution you recommend should require least coding efforts. What should

you do to accomplish this requirement? Select two answers. Each answer provides part of the solution.
a) Create a property named `Discount`. Set the access modifier of the property to public.
b) Create a property named `Discount`. Set the access modifier of the property to private.
c) Use the `get` accessor to check for data consistency and validity.
d) Use the `set` accessor to check for data consistency and validity.
e) Use both the `set` and the `get` accessors to check for data consistency and validity.

Answer: a, d
Difficulty: Medium
Section Reference: Properties
A property is a block of code that allows you to access a class data field in a safe and flexible way. A property's `set` and `get` accessors can include code for checking data consistency or validity. The `get` accessor of a property is used to return the property value. The `set` accessor of a property is used to assign a new value to the property.

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.

Answer: d
Difficulty: Medium
Section Reference: Static Members
The `static` keyword is used to declare members that do not belong to individual objects but to a class itself. A static member cannot be referenced through an instance object. Instead, a static member is referenced through the class name. It is not possible to use the `this` keyword reference with a static method or property because the `this` keyword can be used only to access instance objects.

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.

Answer: a
Difficulty: Medium
Section Reference: Static Members
A class is not a concrete instance of an object. Instead, an object is a concrete instance of a class. The facts in the other answer choices are all correct.

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`

Answer: d
Difficulty: Medium
Section Reference: Understanding Access Modifiers
For the `private` access modifier, access is restricted only to the containing class. For the `public` access modifier, access is not restricted. For the `protected` access modifier, access is restricted only to the derived classes. For the `internal` access modifier, access is restricted only to the code in the same assembly.

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`

Answer: d
Difficulty: Medium
Section Reference: Understanding Inheritance
The `abstract` classes provide a common definition of a base class that can be shared by multiple derived classes. The `sealed` classes, on the other hand, provide complete functionality but cannot be used as base classes. The virtual and interface keywords cannot be applied to a class.

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;`

Answer: c
Difficulty: Medium
Section Reference: Casting Between Types
In case of simple cast operation, the runtime checks whether the value of the variable `o` is compatible with the `Rectangle` class. If, at execution time, the value of `o` is not compatible with the `Rectangle` class, the runtime throws a `System.InvalidCastException`. The `as` operator is similar to the cast operation but, in the case of `as`, if the type conversion is not possible, null is returned rather than an exception raised.

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

Answer: c
Difficulty: Medium
Section Reference: Understanding Polymorphism
Polymorphism is the ability of derived classes to share common functionality with base classes but still define their own unique behavior. Inheritance is a feature of object-oriented programming that allows you to develop a class once, and then reuse that code over and over as the basis of new classes.

Lesson 2: Understanding Data Types and Collections

1. You are developing a new application that optimizes the processing of a manufacturing plant's operations. You need to implement a data structure that works as a "buffer" for overflow capacity. When the manufacturing capacity is available, the items in the buffer need to be processed in the order in which they were added to the buffer. Which data structure should you use to implement such buffer?
a) array
b) linked list
c) stack
d) queue

Answer: d
Difficulty: Medium
Section Reference: Understanding Generic Collections
In a queue, items are processed in the order in which they were added to the queue. In particular, items are always added at the end of the queue and removed from the front of the queue. This is also commonly known as first-in, first-out (FIFO) processing.

2. You are developing a new application that optimizes the processing of a warehouse's operations. When the products arrive, they are stored on warehouse racks. To minimize the time it takes to retrieve an item, the items that arrive last are the first to go out. You need to represent the items that arrive and leave the warehouse in a data structure. Which data structure should you use to represent this situation?
a) array
b) linked list
c) stack
d) queue

Answer: c
Difficulty: Medium
Section Reference: Understanding Generic Collections
A stack is a collection of items in which the last item added to the collection is the first one to be removed.

3. You are developing an application that uses a two-dimensional array. You use the following code to declare the array:

```
int[,] numbers = new int[,]
{
    { 11, 7, 50, 45, 27  },
    { 18, 35, 47, 24, 12 },
    { 89, 67, 84, 34, 24 },
    { 67, 32, 79, 65, 10 }
};
```

Next, you refer to an array element by using the expression `numbers[2, 3]`. What will be the return value of this expression?
a) 47
b) 84
c) 24
d) 34

Answer: d
Difficulty: Medium
Section Reference: Understanding Multi-Dimensional Arrays
In the .NET Framework, all arrays are zero-based. A two-dimensional array can be thought of as a table in which each cell is an array element and can be addressed using the numbers of the row and column to which it belongs. Both the row number and column number are indexed by zero. For example, the expression `number[2, 3]` would refer to an item in the third row and fourth column of an array, which in this case is 34.

4. In your application, you are using a queue data structure to manipulate information. You need to find whether a data item exists in the queue, but you don't want to actually process that data item yet. Which of the following queue operations will you use?
a) `enqueue`
b) `dequeue`
c) `peek`
d) `contains`

Answer: d
Difficulty: Medium
Section Reference: Using Queue<T>
The `contains` operation allows you to determine whether a particular item exists in the queue. The `peek` operation allows you to look at the current item at the head position without actually removing it from the queue. The `enqueue` operation adds an item to the tail end of the queue. The `dequeue` operation removes the current element at the head of the queue.

5. You are developing an application that uses the `Stack<T>` data structure. You write the following code:

```
Stack<int> processStack = new Stack<int>();
processStack.Push(50);
processStack.Push(45);
processStack.Pop();
processStack.Push(11);
processStack.Pop();
processStack.Push(7);
```

What are the contents of the stack, from top to bottom, after these statements are executed?
a) 7, 11, 50
b) 7, 45
c) 7, 50

d) 7, 11, 45

Answer: c
Difficulty: Medium
Section Reference: Using Stack<T>
After the first statement, the content of the stack is (50). After the second statement, the stack contents from top to bottom are (45, 50). After the third statement, the top element is popped, resulting to (50). After the fourth statement, another element is added to the top, resulting to (11, 50). After the fifth statement, the top element is popped, resulting to (50). Finally, the sixth statement is executed and the result of stack is (7, 50).

6. In your application, you are using a stack data structure to manipulate information. You need to find which data item will be processed next, but you don't want to actually process that data item yet. Which of the following queue operations will you use?
a) `pop`
b) `push`
c) `peek`
d) `contains`

Answer: c
Difficulty: Medium
Section Reference: Using Stack<T>
The `peek` operation allows you to look at the current item at the top of the stack without actually removing it. The `contains` operation allows you to determine whether a particular item exists in the stack. The `push` operation adds an item to the top of the stack. The `pop` operation removes the element at the top of the stack.

7. You are developing a C# program that makes use of a singly linked list. You need to traverse all nodes of the list. Which of the following items will you need in order to accomplish this requirement?
a) link to the head node
b) link to the tail node
c) data in the head node
d) data in the tail node

Answer: a
Difficulty: Medium
Section Reference: Using LinkedList<T>
Each node in a linked list contains of two pieces of information: the data corresponding to the node, and the link to the next node. The first node of the list is called the head node. Using this link, you can get to the next node and continue traversing nodes until the final link is a null value.

8. Which of the following is not true about linked lists?
a) A linked list does not allow random access to its items.
b) A link to the head node can help you locate all the nodes in a linked list.

c) The items in a linked list must be stored in contiguous memory locations.
d) Linked lists are extremely fast in performing insert and delete operations.

Answer: c
Difficulty: Medium
Section Reference: Using LinkedList<T>
A linked list is a collection of nodes in which each node contains a reference (or link) to the next node in the sequence. Unlike in an array, items in a linked list need not be contiguous; therefore, a linked list does not require reallocation of memory space for the entire list when more items must be added.

9. 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

Answer: c
Difficulty: Medium
Section Reference: Understanding Value Types and Reference Types
The class Rectangle is a reference type, and the content of variable r1 is actually a reference to a memory location that holds a Rectangle object. So, after the r2 = r1; statement, both `r1` and `r2` point to the same memory location and in turn the same `Rectangle` object. In other words, there is only one rectangle object in memory, and both `r1` and `r2` are referring to it. When the `Length` property is modified, the change applies to both objects `r1` and `r2`.

10. 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

Answer: a
Difficulty: Medium
Section Reference: Understanding Value Types and Reference Types
The `struct` is a value rather than a reference type, so both `r1` and `r2` maintain their own copies of data. So, after the `r2 = r1;` statement, both `r1` and `r2` point to different memory locations. When the `Length` property for `r2` object is modified, the change doesn't affect the object `r1`.

11. You are developing a .NET Framework 4.0 application using the C# programming language. Your application maintains a collection of data. The items added to the collection first must be processed first. Your solution must provide type safety.

Which code should you use?

a)
```
Queue <string> data = new Queue<string>();
data.Enqueue("one");
data.Enqueue("two");
```
b)
```
Queue data = new Queue();
data.Enqueue("one");
data.Enqueue("two");
```
c)
```
Stack <string> data = new Stack<string>();
data.Enqueue("one");
data.Enqueue("two");
```
d)
```
Stack data = new Stack();
data.Enqueue("one");
data.Enqueue("two");
```

Answer: a
Difficulty: Medium
Section Reference: Understanding Generic Collections

`Queue<T>` is a first-in, first-out (FIFO) data structure. That is, items added to the queue first will be processed first. The generic collections solve the problems of type safety and performance associated with the non-generic collections.

12. You are developing a .NET Framework 2.0 application. You need to store a collection of strongly typed objects in your application. The items in the collection are not necessarily in sorted order. You need to be able to retrieve the elements of the collection by specifying an index.

