Lesson 1: Introduction to Programming

1. You need to gain a better understanding of the solution before writing the program. You decide to develop an algorithm that lists all necessary steps to perform an operation in the correct order. Any technique that you use should minimize complexity and ambiguity. Which of the following techniques should you use?
a) flowchart
b) decision table
c) C# program
d) A paragraph in English

Answer: a
Difficulty: Medium
Section Reference: Introducing Algorithms
A flowchart is a graphical representation of an algorithm that lists, in the correct order, all the necessary steps to perform the operation. A flowchart is simple to create and understand and is not ambiguous.

2. Which of the following languages is not considered a high-level programming language?
a) C#
b) Visual Basic
c) Common Intermediate Language
d) C++

Answer: c
Difficulty: Easy
Section Reference: Introducing C#
C#, Visual Basic, and C++ are all high-level programming languages. The Common Intermediate Language is low-level programming language used by the .NET Framework language compilers to create an executable file.

3. You are writing code for a business application by using C#. You write the following statement to declare an array:

```
int[] numbers = { 1, 2, 3, 4, 5 };
```

Now, you need to access the second item in this array (the number 2). Which of the following expression should you use?
a) `numbers[0]`
b) `numbers[1]`
c) `numbers[2]`
d) `numbers[3]`

Answer: b
Difficulty: Medium
Section Reference: Understanding Arrays

Any array item can be directly accessed by using an index. In the .NET Framework, array indexes are zero-based, meaning that to access the first element of an array, you use the index 1; to access the second element, you use the index 2; and so on. In the given case, as you need to access the second element, you use the expression `numbers[2]`.

4. You are developing a C# program. You write the following code:

```
int x = 10;
int y = ++x;
int z = y++;
```

What will be the value of the variable `z` after all the above statements are executed?
a) 10
b) 11
c) 12
d) 13

Answer: b
Difficulty: Hard
Section Reference: Understanding Operators
The way unary increment and decrement operators work when used as part of an assignment can affect the results. In particular, when the unary increment and decrement operators are used as prefixes, the current value of the identifier is returned before the increment or decrement. On the other hand, when used as a suffix, the value of the identifier is returned after the increment or decrement is complete.

When the first statement is executed, the value of `x` is 10. When the second statement is executed, the value of `x` and `y` are both 11. When the final statement is executed, the current value of `y` (11) is assigned to `z` before `y` is incremented by 1.

5. You are writing a method named `PrintReport` that doesn't return a value to the calling code. Which keyword should you use in your method declaration to indicate this fact?
a) `void`
b) `private`
c) `int`
d) `string`

Answer: a
Difficulty: Easy
Section Reference: Understanding Methods
When a method doesn't return a value back to the calling code, it is indicated by using the `void` keyword in the method declaration.

6. You need to provide complex multi-way branching in your C# program. You need to make sure that your code is easy to read and understand. Which of the following C# statements should you use?
a) `case`

b) `break`
c) `if-else`
d) `switch`

Answer: d
Difficulty: Medium
Section Reference: Understanding Decision Structures
The `switch` statement allows multi-way branching. In many cases, using a `switch` statement can simplify a complex combination of `if-else` statements.

7. You are writing a C# program that iterates through a collection such as arrays and lists. You need to make sure that you process each item in the collection once. You also need to ensure that your code is easy to read and debug. Which of the following C# statements provide the best solution for this requirement?
a) `while`
b) `for`
c) `foreach`
d) `do-while`

Answer: c
Difficulty: Easy
Section Reference: Understanding Repetition Structures
The `foreach` statement—an enhanced version of the `for` statement—is useful for iterating through collections such as arrays and lists. Using `foreach` statements eliminates the need for maintaining an index to the current item in the list. This improves code readability, makes debugging easier, and minimizes errors.