What data type should you use to store the objects in your application?
a) Dictionary<T>
b) List<T>
c) ArrayList
d) Hashtable

Answer: b
Difficulty: Medium
Section Reference: Using `List<T>`
You should use the List generic class (`List <T>`) to store the collection of objects in your application. The List generic class enables you to store strongly typed objects in your application. The list generic type also allows you to access the items in the collection by specifying an index.

13. You are using an `ArrayList` collection in your program. You want to modify your program to take advantage of type safety and increased performance offered by the generic types.

Which of the following generic types should you use to replace `ArrayList` with in your program?
a. `Collection<T>`
b. `Dictionary<TKey, TValue>`
c. `List<T>`
d. `LinkedList<T>`

Answer: c
Difficulty: Medium
Section Reference: Understanding Generic Collections
You should use the `List` generic class (`List <T>`) to store the collection of objects in your application. The `List` generic class enables you to store strongly typed objects in your application and provides functionality for a general-purpose list.

14. You need to create a structured data type named `Point`. `Point` should have two fields (`X` and `Y`), each of the `float` data type. You need to make sure that `Point` is a value data type so that the value of the variable is directly stored in its assigned memory location.

What keyword should you use to define `Point`?

a) class
b) struct
c) enum
d) delegate

Answer: b
Difficulty: Medium
Section Reference: Understanding Value Types and Reference Types
The `struct` keyword is used to create user-defined value types that consist of a group of related fields.

15. You are writing a C# program for storing a manufacturing plant. After each item is produced, a quality test is performed, which measures the T-factor of the item. T-factor can be a really large number and can have fractional values.

Which data type should you use to store the value of T-factor in your program?
a. long
b. decimal
c. double
d. byte

Answer: c
Difficulty: Medium
Section Reference: Understanding Intrinsic Data Types
The `double` data type can be used for values raging from -1.79769313486232e308 to 1.79769313486232e308 and is appropriate for this scenario.

16. Which of the following statements is *not* true about the data types declared by using the `struct` keyword?

a. The `struct` keyword is used to define value types
b. A `struct` data type can define a constructor
c. A `struct` data type can define methods and properties
d. A `struct` data type can inherit from another class or struct

Answer: d
Difficulty: Medium
Section Reference: Understanding Value Types and Reference Types
The `struct` keyword is used to define value types. A `struct` data type can contain most of the elements that a class can contain, such as constructors, methods, properties, and so on. Unlike a class, a `struct` cannot inherit from another class or `struct`.

17. Which of the following conversions is permissible in a C# program?

a)
```
int val1;
double val2;
```

```
val2 = 4.65;
val1 = val2;
```

b)
```
int val1;
double val2;

val2 = 4.65;
val1 = (int) val2;
```

c)
```
bool val1;
double val2;

val2 = 4.65;
val1 = val2;
```

d)
```
bool val1;
double val2;

val2 = 4.65;
val1 = (bool) val2;
```

Answer: b
Difficulty: Medium
Section Reference: Understanding Type Conversion and Casting
Conversion from `double` to `int` is possible but you'll lose information such as the value after the decimal point. Because of this possible risk of data loss, the compiler will generate an error unless the programmer explicitly uses the casting operation. Data conversion from `double` to `bool` is not permissible even if you use an explicit cast.

18. You are developing a C# program that process inventory records. You are evaluating several data conversions statements. Which of the following data conversion operations will succeed without any errors or exceptions?

a)
```
double p = 4.5;
object o = p;
int i = (int) o;
```

b)
```
double p = 4.5;
object o = p;
int i = (double) o;
```

c)
```
double p = 4.5;
object o = p;
int i = (int) (double) o;
```

d)
```
double p = 4.5;
object o = p;
int i = (double) (int) o;
```

Answer: c
Difficulty: Medium
Section Reference: Understanding Boxing and Unboxing
In these statements, you are first converting from a value type to a reference type, which causes a boxing operation. Next you convert from a reference type to a value type, which leads to an unboxing operation. For unboxing to succeed, you must cast using the same type that was used for boxing. If you use a different data type, you might get `InvalidCastException` at runtime. In the expression, `(int) (double) o`, you first cast the type to `double` and then cast it again to an `int` data type because the receiving data type is an integer. This is the only conversion that will succeed.

19. You are reviewing a C# program for possible inaccuracy in results. You evaluate the following assignments:
```
double p = 4.5;
object o1 = p;
object o2 = p;
```

Which on the following expressions returns a value of false?

a)
```
o1 == o2
```

b)
```
o1.Equals(o2)
```

c)
```
(double)o1 == (double)o2
```

d)
```
(int) (double) o1 == (int) (double) o2
```

Answer: a
Difficulty: Medium
Section Reference: Understanding Boxing and Unboxing
Here, `o1` and `o2` are two references pointing to separate memory locations. If you compare them directly by using the == operator you are comparing the address of the memory location, which are different and hence result into a `false` value. To compare the values inside the memory location, you need to either unbox the value or use the `Equals` method.

20. You write the following code snippet:
```
int[] numbers = {1, 2, 3, 4};
int val = numbers[2];
```

What is the value of the variable `val` after this code snippet is executed?
a) 1
b) 2
c) 3
d) 4

Answer: c
Difficulty: Medium
Section Reference: Using Arrays
In .NET Framework, array indexes are zero-based. This means that when you access the first element of an array, you use the index value of 0 and you use the index value of 1 to access the second element and so on. In this case, the index value is 2, which accesses the third element of the array.

Lesson 3: Understanding Events and Exceptions

1. 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;`

Answer: c
Difficulty: Medium
Section Reference: Understanding Events and Event Handling
You need to use the += operator rather than the simple assignment operator (=) to attach the event handler. By using the += operator, you ensure that this event handler will be added to a list of event handlers already attached with the event.

2. You are developing a Windows–based application that will be deployed by several customers. The customers would like to have flexibility in specifying settings such as where the database is located. You need to select a solution that requires minimum coding efforts on your part. How should you store this setting in your application?
a) Store the setting in a resource file
b) Store the setting in an application configuration file (app.config)
c) Store the settings in a web configuration file (web.config)
d) Store the settings in an XML file. Deploy the XML file along with the application's executable file.

Answer: b
Difficulty: Medium
Section Reference: Understanding Basic Application Settings
For Web applications, you store the application settings in a file named web.config. For other applications, including console applications, Windows Forms applications, and Windows Presentation Foundation (WPF) applications, the application settings are specified in an app.config file.

3. You are developing a Web application that will be deployed by several customers. The customers would like to have flexibility in specifying settings such as where the database is located. Any solution that you select must not affect other applications installed on the same computer. How should you store this setting in your application?
a) Store the setting in a Web.config file located in the .NET Framework's config folder
b) Store the setting in a Web.config file located in the Web application's folder
c) Store the setting in a Web.config file located in the Web application's bin folder
d) Store the settings in an application configuration file (app.config) located in the Web application's folder

Answer: b
Difficulty: Medium
Section Reference: Understanding Basic Application Settings
For Web applications, you store the application settings in a file named web.config. Although you can have web.config files at multiple levels, the web.config file specified in the web application's folder is used to provide application specific settings.

4. You are developing a Windows–based application that will be deployed by several customers. You need to store a setting named LogFile into a configuration file that you can change without any need to recompile the application. You add the following XML to the app.config file:

```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
   <appSettings>
      <add key="LogFile" value="c:\logs\App.log"/>
   </appSettings>
</configuration>
```

What code should you use to access this setting in your program?
a) `ConfigurationManager.AppSettings["LogFile"]`
b) `AppSettings.ConfigurationManager["LogFile"]`
c) `WebConfigurationManager.AppSettings["LogFile"]`
d) `AppSettings.WebConfigurationManager["LogFile"]`

Answer: a
Difficulty: Medium
Section Reference: Understanding Basic Application Settings
The `ConfigurationManager` class provides the `AppSettings` property to get the data from the `appSettings` section of a configuration file.

5. You are developing a Web application that processes email messages. You need to be able to modify certain application configuration without recompiling the application.

Which of the following should you do? (Select all that apply)
a) Store the configuration in app.config file.
b) Store the configuration in web.config file.
c) Use the `ConfigurationManager` class to access the settings from the configuration file.

d) Use the `WebConfigurationManager` class to access the settings from the configuration file.

Answer: b, d
Difficulty: Medium
Section Reference: Understanding Basic Application Settings
Web application configuration is stored in a Web.config file. The `WebConfigurationManager` class is the preferred way to work with the configuration data stored in the Web.config file.

6. You develop a Windows form application using C#. The name of the application's executable file is ProcessOrder.exe. For easy configuration of the application, you decide to deploy the application with an application configuration file. At runtime, the Windows form application must be able to read the settings stored in the configuration file.

Which of the following actions should you take? (Select all that apply)
a) Name the configuration file as ProcessOrder.config
b) Name the configuration file as ProcessOrder.exe.config
c) Deploy the configuration file to the same directory as the executable file.
d) Deploy the configuration file to a child folder named config.

Answer: b, c
Difficulty: Medium
Section Reference: Understanding Basic Application Settings
For Windows Forms application the name of the configuration file is the name of the application file suffixed with the .config extension. The configuration file must be in the same folder as the executable file.

7. You have written a C# method that opens a database connection by using the `SqlConnect` object. The method retrieves some information from the database and then closes the connection. You need to make sure that your code fails gracefully when there is a database error. To handle this situation, you wrap the database code in a `try-catch-finally` block. You use two `catch` blocks—one to catch the exceptions of type `SqlException` and the second to catch the exception of type `Exception`. Which of the following places should be the best choice for closing the `SqlConnection` object?
a) Inside the `try` block, before the first `catch` block
b) Inside the `catch` block that catches `SqlException` objects
c) Inside the `catch` block that catches `Exception` objects
d) Inside the `finally` block

Answer: d
Difficulty: Medium
Section Reference: Understanding Structured Exception Handling in the .NET Framework
You need to make sure that the `SqlConnection` object is closed properly whether an exception occurred. The `finally` block is always executed and therefore is the best place to place such a code. The other answers are incorrect because code in these blocks can execute sometime but is not guaranteed to execute in every situation.

8. You are assisting your colleague in solving a compiler error that his code is throwing. Following is the problematic portion of his code:

```
try
{
    bool success = ApplyPicardoRotation(100, 0);
    // additional code lines here
}
catch(DivideByZeroException dbze)
{
    //exception handling code
}
catch(NotFiniteNumberException nfne)
{
    //exception handling code
}
catch(ArithmeticException ae)
{
    //exception handling code
}
catch(OverflowException oe)
{
    //exception handling code
}
```

To remove the compilation error, which of the following ways should you suggest to rearrange the code?

a)
```
try
{
    bool success = ApplyPicardoRotation(100, 0);
    // additional code lines here
}
catch(DivideByZeroException dbze)
{
    //exception handling code
}
catch(ArithmeticException ae)
{
    //exception handling code
}
catch(OverflowException oe)
{
    //exception handling code
}
```

b)
```
try
{
    bool success = ApplyPicardoRotation(100, 0);
    // additional code lines here
}
catch(DivideByZeroException dbze)
{
    //exception handling code
}
catch(Exception e)
```

```
{
    //exception handling code
}
catch(OverflowException oe)
{
    //exception handling code
}
```

c)
```
try
{
    bool success = ApplyPicardoRotation(100, 0);
    // additional code lines here
}
catch(DivideByZeroException dbze)
{
    //exception handling code
}
catch(NotFiniteNumberException nfne)
{
    //exception handling code
}
catch(OverflowException oe)
{
    //exception handling code
}
catch(ArithmeticException ae)
{
    //exception handling code
}
```

d)
```
try
{
    bool success = ApplyPicardoRotation(100, 0);
    // additional code lines here
}
catch(DivideByZeroException dbze)
{
    //exception handling code
}
catch(NotFiniteNumberException nfne)
{
    //exception handling code
}
catch(Exception e)
{
    //exception handling code
}
catch(ArithmeticException ae)
{
    //exception handling code
}
```

Answer: c
Difficulty: Medium
Section Reference: Understanding Structured Exception Handling in the .NET Framework

The correct answer arranges the `catch` statements from specific exceptions to the general exceptions. If you place the code to catch a general exception before the specific exception, the `catch` block for that specific statement will never get executed. The C# compiler detects this and flags this situation as error. The exceptions of type `Exception` are most general and hence should be placed in the last `catch` block. Next, the exception of type `ArithmeticException` is more general than `DivideByZeroException`, `OverflowException`, and `NotFiniteNumberException` and should be placed after these specific exceptions.

9. You are developing a desktop-based application that manages inventory. When a new item record is created, the application fires an event. You need to pass the newly added item as part of the event so that the method handling the event can use this information. What should you do?

a) Use an object of `EventArgs` class to hold the event related data.
b) Create a custom class derived from the `EventArgs` class. Use an object of this class to hold the event related data.
c) Use the `EventHandler` delegate to hold the event related data.
d) Use the `delegate` keyword to define custom event related data.

Answer: b
Difficulty: Medium
Section Reference: Understanding Events and Event Handling
The `EventArgs` class is used by events that do not pass any event-related information to an event handler when an event is raised. If the event handler requires event-related information, such as the newly added item, the application must derive a class from the `EventArgs` class to hold the event-related data.

10. You are developing a C# class named `Order`. When an order is changed, you need to fire a `Changed` event. The event does not pass any event-specific data to its subscribers. You need to develop a solution that requires least coding efforts. How should you define the `Changed` event in the `Order` class?

a) `public event EventHandler Changed;`
b) `public delegate EventHandler Changed;`
c) `public event EventArgs Changed;`
d) `public EventHandler event Changed;`

Answer: a
Difficulty: Medium
Section Reference: Understanding Events and Event Handling
You define an event by using the `event` keyword followed by the delegate type. If an event holds no event specific data, using the predefined delegate (`EventHandler`) is sufficient.

11. You are developing a C# class named `Order`. When the shipping mode for the order is changed, you need to fire a `ShippingChanged` event. The event does not pass any event-specific data to its subscribers. You need to develop a solution that requires least coding efforts. How should you define the `Order` class?

a)

```
class Order
{
    public event EventHandler ShippingChanged;
    private string shippingMode;
    public string ShippingMode
    {
        get
        {
            return shippingMode;
        }
        set
        {
            shippingMode = value;
            ShippingChanged(this, EventArgs.Empty);
        }
    }
}
```

b)

```
class Order
{
    public event EventHandler ShippingChanged;
    private string shippingMode;
    public string ShippingMode
    {
        get
        {
            ShippingChanged(this, EventArgs.Empty);
            return shippingMode;
        }
        set
        {
            shippingMode = value;
        }
    }
}
```

c)

```
class Order
{
    public event EventHandler ShippingChanged;
    private string shippingMode;
    public string ShippingMode
    {
        get
        {
            return shippingMode;
        }
        set
        {
            shippingMode = value;
        }
    }
}
```

d)

```
class Order
{
    public event EventHandler ShippingChanged;
    private string shippingMode;
    public string ShippingMode
    {
        get
        {
            return shippingMode;
        }
        set
        {
            shippingMode = value;
            ShippingChanged(this);
        }
    }
}
```

Answer: a
Difficulty: Medium
Section Reference: Understanding Events and Event Handling
In order to invoke the `ShippingChanged` event, you should use `ShippingChanged(this, EventArgs.Empty)`after the value is changed in the set accessor of the `ShippingMode` property.

12. You are developing a C# program that controls a production line. When an item enters the final step of the process, an event `ProcessCompleted` is generated. You need to pass a value, `Frequency`, of `double` data type to all the subscribers of the event. How should you define the event related data in order to accomplish this requirement?

a)

```
class EventData : EventHandler
{
    public double Frequency { get; set; }
}
```

b)

```
class EventData
{
    public double Frequency { get; set; }
}
```

c)

```
class EventData : EventArgs
{
    public double Frequency { get; set; }
}
```

d)

```
class EventArgs: EventData
```

```
{
    public double Frequency { get; set; }
}
```

Answer: c
Difficulty: Medium
Section Reference: Understanding Events and Event Handling
The `EventArgs` class is used by events that do not pass any event-related information to an event handler when an event is raised. If the event handler requires event-related information, the application must derive a class from the `EventArgs` class to hold the event-related data.

13. You are reviewing the code of a C# application that handles an event. Which of the following statements are incorrect about the way events work in the .NET Framework?
a) An event can have multiple subscribers.
b) One event handler method can respond to multiple events.
c) When an event occurs, the publisher of the event might not necessarily know which method will handle that event.
d) When an event occurs, the publisher of the event will know exactly which method will handle that event.
Answer: d
Difficulty: Medium
Section Reference: Understanding Events and Event Handling
An event can have multiple subscribers and each subscriber can respond differently to an event. When an event occurs, the publisher of the event might not necessarily know which method will handle that event.

14. You are reviewing the code of a C# application that handles an event. Which of the following statements are incorrect about the way events and delegates work in the .NET Framework?

a) Delegates are a way for an object to notify other classes or objects when something of interest happens.
b) The delegate corresponding to an event can specify the signature of the methods that can receive notification for the event.
c) The .NET Framework provides a mechanism for connecting the event publisher and subscriber through special delegate types.
d) A delegate is special type that can hold a reference to a method.

Answer: a
Difficulty: Medium
Section Reference: Understanding Events and Event Handling
Events are a way for an object to notify other classes or objects when something of interest happens. The object that sends the notification is called as a publisher of the event. The object or class that receives the notification is called the subscriber of the event.

15. You are reviewing the code of a C# application that handles exceptions. Which of the following statements are correct about the way exception handling works in the .NET Framework?

a) A `try` block must have at least a `catch` block or a `finally` block associated with it.
b) A `try` block must have at least a `catch` block associated with it.
c) A `try` block must have at least a `finally` block associated with it.
d) A `try` block must have at least a `catch` block and a `finally` block associated with it.

Answer: a
Difficulty: Medium
Section Reference: Understanding Structured Exception Handling in the .NET Framework
A `try` block must have at least a `catch` block or a `finally` block associated with it. A `try` block cannot have more than one `finally` block corresponding to it. If there is no `catch` block associated with a `try` block, a `finally` block must be specified.

16. You write the following C# code to handle exception in your program:

```
public void Process()
{
    try
    {
        ProcessData();
    }
    catch (ArithmeticException ex)
    {
        Console.WriteLine(ex.Message);
    }
    catch (Exception ex)
    {
        Console.WriteLine(ex.Message);
    }
}
```

You need to make sure that you are catching the right exception. Which of the following exceptions will be caught by the given code? (Select the best answer)

a) `FileNotFoundException`
b) `DivideByZeroException`
c) `ArithmeticException`
d) All of the above

Answer: d
Difficulty: Medium
Section Reference: Understanding Structured Exception Handling in the .NET Framework
In the given case, the `Exception` class is the most generic exception class of all. The `FileNotFoundException`, `DivideByZeroException` and `AirthmeticExceptions` classes all derive from the `Exception` class is. As a result, the code will catch all the exceptions.