8. You are developing a C# program that needs to perform 5 iterations. You write the following code:

```
01:  int count = 0;
02:  while (count <= 5)
03:  {
04:      Console.WriteLine("The value of count = {0}", count);
05:      count++;
06:  }
```

When you run the program, you notice that the loop does not iterate five times. What should you do to make sure that the loop is executed exactly five times?
a) Change the code in line 01 to
```
int count = 1;
```
b) Change the code in line 02 to:
```
while (count == 5)
```
c) Change the code in line 02 to
```
while (count >= 5)
```
d) Change the code in line 05 to
```
++count;
```

Answer: a
Difficulty: Medium
Section Reference: Understanding the while loop
When the value of count starts at 1, the `while` loop executes once for each value of count 1, 2, 3, 4, and 5. When the `while` condition is changed to `(count == 5)` or to `(count >= 5)`, the loop will execute 0 times because the initial value of count is 0. Having `++count` as a standalone statement is same as `count++` and will not cause the results to vary.

9. You are developing a C# program. You write the following code line:

```
int x = 6 + 4 * 4 / 2 - 1;
```

What will be the value of the variable `x` after this statement is executed?
a) 19
b) 13
c) 20
d) 14

Answer: b
Difficulty: Medium
Section Reference: Understanding Operators
To evaluate this expression, you have to take into account operator precedence. The operators * and / have a higher precedence than + and –. You can also write this expression as

6 + ((4 * 4) / 2) – 1

This simplifies to, 6 + (8) – 1, resulting in 13.

10. You are writing a C# program that needs to manipulate very large integer values that may exceed 12 digits. The values can be positive or negative. Which data type should you use to store a variable like this?
a) `int`
b) `float`
c) `double`
d) `long`

Answer: d
Difficulty: Easy
Section Reference: Understanding Data Types
The `long` data type takes double the memory size of the `int` data type and can store integer values that exceed 12 digits. The `int` data type is relatively smaller. The `float` and `double` data types are more suited for storing floating-point numbers.

11. 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 Exception Handling
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.

12. 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 Exception Handling
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.

13. You are developing a C# program. You write a recursive method to calculate the factorial of a number. Which of the following code segment should you use to generate correct results?

a)
```
public static int Factorial(int n)
{
    if (n == 0)
    {
        return 1;
    }
    else
    {
        return n * Factorial(n - 1);
    }
}
```

b)
```
public static int Factorial(int n)
{
    if (n == 0)
    {
        return 1;
    }
    else
    {
        return (n – 1) * Factorial(n);
    }
```

```
    }
```

c)
```
    public static int Factorial(int n)
    {
        if (n == 0)
        {
            return n;
        }
        else
        {
            return Factorial(n - 1);
        }
    }
```

d)
```
    public static int Factorial(int n)
    {
            return n * Factorial(n - 1);
    }
```

Answer: a
Difficulty: Medium
Section Reference: Understanding Recursion
Answer a specifies the correctly formed base and the recursive case. Answer b is incorrect because the expression `(n – 1) * Factorial(n)` is not progressing towards the base case. Answer c is incorrect because the recursive case is not using the multiplication to get to the final value. Answer d is incorrect because the base case is missing and the method will never terminate.

14. You are developing a C# program. You write the following code:

```
01:  int count = 0;
02:  while (count < 5)
03:  {
04:      if (count == 3)
05:         break;
06:      count++;
07:  }
```

How many times will the control enter the `while` loop?
a) 5
b) 4
c) 3
d) 2

Answer: b
Difficulty: Medium
Section Reference: Understanding Repetition Structures
You enter the loop each time when the value of count is 0, 1, 2, and 3. So the correct answer is 4. When the value of count reaches 3, the `break` statement is executed to terminate the loop and transfer the control outside the loop.

15. You are developing a C# program. You write the following code:

```
int i = 6;
do
{
    if (i == 3)
       break;
    Console.WriteLine("The value of i = {0}", i);
    i++;
    }
while (i <= 5);
```

How many times will the control enter the `while` loop?
a) 0
b) 1
c) 2
d) 3

Answer: b
Difficulty: Medium
Section Reference: Understanding Repetition Structures
The control will enter the loop only once. At the end of the first iteration, the condition will fail (because the number 6 is greater than the number 5) and the loop will terminate.