17. You are developing a Windows based application using the C# programming language. You need to use application specific settings data in an application configuration file. You should be

able to change certain settings at runtime without the need to modify the program's source code. Which data format should you use to write the settings in the application configuration file?

a) Comma-separated values
b) Binary
c) XML
d) A custom format defined the application you need to configure

Answer: c
Difficulty: Medium
Section Reference: Understanding Basic Application Settings
Application settings allow the applications to store custom application-specific data. The settings data is stored as XML in a disk file.

18. You are developing a Windows-based application using the C# programming language. You need to use application specific settings data in an application configuration file. You should be able to change the location of the log file at runtime without the need to modify the program's source code. How should you write the settings in the application configuration file?

a)
```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
   <appSettings>
      <add key="LogFile" value="c:\logs\App.log"/>
   </appSettings>
</configuration>
```
b)
```
<?xml version="1.0" encoding="utf-8" ?>
<configuration>
   <connectionStrings>
      <add key="LogFile" value="c:\logs\App.log"/>
   </connectionStrings>
</configuration>
```

c)
```
<?xml version="1.0" encoding="utf-8" ?>
<appSettings>
   <configuration>
      <add key="LogFile" value="c:\logs\App.log"/>
   </configuration>
</appSettings>
```

d)
```
<?xml version="1.0" encoding="utf-8" ?>
<connectionStrings>
   <configuration>
      <add key="LogFile" value="c:\logs\App.log"/>
   </configuration>
</connectionStrings>
```

Answer: a

Difficulty: Medium
Section Reference: Understanding Basic Application Settings
The configuration settings are specified in an XML file. The root level element is the `<configuration>` element. The `<appSettings>` element is a child element of the `<configuration>` element and is used to store the application-specific settings.

19. You are developing a Web application using the C# programming language. You decide to store the database connection string in a Web configuration file. The name of the connection string setting is `ProdServer`. Which of the following expressions should you use to access this connection string in your C# program?

a) `WebConfigurationManager.AppSettings["ProdServer "]`
b) `ConfigurationManager.AppSettings["ProdServer "]`
c) `ConfigurationManager.ConnectionStrings["ProdServer "]`
d) `WebConfigurationManager.ConnectionStrings["ProdServer "]`

Answer: d
Difficulty: Medium
Section Reference: Understanding Basic Application Settings
The `WebConfigurationManager` class is the preferred way to work with the configuration files related to Web applications. The `ConnectionStrings` property gets the data from the `connectionStrings` section of the configuration file.

20. You are developing a C# Windows application that processes orders. When there is an error in printing the packing list, you need to throw an application-specific exception in your code. You need to follow the best practices for handling exceptions in the .NET Framework. Which of the following classes should you inherit from to create an application-specific exception class?

a) `System.Exception`
b) `System.SystemException`
c) `System.ApplicationException`
d) `System.ArgumentException`

Answer: d
Difficulty: Medium
Section Reference: Understanding Structured Exception Handling in the .NET Framework
If you are designing an application that needs to throw any application-specific exceptions, you should create a custom exception class that derives from the `System.Exception` class.

Lesson 4: Understanding Code Compilation and Deployment

1. You are developing a C# program. You compile the program by using a C# compiler. Which of the following statements accurately describes how a program is compiled on the .NET Framework?
a) The compiler translates the program to native code.
b) The compiler translates the program to an intermediate language code.
c) The compiler translates the program to assembly language code.
d) The compiler uses the common language runtime's just-in-time compilation method for translating code.

Answer: b
Difficulty: Medium
Section Reference: Understanding Code Compilation
In the case of .NET Framework, a program in a higher-level programming language such as C# or Visual Basic is first compiled to the Common Intermediate Language (CIL). CIL is an intermediate language that sits between the high-level programming language and the machine code.

2. Which of the following components of the Common Language Infrastructure (CLI) defines the rules for declaring and managing data types and their operations?
a) Common Type System (CTS)
b) Common Language Specifications (CLS)
c) Metadata
d) Virtual Execution System (VES)

Answer: a
Difficulty: Medium
Section Reference: Understanding Common Language Infrastructure (CLI)
Common Type System (CTS) define the rules for declaring, using and managing data types and their operations. CTS help with language integration and allows for objects written in one language to be used by objects written in another language as if they were written in the same language.

3. You are developing an application that has a Receivables module and a Payable module. The Receivable module is being written in C# and the Payable module is being written in Visual Basic. The Receivables module needs to user certain functionality from the Payable module. Any solution that you develop must require least programming efforts. How should you structure your application?
a) Create separate Visual studio projects for Receivables and Payable modules. Add reference to Payable from the Receivable project.
b) Create a single Visual Studio project for both Receivables and Payable modules.
c) Rewrite the Payable module in C#. Use a single Visual Studio project for both Receivables and Payable modules.
d) Rewrite the Receivables module in Visual Basic. Use a single Visual Studio project for both Receivables and Payable modules.

Answer: a
Difficulty: Medium
Section Reference: Understanding Language Interoperability
Language interoperability is a run-time feature. You can't mix and match different programming languages as a single compilation unit. A compiler can only compile code written in one programming language. However, you can certainly have an assembly where all code was written in C# interoperate with another assembly where all code was written using Visual Basic. For the same reason, when you create a Visual Studio Project, you can only use one programming language in the project. It has to be all compiled by a single language compiler. You can, of course, add references to other projects where code was written in a different programming language.

4. Which of the following components of the Common Language Infrastructure (CLI) specifies how the runtime loads and executes CLI-compatible programs?
a) Common Type System (CTS)
b) Common Language Specifications (CLS)
c) Metadata
d) Virtual Execution System (VES)

Answer: d
Difficulty: Medium
Section Reference: Understanding Common Language Infrastructure (CLI)
The Virtual Execution System (VES) specifies how the runtime loads and executes CLI-compatible programs. The VES provides the services needed to execute code, using the metadata to connect separately generated code at runtime. When the code is executed, the platform-specific VES compiles the CIL to the machine language according to the specific hardware and operating system.

5. Which of the following components of the Common Language Infrastructure (CLI) defines the rules to which a language must comply in order to interoperate with other CLS-compliant programming languages?
a) Common Type System (CTS)
b) Common Language Specifications (CLS)
c) Metadata
d) Virtual Execution System (VES)

Answer: b
Difficulty: Medium
Section Reference: Understanding Common Language Infrastructure (CLI)
The Common Language Specifications (CLS) defines the rules for programming language features. These are the rules to which a language must comply in order to interoperate with other CLS-compliant programming languages.

6. In the .NET Framework assemblies, what is the role for metadata?

a) The metadata is a structured way to represent information about a program structure that the Common Language Infrastructure (CLI) uses to locate and load classes at the runtime.
b) The metadata is a structured way to represent information about a program structure that the Common Language Infrastructure (CLI) uses to locate and load classes at the compile time.
c) The metadata is a structured way to represent information about the rules that the Common Language Infrastructure (CLI) uses for declaring, using and managing data types and their operations.
d) The metadata is a structured way to represent information about the rules that a language must comply to in order to interoperate with other Common Language Specification (CLS)-compliant programming languages.

Answer: a
Difficulty: Medium
Section Reference: Understanding Common Language Infrastructure (CLI)
The metadata is a structured way to represent information about a program structure that the Common Language Infrastructure (CLI) uses to locate and load classes at the runtime.

7. Which of the following items is part of a .NET Framework assembly's manifest?
a) Assembly version and identity
b) Data about the classes contained in the assembly
c) Common Intermediate Language (CIL) code that implements the classes
d) A set of resources (such as .bmp file or a .jpg file) used by the code

Answer: a
Section Reference: Understanding Assemblies and Metadata
The Assembly manifest contains information such as version and identity of the assembly.

8. You are working on an application that helps a user inspect and decompile .NET Framework assemblies. You extract the metadata from an assembly. Which of the following information will you *not* find stored in an assembly's metadata?

a) A list of type members
b) Method parameters
c) Return types of methods
d) The content of a resource file

Answer: d
Section Reference: Understanding Assemblies and Metadata
Although the contents of a resource file are part of an assemblies but they are not part of the metadata. Metadata has complete information about the structure of a type and its members. For example, metadata includes the method parameters and return types of a method.

9. You are working on an application that helps a user inspect and decompile .NET Framework assemblies. Which of the following namespaces contains the classes that provide a logical view of an assembly's metadata?

a) System.Security
b) System.ComponentModel
c) System.Reflection
d) System.Resources

Answer: c
Section Reference: Understanding Assemblies and Metadata
The information available as part of metadata is valuable for getting information about the code after the code is compiled. The .NET Framework provides a set of classes as part of the System.Reflection namespace that provides a logical view of the metadata. You can use the reflection API to inspect code and dynamically invoke methods at runtime.

10. You acquired an assembly from one of your suppliers. You do not have access to the source code for the assembly. You need to view the contents of the assembly like the manifest, metadata, and the CIL. Which of the following .NET Frameworks should you use?

a) Assembly Linker (al.exe)
b) Intermediate Language Disassembler (ldasm.exe)
c) Naïve Image Generator (ngen.exe)
d) Assembly Cache Viewer (shfusion.dll)

Answer: b
Section Reference: Understanding Assemblies and Metadata
The Intermediate Language Disassembler (ildasm.exe) is part of the .NET Framework software development kit (SDK). This tool allows you to view the contents of an assembly like the manifest, metadata, and the CIL.

11. You are developing a new .NET Framework application that consists of several assemblies. You decide to deploy the assemblies as private assemblies. Which of the following statements is not true about private assemblies?

a) Private assemblies are designed to be used by only a single application.
b) The .NET Framework does not impose any special versioning or naming requirements for a private assembly.
c) The private assemblies must be registered in the Windows Registry.
d) You can specify a version for a private assembly by using the assembly-level AssemblyVersion attribute.

Answer: c
Section Reference: Understanding Private Assemblies
The .NET Framework does not require assemblies to be registered in the Windows Registry. Applications that use private assemblies can be simply deployed by using the XCOPY command.

12. You are developing a new .NET Framework application that consists of several assemblies. Your application shares some of these assemblies with other applications on a computer. Which of the following statements is *not* true about shared assemblies?

a) A shared assembly must have an associated strong name.
b) A shared assembly must be installed in the Global Assembly Cache (GAC).
c) Multiple versions of a shared assembly can coexist in the Global Assembly Cache (GAC).
d) The shared assemblies can be simply deployed by using the XCOPY command.

Answer: d
Section Reference: Understanding Shared Assemblies
A shared assembly cannot be deployed by simply using the XCOPY command. You need to either use the Windows installer or a .NET Framework tool such as gacutil.exe to deploy a shared assembly.

13. You are developing an assembly that will be deployed as a shared assembly. You need to assign a string name to this assembly. Which information can you optionally leave out when creating a strong name?

a) The simple name
b) The version number
c) The culture identity
d) The public key token

Answer: c
Section Reference: Understanding Shared Assemblies
To create a strong name, you need an assembly's simple name, its version number, an optional culture identity, and a key pair.

14. You are developing a component that will be shared across several applications installed on a computer. You want to place the assembly named wiplocal.dll in the global assembly cache. You have already stored the company's public key in the assembly manifest for the assembly. Which of the following commands should you run to install the assembly to the global assembly cache?

a) sn.exe –Vr wiplocal.dll
b) sn.exe –Vu wiplocal.dll
c) gacutil.exe /i wiplocal.dll
d) gacutil.exe /u wiplocal.dll

Answer: c
Section Reference: Understanding Shared Assemblies
The company's public key is already stored in the assembly manifest for the assembly. So there is no need to use the sn.exe tool. You should run the gacutil.exe command with the switch /i to install the assembly to the global assembly cache.

15. You are developing a component that will be shared across several applications installed on a computer. You may have multiple versions of this component and each application that might use this component might refer to a specific version of the component. You need to make sure that applications can correctly use the component and you want to minimize deployment efforts. Where should you deploy this component?

a) Store the component in the application folder for each application.
b) Add the component to the global assembly cache.
c) Add the component to the Windows System directory.
d) Store the component anywhere that you like and specify the location by using the <codebase> element in the application configuration file.

Answer: b
Section Reference: Understanding Version Control
Multiple versions of a shared assembly can co-exist in the global assembly cache. When you have multiple versions of an assembly installed in the global assembly cache, you can configure an application to use a specific version of the assembly. You should deploy the component to the global assembly cache.

16. You are developing a component that will be shared across several applications installed on a computer. You want to prepare the component so that it can be added to the global assembly cache. You have assigned a version number and culture. Next, you want to add the public key information to the assembly manifest for the assembly. Which of the following tools should you use?

a) sn.exe
b) gacutil.exe
c) installutil.exe
d) al.exe

Answer: a
Section Reference: Understanding Strong Naming
To create a strong name, you need an assembly's simple name, its version number, an optional culture identity, and a key pair. You can generate public/private key pairs by using the command-line Strong Name tool (sn.exe).

17. You develop a component that will be shared across several applications installed on a computer. You place the assembly named wiplocal.dll in the global assembly cache. Later you realize that you need to remove this assembly from the global assembly cache. Which of the following commands should you use?

a) gacutil /i wiplocal.dll
b) gacutil /l wiplocal
c) gacutil /u wiplocal.dll
d) gacutil /u wiplocal

Answer: d
Section Reference: Using the Global Assembly Cache (GAC)
You can remove an assembly from the GAC by using the gacutil.exe command with the /u option. You need only to provide the name of the assembly and not the file name with extension. Also, when there are multiple assemblies in the GAC with the same name, you don't need to provide additional details (such as version, culture, and public key token).

18. You are developing a new .NET Framework application that consists of several assemblies. Your application shares some of these assemblies with other application on a computer. The software application will be installed by the end-user. The installation process should be simple and similar to other applications on the user's computer. Which of the following solutions should you recommend for installing this application?

a) Use the Windows Installer technology to install the application.
b) Use xcopy.exe for copying files to the Program folder and use gacutil.exe to copy the files to the global assembly cache.
c) Use installutil.exe for copying files to the Program folder and use gacutil.exe to copy the files to the global assembly cache.
d) Create a console application by using C# to copy the files to their correct locations.

Answer: a
Section Reference: Using the Global Assembly Cache (GAC)
You should use the Windows Installer technology because it is the recommended approach for installing assemblies on the end-user's computer.

19. You are evaluating the benefits of using the global assembly cache for storing .NET Framework assemblies. Which of the following benefits is not provided by the global assembly cache to a shared assembly?

a) Integrity check
b) Security
c) Side-by-side versioning
d) XCOPY deployment

Answer: d
Section Reference: Understanding Code Deployment
The global assembly cache provides the following benefits to a shared assembly: integrity check, security, and side-by-side versioning. You can't use the XCOPY command to deploy assemblies to the global assembly cache. You need special tools such as gacutil.exe or the Windows Installer to deploy a shared assembly to the global assembly cache.

20. You are developing a component that will be deployed as a shared assembly. You need to sign the assembly with a strong name. You create a key-pair file (key.snk), which contains both the public key and private key for the organization. You want to use the public key only for developing and testing. The public key will be stored in a file named public.snk. Which of the following commands should you use to extract the public key from key.snk?

a) sn.exe –R key.snk public.snk
b) sn.exe –p key.snk public.snk
c) sn.exe –Vr key.snk
d) sn.exe –Vu key.snk

Answer: b

Section Reference: Understanding Strong Naming
You should use the option -p to extract the public key from the key.snk file and store it in the public.snk file.

Lesson 5: Understanding Input/Output (I/O) Classes

1. You are developing a C# application that processes email messages. The program runs locally on a Windows machine but requires minimal user interface and uses a text-mode window to interact with the user. You need to select an application type that matches best with the application's requirement.

What type of application should you develop for this requirement?

a) Console application
b) Windows application
c) Windows service application
d) Web application

Answer: a
Difficulty: Medium
Section Reference: Understanding Console Input/Output (I/O)
Console applications do not have a graphical user interface and use a text-mode console window to interact with the user. Console-based applications are best suited for tasks that require minimal or no user interface.

2. You are developing a console-based application by using the C# programming language. You need to write code that read the next character or function key pressed by the user. The code should be able act on the characters as they are pressed.

Which of the following methods should you use to accomplish this task?

a) `Console.Read`
b) `Console.ReadKey`
c) `Console.ReadLine`
d) `Console.OpenStandardInput`

Answer: b
Difficulty: Medium
Section Reference: Understanding Console Input/Output (I/O)
The `Console.ReadKey` method obtains the next character or function key pressed by the user.

3. You are developing a console-based application by using the C# programming language. The application will accept a list of bin numbers as command-line arguments and displays the contents in those bins on the console. The bin numbers in the input are separated by spaces. You need to accept the command-line arguments in the console application.

How should you write the method that works as the entry-point of your program?

a) `public static int Main(string[] args) { // method code }`

b) `public static int Main(int[] args) { // method code }`
c) `public int Main(string[] args) { // method code }`
d) `public int Main(int[] args) { // method code }`

Answer: a
Difficulty: Medium
Section Reference: Understanding Console Input/Output (I/O)
The `Main` method is the entry point to a console application. The command-line arguments are the values passed to the Main method from the operating system. If you need to pass more than one argument, you can separate the arguments by space. The `Main` method receives the command-line arguments as a string array.

4. You are developing an application, `ProcessOrder` that processes orders. The application takes an order range as input and processes each order as per the business logic. The application must be run as part of a batch process. The order range is available from the output of another application, `GetShippedOrders`.

How should you design the `ProcessOrder` application?

a) Console application
b) Windows application
c) Windows service application
d) Web application

Answer: a
Difficulty: Medium
Section Reference: Understanding Console Input/Output (I/O)
A console application is best suited for tasks that require minimal or no user interface. Think of these applications as commands. You issue the command on the command line (optionally passing a parameter) and the application accomplishes the specified task and optionally displays a message summarizing the action. Console applications can also be executed as part of a batch process.

5. You are working on an inventory application. The inventory data is stored in the XML format. You receive product information from a vendor in XML format. You verify that this file contains well-formed and well-structure XML data. You need to import this data in your system. Before you import the data, you need to determine the structure of the XML file so that you can programmatically assign data to their correct location. Any solution that you suggest must involve least amount of coding efforts.

What should you do to determine the structure of the incoming XML files?

a) Use the `XMLSchema` class
b) Use the `XMLSerializer` class
c) Use the XML Schema Definition (xsd.exe) tool
d) Use the Type Library Importer (tlbimp.exe) tool

Answer: c
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
XML schema is particularly important when an XML file is used to share data between two applications. Without XML schema, the applications won't know how the data in the XML file is structured. If you already have a well-formed and well-structured XML data file, you can infer XML schema from the XML data by using the .NET Framework XML Schema Tool (xsd.exe).