16. You are writing a C# program and need to select an appropriate repetition structure for your requirement. You need to make sure that the test for the termination condition is performed at the bottom of the loop rather than at the top. Which repletion structure should you use?
a) The `while` statement
b) The `for` statement
c) The `foreach` statement
d) The `do-while` statement

Answer: d
Difficulty: Easy
Section Reference: Understanding Repetition Structures
The `do-while` statement performs the test for the termination condition at the bottom of the loop. All other repletion structure performs the test at the top of the loop.

17. You are writing a C# program. You write the following method:

```
public static void TestSwitch(int op1, int op2, char opr)
{
    int result;
    switch (opr)
    {
        case '+':
            result = op1 + op2;
        case '-':
            result = op1 - op2;
```

```
            case '*':
                result = op1 * op2;
            case '/':
                result = op1 / op2;
            default:
                Console.WriteLine("Unknown Operator");
                return;
        }
        Console.WriteLine("Result: {0}", result);
        return;
    }
```

However, when you compile this code, you get the following error message:

Control cannot fall through from one case label to another

How should you modify the code to make sure that it compiles successfully?

a) After each case, add the following code line:
`break;`

b) After each case, add the following code line:
`continue;`

c) After each case, add the following code line:
`goto default;`

d) After each case, add the following code line:
`return;`

Answer: a
Difficulty: Easy
Section Reference: Understanding Decision Structures
In this code example, no `break` statement occurs after each case. The `break` statement terminates the `switch` statement and transfers control to the next statement outside the `switch` block. The `continue` statement is not the right answer because no enclosing loop is included here. The `goto` and `return` statements are not correct because they will change the program's intended output.

18. You are developing an algorithm for a retail Web site. You need to calculate discounts on certain items based on the quantity purchased. You develop the following decision table to calculate the discount:

Quantity < 10	Y	N	N	N
Quantity < 50	Y	Y	N	N
Quantity < 100	Y	Y	Y	N
Discount	5%	10%	15%	20%

If a customer buys 50 units of an item, what discount will be applicable to the purchase?

a) 5 percent
b) 10 percent
c) 15 percent
d) 20 percent

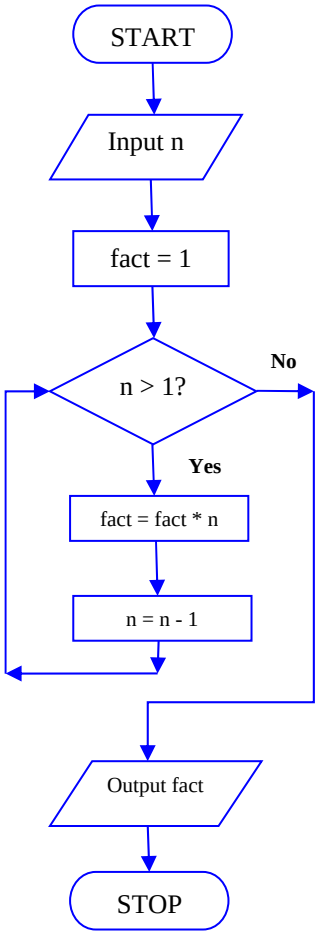
Answer: c
Difficulty: Medium
Section Reference: Introducing Decision Tables
When a customer buys 50, the conditions Quantity < 10 and Quantity < 50 are both false but the condition Quantity < 100 is true. So, when you look at the column N, N, and Y, the corresponding value of the discount is 15%.

19. You are developing an algorithm before you write the C# program. You need to perform some calculations on a number. You develop the following flowchart for the calculation:

If the input value of n is 5, what is the output value of the variable fact according to this flowchart?

a) 720
b) 120
c) 24
d) 6

Answer: b



Difficulty: Easy

Section Reference: Introducing Flowcharts
Here, you enter the loop once each time when the value of n is 5, 4, 3, and 2. So the final result will be 5 * 4 * 3 * 2 = 120.

20. You are writing a C# program that needs to iterate a fixed number of times. You need to make sure that your code is easy to understand and maintain even when the loop body contains complex code. Which of the following C# statements provide the best solution for this requirement?
a) `while`
b) `for`
c) `foreach`
d) `do-while`

Answer: b
Difficulty: Easy
Section Reference: Understanding Repetition Structures
The `for` loop is ideal for creating iterations that must execute a specified number of times. The `for` loop combines the three elements of iteration—the initialization expression, the termination condition expression, and the counting expression—into a more readable code by placing them outside the loop body. This improves code readability, makes debugging easier and minimizes errors.

Lesson 2: Introduction to Object-Oriented Programming

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

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

Answer: b
Difficulty: Medium
Section Reference: Understanding Classes
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 `Process`:

```
void Draw(object o)
{

}
```

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

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 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
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.

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 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 Values and References

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`.

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

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

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

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

What will be the output when this code is executed?

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

Answer: a
Difficulty: Medium
Section Reference: Understanding Values and References

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`.

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: Understanding 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: Understanding 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: Understanding Inheritance
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 3: Understanding General Software Development

1. Arrange the various activities of an application lifecycle in the order in which they are likely to occur.
a) Requirements analysis, design, coding, testing, and release
b) Design, requirements analysis, coding, testing, and release
c) Release, requirements analysis, coding, testing, and design
d) Requirements analysis, design, release, coding, and testing

Answer: a
Difficulty: Easy
Section Reference: Understanding Application Lifecycle Management
The activities of an application lifecycle are likely to take place in the following order: requirements analysis, design, coding, testing, and release.

2. You are planning to develop a new software system for your organization. You need to review the plans, models, and architecture for how the software will be implemented. Of which of the following activities should you review the output?
a) requirements analysis
b) design
c) coding
d) testing

Answer: b
Difficulty: Medium
Section Reference: Understanding Application Lifecycle Management
The design activity is used to create plans, models, and architecture for how the software will be implemented.

3. You are planning to develop a new software system for your organization. You need to review the system's technical blueprint. Which of the following participants is responsible for providing the technical blueprint?
a) user interface designer
b) developer
c) architect
d) technical writer

Answer: c
Difficulty: Medium
Section Reference: Understanding Application Lifecycle Management
An architect designs the technical blueprint of the system. This includes identifying components and services, their behavior, and how they interact with each other and with the external world.

4. You are planning to develop a new software system for your organization. Someone needs to be responsible for developing system manuals and help files. Which of the following participants should you identify for this task?

a) user interface designer
b) content developer
c) user interface designer
d) technical writer

Answer: d
Difficulty: Medium
Section Reference: Understanding Application Lifecycle Management
Identify a technical writer for this task. Technical writers develop the system manuals and help files that will be delivered with the application.

5. You are planning to develop a new software system for your organization. You need to verify that the implementation of the system matches with the requirements of the system. Which of the following activities would accomplish this requirement?
a) testing
b) design
c) release
d) requirements analysis

Answer: a
Difficulty: Medium
Section Reference: Understanding Application Lifecycle Management
Use the testing activity to assure the quality of the final product. Testing can identify possible gaps between the system expectations described in the requirements document and actual system behavior.

6. You are planning to develop a new software system for your organization. You need to review the plan for packaging, deployment, delivery, and support for the software. Which of the following should you contact?
a) quality assurance manager
b) release manager
c) technical architect
d) database administrator

Answer: b
Difficulty: Medium
Section Reference: Understanding Application Lifecycle Management
Release management includes activities such as packaging and deploying the software, managing software defects, and managing software change requests. The release manager coordinates various teams and business units to ensure timely release of a software product.

7. You are in the process of developing a new software application. As defects are reported, you take the necessary steps to fix them. You need to make sure that each new fix doesn’t break anything that was previously working. Which type of testing should you use?
a) integration testing
b) system testing

c) acceptance testing
d) regression testing

Answer: d
Difficulty: Medium
Section Reference: Understanding Testing
As the defects in a software application are reported and fixed, you need to make sure that each new fix doesn't break anything that was previously working. This is where regression testing comes in handy. With every new fix, software testers usually run a battery of regression tests to make sure that every function that was already known to work correctly is still working.