6. You are working on an inventory application that runs on the .NET Framework version 4.0. The inventory data is stored in the XML format. You receive product information from a vendor in XML format. You verify that this file contains well-formed and well-structure XML data. You need to import this data in your system. Before you import the data, you need to determine that the structure of the XML file conforms to the XML schema defined by your application's specifications. You decide to use the `XmlReader` class for validation.

What properties of the `XmlReader` class should you modify to validate the structure of the incoming XML files?

a) Set the `Settings` property to an instance of the `XmlReaderSettings` class where `ValidationType` is set to `ValidationType.DTD`.
b) Set the `Settings` property to an instance of the `XmlReaderSettings` class where `ValidationType` is set to `ValidationType.Schema`.
c) Set the `Settings` property to an instance of the `XmlReaderSettings` class where `ConformanceLevel` is set to `ConformanceLevel.Fragment`.
d) Set the `Settings` property to an instance of the `XmlReaderSettings` class where `ConformanceLevel` is set to `ConformanceLevel.Document`.

Answer: b
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
You should set the Settings property of the `XmlReader` class to an instance of the `XmlReaderSettings` class. You should also set the `ValidationType` property of the `XmlReaderSettings` class as `ValidationType.Schema` to indicate that you would like to validate the XML data on the specified schema.

7. You are developing C# application that generates XML data files for product catalog. You write data to an XML file on the disk by using the `XmlWriter` class. The program waits for the results from a Web service to write additional data. You want to write additional data to the disk file but do not want to lose the data that is still in the `XmlWriter` buffer.

What method of the `XmlWriter` class should you use to ensure that there is no data loss?

a) `Flush`
b) `Close`
c) `Dispose`

d) `WriteRaw`

Answer: a
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
`XmlWriter` uses buffered input to improve performance. This means that `XmlWriter` maintains a small internal memory where it will collect the data as it arrives. When the `XmlWriter` has enough data to work with, it performs the actual disk-write operation. When you call the `XmlWriter.Flush` method, you instruct the `XmlWriter` to immediately transfer the contents of the internal buffer to the disk. Calling Flush before closing `XmlWriter` ensures that you don't lose any data that is still sitting in the buffer.

8. You are working on an inventory application that runs on the .NET Framework version 4.0. The inventory data is stored in the XML format. You receive product information from a vendor in XML format. You need to validate and import this data in your system. You need to also log any schema validation warnings encountered during validation. You use the `XmlReader` class for validation and use the `XmlReaderSettings` class to specify validation settings.

Which property of the `XmlReaderSettings` class should you use to ensure that schema validation warnings are enabled?

a) `ValidationType`
b) `ValidationFlag`
c) `ConformanceLevel`
d) `Schemas`

Answer: b
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
The `ValidationFlag` property of the `XmlReaderSettings` class is used to indicate the schema validation settings such as if the validation warning messages are enabled.

9. You are creating an XML document that contains customer data. The Customer Id should be added as an XML attribute. You need to make sure that the XML document is Well-formed.

How should you structure the customer data in the document?

a)
```
<Customer Id="ALFKI" />
```
b)
```
<Customer>
 <Id>ALFKI</Id>
</Customer>
```
c)
```
<Customer>
 <Id="ALFKI" />
<Customer>
```

d)
```
<Customer
   Id="ALFKI">
```

Answer: a
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
An opening tag and closing tag together with their content is called an xml element. Elements can contain attributes. An attribute is a piece of data that further describes an xml element. An attribute is placed inside the opening tag of the element as follows, `<Customer Id="ALFKI" />`

10. You are creating an XML document that will contain product-related data. You need to add a processing instruction that tells a program that the XML document conforms to the XML version 1.0 specifications and uses UTF-8 character set for its data elements.

What should you do to add this information to your XML document?

a) Add the following line at the top of the XML page:
```
<xml version="1.0" encoding="utf-8">
```
b) Add the following line at the bottom of the XML page:
```
 <?xml version="1.0" encoding="utf-8"?>
```
c) Add the following line at the bottom of the XML page:
```
 <xml version="1.0" encoding="utf-8">
```
d) Add the following line at the top of the XML page:
```
<?xml version="1.0" encoding="utf-8"?>
```

Answer: d
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
The XML tags that begin with the `<?` characters are called processing instructions. The `<?xml` processing instruction tells us that the document is an XML document, conforms to the XML version 1.0 specifications, and uses UTF-8 character set for its data elements.

11. You are developing a C# program that generates XML data files, which will be shared with vendors. Vendors will use this XML data file to import customer data into their systems. You need to make sure that the XML data files conform to the following XML Schema:
```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema id="Customers"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:msdata="urn:schemas-microsoft-com:xml-msdata">
  <xs:element name="Customers"
  msdata:IsDataSet="true"
  msdata:UseCurrentLocale="true">
    <xs:complexType>
      <xs:choice minOccurs="0" maxOccurs="unbounded">
        <xs:element name="Customer">
          <xs:complexType>
            <xs:sequence>
              <xs:element name="CompanyName"
              type="xs:string"
```

```
              minOccurs="0" msdata:Ordinal="0" />
              <xs:element name="Phone"
              type="xs:string"
              minOccurs="0" msdata:Ordinal="1" />
            </xs:sequence>
            <xs:attribute name="Id"
            type="xs:string" />
          </xs:complexType>
        </xs:element>
      </xs:choice>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

Which of the following XML data conforms to this schema?

a)

```
<?xml version="1.0" encoding="utf-8"?>
<Customers>
  <Customer Id="ALFKI">
    <CompanyName>Alfreds Futterkiste</CompanyName>
    <Phone>030-0074321</Phone>
  </Customer>
  <Customer Id="EASTC">
    <CompanyName>Eastern Connection</CompanyName>
    <Phone>(171) 555-0297</Phone>
  </Customer>
</Customers>
```

b)

```
<?xml version="1.0" encoding="utf-8"?>
<Customer Id="ALFKI">
  <CompanyName>Alfreds Futterkiste</CompanyName>
  <Phone>030-0074321</Phone>
</Customer>
<Customer Id="EASTC">
  <CompanyName>Eastern Connection</CompanyName>
  <Phone>(171) 555-0297</Phone>
</Customer>
```

c)

```
<?xml version="1.0" encoding="utf-8"?>
<Customers Id="ALFKI">
  <CompanyName>Alfreds Futterkiste</CompanyName>
  <Phone>030-0074321</Phone>
</Customers>
<Customers Id="EASTC">
  <CompanyName>Eastern Connection</CompanyName>
  <Phone>(171) 555-0297</Phone>
</Customers>
```

d)

```
<?xml version="1.0" encoding="utf-8"?>
<Customers>
  <Customer>
    <CompanyName>Alfreds Futterkiste</CompanyName>
    <Phone>030-0074321</Phone>
    <Id>ALFKI</Id>
```

```
  </Customer>
  <Customer>
    <CompanyName>Eastern Connection</CompanyName>
    <Phone>(171) 555-0297</Phone>
    <Id>EASTC</Id>
  </Customer>
</Customers>
```

Answer: a
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
The correct answer is as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<Customers>
  <Customer Id="ALFKI">
    <CompanyName>Alfreds Futterkiste</CompanyName>
    <Phone>030-0074321</Phone>
  </Customer>
  <Customer Id="EASTC">
    <CompanyName>Eastern Connection</CompanyName>
    <Phone>(171) 555-0297</Phone>
  </Customer>
</Customers>
```

As per the schema, the root element of the XML document is `Customers`. This element must have 0 or more child elements by the name `Customer`. Also as per the schema, The `Customer` element should have an attribute, `Id`.

12. You are working on an inventory application. You need to import inventory data specified in an XML format. You need to know how the data in the XML file is structured.

Which of the following techniques is the least effective way to retrieve information about the schema of an XML file?

a) Infer schema from a well-formed XML file
b) Use the schema specified as part of the XML file
c) Use the schema specified in a separate XML file
d) Use the schema specified in a binary file

Answer: d
Difficulty: Medium
Section Reference: Understanding XML Classes in the .NET Framework
The schema of the XML file can be inferred from the structure of an XML document, specified as part of the file, or specified in a separate file. However, the schema itself is always written in a human readable XML format and should not be specified in a binary file.

13. You are developing a C# program. You need to read the next line of characters from the standard input stream as a string.

Which of the following methods should you use?

a) `Console.Read`
b) `Console.ReadKey`
c) `Console.ReadLine`
d) `StreamReader.ReadLine`

Answer: c
Difficulty: Medium
Section Reference: Understanding Console Input/Output (I/O)
The `Console.ReadLine` method reads the next line of characters from the standard input stream as a string. The `Console.Read` and `Console.ReadKey` method only read the next character from the standard input stream. The `StreamReader.ReadLine` method does not read from standard input stream.

14. You are developing a C# program. You need to write text, followed by a line terminator character, to the standard output stream. Any solution that you select must require least amount of coding.

Which of the following methods should you use?

a) `Console.Write`
b) `Console.WriteLine`
c) `StreamWriter.WriteLine`
d) `StringWriter.WriteLine`

Answer: b
Difficulty: Medium
Section Reference: Understanding Console Input/Output (I/O)
The `Console.WriteLine` method writes text to the standard output stream, followed by the line terminator character. The `Console.Write` method does not follow the output with a line time terminator character. The `StreamWriter` and `StringWriter` classes do not write to standard output stream.