8. You have completed developing a new software application. To ensure the quality of the software, you need to verify that each method or function has proper test cases available. Which testing approach should you use?
a) white-box testing
b) black-box testing
c) alpha testing
d) beta testing
Answer: a
Difficulty: Medium
Section Reference: Understanding Testing
Black-box testing treats the software as a "black box," focusing solely on inputs and outputs. On the other hand, white-box testing is used to make sure that each method or function has proper test cases available. Alpha and beta testing are both black-box types of testing.

9. You have completed developing several major features of a new software application. You plan to provide an early look at the product to important customers to gather some early feedback. Your application still misses features and you haven't yet optimized the application for performance and security. Which kind of testing should you perform with a limited number of important customers?
a) white-box testing
b) black-box testing
c) alpha testing
d) beta testing

Answer: c
Difficulty: Medium
Section Reference: Understanding Testing
Alpha testing—performed by a limited group of users—provides opportunities to give the most important customers an early look at the product and to gather feedback. Alpha releases may miss some features and generally lack many nonfunctional attributes such as performance. In the next level of testing, beta testing, you release the product to a wider audience of customers and solicit feedback. In terms of functionality, the beta release of the software is very close to the final release. However, the development teams might still be working on improving performance and fixing known defects.

10. 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 Data Structures
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.

11. 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 Data Structures
A *stack* is a collection of items in which the last item added to the collection is the first one to be removed.

12. You are developing an application that uses a double 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 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.

13. 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: Understanding Queues
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.

14. You are developing an application that uses the `Stack` data structure. You write the following code:

```
Stack first = new Stack();
first.Push(50);
first.Push(45);
first.Pop();
first.Push(11);
first.Pop();
first.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: Understanding Stacks
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).

15. 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: Understanding Stacks
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.

16. You are developing a sorting algorithm that uses partitioning and comparison to arrange an array of numbers in the correct order. You write a method that partitions the array so that the items less than `pivot` go to the left side, whereas the items greater than `pivot` go to the right side. The partitioning method has the following signature:

```
static int Partition (int[] numbers, int left,
  int right, int pivotIndex)
```

Which of the following algorithms should you use to sort the array using the `Partition` method?

a)
```
static int[] QuickSort(int[] numbers,
       int left, int right)
{
    if (right > left)
    {
        int pivotIndex = left + (right - left) / 2;
        pivotIndex = Partition(
            numbers, left, right, pivotIndex);
        QuickSort(
            numbers, left, pivotIndex - 1);
        QuickSort(
            numbers, pivotIndex + 1, right);
    }
    return numbers;
}
```

b)
```
static int[] QuickSort(int[] numbers,
       int left, int right)
{
    if (right > left)
    {
        int pivotIndex = left + (right - left) / 2;
        pivotIndex = Partition(
            numbers, left, right, pivotIndex);
        QuickSort(
            numbers, left, pivotIndex);
        QuickSort(
            numbers, pivotIndex + 1, right);
    }
    return numbers;
}
```

c)
```
static int[] QuickSort(int[] numbers,
       int left, int right)
{
    if (right > left)
    {
        int pivotIndex = left + (right - left) / 2;
        pivotIndex = Partition(
            numbers, left, right, pivotIndex);
        QuickSort(
            numbers, left, pivotIndex - 1);
        QuickSort(
            numbers, pivotIndex, right);
    }
    return numbers;
}
```

d)
```
static int[] QuickSort(int[] numbers,
       int left, int right)
{
    if (right > left)
    {
        int pivotIndex = left + (right - left) / 2;
        pivotIndex = Partition(
            numbers, left, right, pivotIndex);
        QuickSort(
            numbers, left, pivotIndex + 1);
        QuickSort(
            numbers, pivotIndex + 1, right);
    }
    return numbers;
}
```

Answer: a
Difficulty: Medium
Section Reference: Understanding QuickSort
After you partition the array, you need only to sort the left and right sides of the array. The middle element is automatically sorted. To sort the left array, use the expression `QuickSort(`

`numbers, left, pivotIndex - 1)`; to sort the right array, you should use the expression `QuickSort(numbers, left, pivotIndex + 1)`.

17. You are studying various sorting algorithms to understand, analyze, and compare the various sorting techniques. Which of the following techniques should you utilize when using the `BubbleSort` algorithm?
a) comparison
b) comparison and swap
c) comparison and partition
d) partition and swap

Answer: b
Difficulty: Medium
Section Reference: Understanding Sorting Algorithms
The `BubbleSort` algorithm uses a series of comparison and swap operations to arrange list elements in the correct order.

18. 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 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: Understanding Linked Lists
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.

19. 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: Understanding Linked Lists
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.

20. You are developing a program that performs frequent insert and delete operations on the data. Your requirement also dictates the capability to access previous and next records when the user clicks the previous or next button. Which of the following data structures will best suit your requirements?
a) array
b) circular linked list
c) linked list
d) oubly linked list

Answer: d
Difficulty: Medium
Section Reference: Understanding Linked Lists
Because you need to perform frequent insert and delete operations, using a linked list is better than using arrays. Also, because you need access to both previous and next records, you must use a doubly linked list. The linked list and circular linked list let you traverse in only one direction.

Lesson 4: Understanding Web Applications

1. You are developing a Web page for a medium-sized business. You want to separate the formatting and layout of the page from its content. Which of the following technologies should you use to define the formatting and layout of the page content?
a) Cascading Style Sheets (CSS)
b) Hypertext Markup Language (HTML)
c) JavaScript
d) Hypertext Transmission Protocol (HTTP)

Answer: a
Difficulty: Medium
Section Reference: Understanding Web Page Development
Cascading Style Sheets (CSS) help you define the formatting and layout of a page's content and store that separately from the content. HTML is a text-based language that uses various markup tags that describe how content is displayed. JavaScript is scripting language that you use to add functionality and behavior to a Web page. HTTP is the underlying communication protocol used by the World Wide Web.

2. You want to display an image on your Web page. The image is stored on a separate Web server but can be accessed with a public URL. Which of the following HTML tags should you use to ensure that the image is displayed when the user navigates to your Web page?
a) `<LINK>`
b) `<IMG>`
c) `<A>`
d) `<HTML>`

Answer: b
Difficulty: Easy
Section Reference: Understanding HTML