15. You are writing a C# program that needs to perform file operations such as copy, move, or delete. The business logic may require you to perform multiple operations on a file. You need to develop a solution a fast and efficient solution.

Which of the following classes should you choose to perform these file operations?

a) `File`
b) `FileInfo`
c) `FileStream`
d) `FileSystemInfo`

Answer: b
Difficulty: Medium
Section Reference: Understanding .NET File Classes in the .NET Framework

The static methods of the `File` class perform security checks each time they are called. So, if you are going to perform multiple operations on a file, it might be more efficient to use the methods in the `FieInfo` class instead of the `File` class. If security if paramount, it might be helpful to use the `File` class methods.

16. You are writing a C# program that needs to create, move, and enumerate through directories and subdirectories on disk. The need to make sure that all the security checks are performed each time a directory operation is performed.

Which of the following classes should you choose to perform these directory operations?

a) `Directory`
b) `DirectoryInfo`
c) `DriveInfo`
d) `FileSystemInfo`

Answer: a
Difficulty: Medium
Section Reference: Understanding .NET File Classes in the .NET Framework
The static methods of the `Directory` class perform security checks each time they are called. So, if you are going to perform multiple operations on a directory, it might be more efficient to use the methods in the `DirectoryInfo` class instead of the `Directory` class. If security is paramount, it might be helpful to use the `Directory` class methods.

17. You are developing a program that writes product catalog to a disk file. The product catalog contains text, images, videos and sound files.

Which class should you use to write this file to the disk?

a) `StringWriter`
b) `StreamWriter`
c) `BinaryWriter`
d) `XmlWriter`

Answer: c
Difficulty: Medium
Section Reference: Understanding .NET File Classes in the .NET Framework
A binary file is a disk file that can store any type of data. Examples of binary data include mathematical data, image data, video data, audio data, or a combination of them all. To write to a binary file, you should use an instance of the `BinaryWriter` class.

18. You are developing a C# application that creates text files. You write the following code:

```
using (StreamWriter sw =
   new StreamWriter("file.txt"))
{
   sw.Write("Sample Text");
}
```

You now need to read the text from this file.

Which of the following code segments should you use?

a)
```
using (StreamReader sr =
   new StreamReader("file.txt", Encoding.UTF7))
{
    string line;
    while ((line = sr.ReadLine()) != null)
    {
        Console.WriteLine(line);
    }
}
```
b)
```
using (StreamReader sr =
   new StreamReader("file.txt", Encoding.ASCII))
{
    string line;
    while ((line = sr.ReadLine()) != null)
    {
        Console.WriteLine(line);
    }
}
```
c)
```
using (StreamReader sr =
   new StreamReader("file.txt", Encoding.UTF8))
{
    string line;
    while ((line = sr.ReadLine()) != null)
    {
        Console.WriteLine(line);
    }
}
```
d)
```
using (StreamReader sr =
   new StreamReader("file.txt", Encoding.Unicode))
{
    string line;
    while ((line = sr.ReadLine()) != null)
    {
        Console.WriteLine(line);
    }
}
```

Answer: c
Difficulty: Medium
Section Reference: Understanding .NET File Classes in the .NET Framework
The `StreamReader` and `StreamWriter` classes provide methods to read data from and write data to text files using the specified encoding. Unless specified otherwise, both classes default to using the `UTF8` encoding. It is important to make sure that you use the same encoding scheme for reading and writing data. If you use a different coding scheme than what is expected, the text might be garbled.

19. You are developing a C# application that creates text files. You write the following code:

```
using (BinaryWriter writer = new BinaryWriter(
        File.Open("data.bin", FileMode.Create)))
 {
    writer.Write(3.141f);
 }
```

You now need to read data from this file.

Which of the following code segments should you use?

a)

```
using (BinaryReader reader = new BinaryReader(
        File.Open("data.bin", FileMode.Open)))
{
    Console.WriteLine(reader.ReadInt32());
}
```

b)

```
using (BinaryReader reader = new BinaryReader(
        File.Open("data.bin", FileMode.Open)))
{
    Console.WriteLine(reader.ReadString());
}
```

c)

```
using (BinaryReader reader = new BinaryReader(
        File.Open("data.bin", FileMode.Open)))
{
    Console.WriteLine(reader.ReadSingle());
}
```

d)

```
using (BinaryReader reader = new BinaryReader(
        File.Open("data.bin", FileMode.Open)))
{
    Console.WriteLine(reader.ReadBoolean());
}
```

Answer: c
Difficulty: Medium
Section Reference: Understanding .NET File Classes in the .NET Framework
The order in which you read or write binary data is important. If you try to read a string data from a disk when the actual data stored is a floating-point number, you will get unexpected results. The Write method of the `BinaryWriter` class provides several overrides to accommodate different data types. However, for `BinaryReader` (the return types are different for each read method), there are separate read methods, one for each data type. In this case, because you are reading a floating point number, you should use the `ReadSingle()` method of the `BinaryReader` class.

20. You are writing a C# program. You need to read lines of information from a text file. The text stored in the file uses the UTF-7 encoding.

Which of the following classes should you use to read data from this file?

a) `StreamReader`
b) `BinaryReader`
c) `StringReader`
d) `TextReader`

Answer: a
Difficulty: Medium
Section Reference: Understanding .NET File Classes in the .NET Framework
`StreamReader` is designed for character input in a particular encoding. You should use the `StreamReader` class for read1ing lines of information from a text file.

Lesson 6: Understanding Security

1. You are developing a Web application using ASP.NET. This application will be deployed on a Windows Server 2008 machine. You need to write code that validates the user's credentials against the Web server. Which authentication mechanism should you use in your code?

a) Basic
b) Form-based
c) Windows
d) Passport

Answer: c
Difficulty: Medium
Section Reference: Understanding Authentication and Authorization
The .NET Framework provides several authentication schemes such as basic, digest, Windows, Passport, form-based and custom-defined. If you are validating the credentials against a Windows Web server, you should be using the Windows authentication scheme.

2. You are developing a Windows application using the C# programming language. You implement role-based security in your application. From your code, you need to retrieve information such as the username and his authentication method. Which of the following objects should you use?

a) `WindowsIdentity`
b) `WindowsPrincipal`
c) `PrincipalPermission`
d) `GenericPrincipal`

Answer: a
Difficulty: Medium
Section Reference: Understanding Authentication and Authorization
Role-based security revolves around two interfaces: `IIdentity` and `IPrincipal`. For applications that use Windows accounts in role-based security, these interfaces are implemented by the `WindowsIdentity` and `WindowsPrincipal` objects, respectively. The `WindowsIdentity` object represents the Windows user who is running the current code. The properties of this object allow you to retrieve information such as the username and his authentication method.

3. You are developing a Windows application that uses role-based security. When the application is run, you need to determine whether the current user is in a specific windows group. The name of the group is provided in the application configuration file. Which of the following methods should you use?

a) `WindowsPrincipal.IsInRole`
b) `WindowsIdentity.Groups`
c) `WindowsIdentity.AuthenticationType`

d) `WindowsPrincipal.GetType`

Answer: a
Difficulty: Medium
Section Reference: Understanding Authentication and Authorization
You can use .NET Framework role-based security to implement authorization. One way to manage role-based security is to use the `IsInRole` method of the `WindowsPrincipal` object. This method can be used to determine whether the current user is in a specific windows group. The result of this method call can be used to modify your application's user interface or to perform other tasks.

4. You are developing a Web application that uses role-based security. When the application is run, you need to determine whether a user is allowed to perform a requested action. Which of the following security features should you use to accomplish this task?

a) Authentication
b) Authorization
c) Public-key encryption
d) Secret-key encryption

Answer: b
Difficulty: Medium
Section Reference: Understanding Authentication and Authorization
Authorization is the process of determining whether an authenticated identity is allowed to perform a requested action.

5. You are developing a program that implements role-based security. You need to determine whether the user belongs to a custom Windows user group that has a specified name. Which form of the `WindowsPrincipal.IsInRole` method should you use?

a) `IsInRole(Int32)`
b) `IsInRole(SecurityIdentifier)`
c) `IsInRole(string)`
d) `IsInRole(WindowsBuiltInRole)`

Answer: c
Difficulty: Medium
Section Reference: Understanding Authentication and Authorization
You should use `IsInRole(string)` form because this form checks for membership in a group with the specified name.

6. You are developing a program that implements role-based security. You need to determine the security context under which code is running. Which of the following security interfaces should you use (select two)?

a) `IIdentity`

b) `IPrincipal`
c) `IPermission`
d) `ICryptoTransform`
e) `IEvidenceFactory`

Answer: a, b
Difficulty: Medium
Section Reference: Understanding Authentication and Authorization
Role-based security revolves around two interfaces: `IIdentity` and `IPrinicipal`. For applications that use Windows accounts in role-based security, these interfaces are implemented by the `WindowsIdentity` and `WindowsPrincipal` objects, respectively.

7. You are developing a Web application that implements role-based security. Your code need to check group membership of a user on the Windows 2008 Server. You write the following code:
```
WindowsIdentity identity = WindowsIdentity.GetCurrent();
```
You notice that the method `GetCurrent()` is failing. What should you do to get the correct identify information for the user?

a) Precede the code with the following:
```
AppDomain.CurrentDomain
  .SetPrincipalPolicy(PrincipalPolicy.WindowsPrincipal);
```
b) Precede the code with the following:
```
AppDomain.CurrentDomain
  .SetPrincipalPolicy(PrincipalPolicy.UnauthenticatedPrincipal);
```
c) Precede the code with the following:
```
AppDomain.CurrentDomain
  .SetPrincipalPolicy(PrincipalPolicy.NoPrincipal);
```
d) Precede the code with the following:
```
AppDomain.CurrentDomain.SetThreadPrincipal(new GenericPrincipal());
```

Answer: a
Difficulty: Medium
Section Reference: Understanding Authentication and Authorization
You must set the current application domain's principal policy to the enumeration value `WindowsPrincipal`. By default, the principal policy is set to `UnauthenticatedPrincipal`. If you do not set the principal policy to `WindowsPrincipal`, the `WindowsIdentity.GetCurrent` method will fail.

8. You are developing a Web application by using C# programming language. The data that the application processes is sensitive. You need to make sure that the data cannot be viewed by unauthorized users. You also need to detect whether the secured data has been modified. Which of the following .NET Framework security features should you use to implement this requirement?

a) Authentication
b) Authorization
c) Cryptography
d) Code-access security

Answer: c
Difficulty: Medium
Section Reference: Understanding Cryptography
You should use cryptography to implement this requirement. Cryptography encrypts the data so that it cannot be by viewed by unauthorized users and to detect whether the data has been modified.

9. You are developing a C# program that performs several tasks including encryption and decryption of data, hashing, random number generation, and message authentication. You want to use the classes available in the .NET Framework in order to quickly write your program. Which of the following namespaces should you choose your classes from to develop your program?

a) `System.Security`
b) `System.Security.AccessControl`
c) `System.Security.Authentication`
d) `System.Security.Cryptography`

Answer: d
Difficulty: Medium
Section Reference: Understanding Cryptography
The `System.Security.Cryptography` namespace contains various classes that provide cryptography services, including encryption and decryption of data, hashing, random number generation, and message authentication.

10. You are developing a C# program that encrypts and decrypts data. You need to use the same key for both encryption and decryption. Which security feature of the .NET Framework should you use?

a) Public-key encryption
b) Secret-key encryption
c) Code access security
d) Authorization

Answer: b
Difficulty: Medium
Section Reference: Understanding Cryptography
In the secret-key encryption technique, both the sender and receiver of the message share a secret encryption key. The sender encrypts the message before sending it across and the receiver uses the same key to decrypt the message.

11. You are developing a C# program that encrypts and decrypts data. You need to use the highest level of encryption. Which of the following cryptography classes should you use to encrypt data in your program?

a) `AesManaged`
b) `DESCryptoServiceProvider`
c) `RC2CryptoServiceProvider`
d) `TripleDESCryptoServiceProvider`

Answer: a
Difficulty: Medium
Section Reference: Understanding Cryptography
In the given classes, the `AesManaged` class provides the highest-level of encryption. The `AesManaged` class implements the Advanced Encryption Standard (AES) symmetric algorithm.

12. You are developing a C# program that encrypts and decrypts data. You need to use the highest level of encryption. Your program should be compliant with the Federal Information Processing Standards (FIPS). Which of the following cryptography classes should you use to encrypt data in your program?

a) `RijndaelManaged`
b) `AesManaged`
c) `DESCryptoServiceProvider`
d) `TripleDESCryptoServiceProvider`

Answer: b
Difficulty: Medium
Section Reference: Understanding Cryptography
In the given classes, the `AesManaged` class and `RijndaelManaged` class provide the highest-level of encryption. The AES algorithm is compliant with the Federal Information Processing Standards (FIPS) whereas the `Rijndael` algorithm is not. As a result, you should be using the `AesManaged` class in your program.

13. You are developing a C# program that encrypts and decrypts data. You use a cryptography class that public-key algorithm for encrypting and decrypting data. Which of the following statements correctly describes how public-key encryption works (select two correct answers)?

a) The data encrypted using a public key can only be decrypted using the corresponding private key.
b) The data encrypted using a private key can only be decrypted using the corresponding public key.
c) The data signed by a private key can be verified only by the corresponding public key.
d) The data signed by a public key can be verified only by the corresponding private key.

Answer: a, c
Difficulty: Medium
Section Reference: Understanding Cryptography
The public key and the private key are cryptographically paired. That is, the data encrypted using a public key can only be decrypted using the corresponding private key. Additionally, the data signed by a private key can be verified only by the corresponding public key.

14. You develop a C# program that encrypts and decrypts data by suing the public-key cryptography methods. Alice uses your program to encrypt some data that can only be read by Bob. Alice uses Bob's public key to encrypt the data and sends the data to Bob via an email. What step should Bob take in order to decrypt data sent by Alice?

a) Bob should use Alice's public key to decrypt data.
b) Bob should use Alice's private key to decrypt data.
c) Bob should use his own public key to decrypt data.
d) Bob should use his own private key to decrypt data.

Answer: d
Difficulty: Medium
Section Reference: Understanding Cryptography
As Alice uses Bob's public key for encryption, Bob would use his private key to decrypt that message. When a sender and receiver communicate encrypted data by using the public key cryptography, they don't need to share the private-key information. Only the public key is shared.

15. You develop a C# program that allows users to send and receive authenticated messages. That is the receiver of a message can reliably verify that identity of the message's author. Alice uses your program to sign a message with her private key. When Bob receives the message, he needs to verify that the message was sent by Alice and that the message has not been tampered with during the transfer. What should Bob do?

a) Bob should use Alice's private key to verify that the message is sent by Alice.
b) Bob should use Alice's public key to verify that the message is sent by Alice.
c) Bob should use his own private key to verify that the message is sent by Alice.
d) Bob should use his own public key to verify that the message is sent by Alice.

Answer: b
Difficulty: Medium
Section Reference: Understanding Cryptography
Because the private key is known only to the owner of the key, it can be used for providing digital signatures. The data signed by a private key can be verified only by the corresponding public key. When Bob receives the message, he should use Alice's public key to verify that the message is indeed sent by Alice and has not been tampered with during the transfer.

16. You are developing a secure application by using the C# programming language. You need to help reduce the chances that your code is misused by malicious code to perform unintended operations. Which of the following .NET Framework security features should you use?

a) Permissions
b) Secret-key encryption
c) Code access security
d) Authorization

Answer: c
Difficulty: Medium
Section Reference: Understanding Code Access Security
Code access security defines what code running on a computer system is allowed to do. If you specify the operations your code is allowed to perform, the code access security system can help reduce the chances that your code is misused by malicious code to perform unintended operations.

17. You are developing a C# application that processes orders. You need to make sure that the application uses the code access security features provided by the .NET Framework. From the following list, identify the tasks that can be performed by using the code access security features (select two correct answers).

a) Verify a user's identity using his or her credentials.
b) Help reduce the chances that trusted code is misused by malicious code to perform unintended operations.
c) Enforce that the code originating from unknown or untrusted source runs with added protection.
d) Determine whether an authenticated identity is allowed to perform a requested action.

Answer: b, c
Difficulty: Medium
Section Reference: Understanding Code Access Security
Code access security defines what code running on a computer system is allowed to do. Code access security offers protections in the following two situations:

- Enforces that the code originating from unknown or untrusted source runs with added protection.
- If you specify the operations your code is allowed to perform, the code access security system can help reduce the chances that your code is misused by malicious code to perform unintended operations.

18. You are developing an application that doesn't need to access protected resource. You want to ensure that your code is never used to accidentally or maliciously access protected resources. What should you do to accomplish this?

a) Apply the following attribute to the assembly
```
[assembly: SecurityTransparent()]
```
b) Apply the following attribute to the assembly
```
[assembly: SecurityCritical()]
```
c) Apply the following attribute to the assembly
```
[assembly: SecuritySafeCritical()]
```
d) Apply the following attribute to the assembly
```
[assembly: SecurityRules(SecurityRuleSet.Level2)]
```

Answer: a
Difficulty: Medium

Section Reference: Understanding Code Access Security
In some cases, an assembly might not need all the permissions to run and you might want to explicitly reduce the permissions available to the code in order to reduce the risk of accidental or unauthorized use of the permissions. To do this, you use the `SecurityTransparentAttribute` class, which is part of the `System.Security` namespace.

19. You are developing a C# application that uses the `RSACryptoServiceProvider` class. You need to provide the public key information but protect the private key. What should you do to accomplish this requirement?

a) Call the `ExportParameters` method with a parameter value of `false`.
b) Call the `ExportParameters` method with a parameter value of `true`.
c) Call the `Encrypt` method with a parameter value of `true`.
d) Call the `Encrypt` method with a parameter value of `false`.

Answer: a
Difficulty: Medium
Section Reference: Understanding Cryptography
When you use the `ExportParameters` method with the false argument, only the public key is exported; the private key is not exported. On the other hand, when you call the `ExportParameters` method with the `true` value, the private key is exported as well.

20. You need to create a partially trusted host for an assembly in your application. What should you do to accomplish this?

a) Apply the following attribute to the assembly
```
[assembly: SecurityRules(SecurityRuleSet.Level1)]
```
b) Apply the following attribute to the assembly
```
[assembly: SecurityRules(SecurityRuleSet.Level2)]
```
c) Apply the following attribute to the assembly
```
[assembly: AllowPartiallyTrustedCallers()]
```
d) Use the `AppDomain.CreateDomain` method

Answer: d
Difficulty: Medium
Section Reference: Understanding Code Access Security
The `AppDomain.CreateDomain` method creates a security sandbox. You can use this security sandbox to create a partially trusted host for the given assembly in your application.