The HTML `<IMG>` tag is used to display the images on a Web page. The source of the image can be on the same or a different Web server. The `<LINK>` tag is used to link a CSS file with the HTML page. The `<A>` tag is used to create anchor links. The `<HTML>` tag is used to specify the contents of a Web page.

3. You are developing a new Web page. You need to create hyperlinks that point to other pages on the World Wide Web. Which of the following methods should you use to create these hyperlinks on your Web page?
a) the `SRC` attribute of the `<IMG>` tag
b) the `HREF` attribute of the `<A>` tag
c) the `HREF` attribute of the `<LINK>` tag
d) the `XMLNS` attribute of the `<HTML>` tag

Answer: b
Difficulty: Easy
Section Reference: Understanding HTML

To create a hyperlink to another Web page, use the HREF attribute of the <A> tag. The IMG tag is used to specify the location of an image. The LINK tag is used to link to a CSS resource. The HTML tag is used to specify the contents of a Web page.

4. You need to perform data validation to ensure that the input fields are not empty and the user's email address and phone numbers have been provided in the required format. You need to minimize the transmission of information across the networks. Which of the following coding approaches should you follow?

a) Use JavaScript code that executes on the Web server.
b) Use C# code that executes on the Web server.
c) Use JavaScript code that executes in the browser.
d) User C# code that executes in the browser.

Answer: c
Difficulty: Medium
Section Reference: Understanding JavaScript
JavaScript is a client-side scripting language that runs inside Web browsers to help create far more interactive Web pages than are possible with only HTML. C# code does not run within Web browsers. Writing code that runs on a Web server increases transmission of information across networks and provides slow response to the users.

5. You write large amount of JavaScript code for your Web site. You need to take advantage of caching techniques to make sure that Web pages load as quickly as possible. You also need to ensure that you can modify the JavaScript code with the least amount of effort. What should you do?
a) Write JavaScript code inside the <SCRIPT> tag. Include the <SCRIPT> within the <HEAD> tag of the HTML page.
b) Write JavaScript code inside the <SCRIPT> tag. Include the <SCRIPT> within the <BODY> tag of the HTML page.
c) Write JavaScript code in a separate file. Use the SRC attribute of the <SCRIPT> tag to link to the JavaScript file.
d) Write JavaScript code in a separate file. Use the HREF attribute of the <LINK> tag to link to the JavaScript file.

Answer: c
Difficulty: Medium
Section Reference: Understanding JavaScript
You should write JavaScript code in a separate file and then use the SRC attribute of the <SCRIPT> tag to link to the JavaScript file. When the JavaScript code is in an external file, it can be cached on the client side and doesn't need to be downloaded with every page. Writing the JavaScript code inside the <SCRIPT> code and including the <SCRIPT> tag within <HEAD> or <BODY> increases the Web page's size and causes the JavaScript code to be downloaded with each page request, thereby slowing down page loads. Using the <LINK> tag will not work because it is used to link to the external CSS file.

6. Which of the following processes is responsible for providing the ASP.NET functionality?
a) inetinfo.exe
b) iexplore.exe
c) aspnet_isapi.dll
d) aspnet_wp.exe

Answer: d
Difficulty: Medium
Section Reference: Understanding ASP.NET Application Development
The aspnet_wp.exe (ASP.NET Worker Process) file handles the Web requests for ASP.NET resources. The ASP.NET ISAPI extension (aspnet_isapi.dll) is responsible for invoking the ASP.NET worker process (aspnet_wp.exe), which, in turn, controls the execution of the request. The inetinfo.exe is the Internet Information Services process. The iexplore.exe process is for the Internet Explorer Web browser.

7. You are developing an ASP.NET Web page that displays status of a shipment. You need to write some code that will change the Web page's appearance and assign values to some controls. Where should you put this code?
a) In the `InitializeComponent` method
b) In a method that handles the `Load` event
c) In a method that handles the `Init` event
d) In a method that handles the `PreRender` event

Answer: b
Difficulty: Medium
Section Reference: Understanding ASP.NET Page Life Cycle and Event Model
The method that handles the `Load` event is the most appropriate place for writing initialization code such as this. You should not be including the Visual Studio `InitializeComponent` method in your code. The method that handles the `Init` event does not have access to the controls because they are available only after the page is initialized. If you write the code in the method that handles the `PreRender` event, any changes to the control's properties do not have a visible effect because the page is already ready to be rendered.

8. You write the following code in your Web page:

```
protected void Page_Load
        (object sender, EventArgs e)
{
    /* additional code here */
}
```

You expect this code to be executed in response to the `Load` event of the ASP.NET page. However, when you request the page, you notice that the method is not executed. What should you do to make sure that the `Page_Load` method is executed when the `Load` event of the Web page is fired?
a) Set the `AutoEventWireup` attribute of the `@Page` directive to true.
b) Set the `AutoEventWireup` attribute of the `@Page` directive to false.

c) Set the `IsCallBack` property of the Page class to true.
d) Set the `IsPostBack` property of the `Page` class to true.

Answer: a
Difficulty: Medium
Section Reference: Understanding ASP.NET Page Life Cycle and Event Model
When the `AutoEventWireup` attribute of the `@Page` directive is set to true, specially named methods such as `Page_Load` are automatically wired up with their corresponding events. When the `AutoEventWireup` attribute of the `@Page` directive is set to false, the `Page_Load` method is not associated with the `Load` event of the `Page` class. The `IsCallBack` property of the `Page` class indicates whether the page request is the result of a callback. The `IsPostBack` property of the `Page` class indicates whether the page request is the result of a post-back operation.

9. You need to display specific messages to the users when their browser is not running JavaScript. Which of the following code segment should you use?
a) `<script runat="server"> … </script>`
b) `<script> ... </script>`
c) `<% … %>`
d) `<noscript> ... </noscript>`

Answer: d
Difficulty: Medium
Section Reference: Understanding Web Page Development
Use `<noscript>` element to display a specific message to users when their browser is not running JavaScript. The `<script>` tag is ignored when JavaScript is not enabled. The `<% ... %>` and `<script runat="server"> … </script>` tags are used only for server-side programming.

10. You are developing an ASP.NET application using C#. On your Web page, you want to display the results returned by a C# method named `GetShipmentStatus` when the page is rendered to the client. Which of the following code segments should you use to call the `GetShipmentStatus` method?

a)
```
<script language="c#" runat="server">
    Response.Write(GetShipmentStatus());
</script>
```

b)
```
<script language="c#" runat="client">
    Response.Write(GetShipmentStatus());
</script>
```

c)
```
<script language="c#">
    Response.Write(GetShipmentStatus());
</script>
```

d)
```
<%= GetShipmentStatus() %>
```

Answer: d

Difficulty: Medium
Section Reference: Understanding Client-Side vs. Server-Side Programming
The `<%= . . . %>` construct is used to display values from ASP.NET code, such as a method call. Using the `<script>` tag is incorrect because this tag is used for defining class-level methods, properties, and variables.

11. You are developing an ASP.NET application using C#. You create a code-behind class named `Status` that contains the business logic. This class is under the namespace Northwind and is stored in a file named status.aspx.cs. You need write the user interface code that uses this class. Which of the following code segments should you use?

a) `<% Page Language="c#" Codebehind="status.aspx.cs" ClassName="Northwind.Status" %>`

b) `<% Page Language="c#" Codebehind="status.aspx.cs" Inherits="Northwind.Status" %>`

c) `<% Page Language="c#" Src="status.aspx.cs" Inherits="Northwind.Status" %>`

d) `<% Page Language="c#" Src="status.aspx.cs" ClassName="Northwind.Status" %>`

Answer: c
Difficulty: Medium
Section Reference: Understanding ASP.NET Application Development
The `Inherits` attribute in the `@Page` directive specifies a fully qualified name of the code-behind class from which the code should inherit. The `Src` attribute specifies the name of the source code file. The `Codebehind` attribute is used only by Visual Studio and is not used at runtime. The `Classname` attribute does not link ASP.Net pages with the code-behind class or file.

12. You are developing a restaurant locator Web site in ASP.NET and C#. As users browse through the Web site, each of the Web pages must display a list of the recently viewed restaurant in the lower left corner. You want this information to be available across Web pages and browser restarts but do not want to use server-side resources to accomplish this. Which of the following state management techniques will help you accomplish this requirement with minimum effort?
a) hidden fields
b) view state
c) cookies
d) sessions

Answer: c
Difficulty: Medium
Section Reference: Understanding State Management
Use cookies because they allow you to store a small amount of information on the user's computer. Hidden fields, view state, and sessions are not correct because these options cannot store information across browser restarts.

13. You are developing an order-entry application that will be used by all employees in your company. You use ASP.NET to develop this application and deploy it on the company's Internet Information Services (IIS) server. What should you install on the users' computers before they can access the order-entry application?

a) .NET Framework redistributable
b) .NET Framework Software Development Kit (SDK)
c) Visual Studio Express Edition
d) Web browser

Answer: d
Difficulty: Easy
Section Reference: Understanding Web Page Development
You need to deploy only a Web browser to access the application. A .NET Framework redistributable is required only when code is executed on the client side, such as in a Windows Forms or a Windows Presentation Foundation (WPF) application. .NET Framework SDK and Visual Studio Express Edition are needed only on the development workstation.

14. You create an ASP.NET Web Service that tracks the shipment of orders. The Web service includes a class named `StatusService`, which contains the following method:

```
public string GetStatus()
{
    /* additional code here */
}
```

You note that you can instantiate the `StatusService` class from a Web service client project, but the `GetStatus` method is not available. What could be the problem?
a) Only properties can be part of the public interface of a Web service.
b) You must mark the method with the `WebService` attribute.
c) The methods of a Web service can return only object data.
d) You must mark the method with the `WebMethod` attribute.

Answer: d
Difficulty: Easy
Section Reference: Understanding Web Service Development
Adding the `WebMethod` attribute to a public method makes it callable from remote Web clients. Methods can be part of the public interface of a Web service. The `WebService` attribute is applied only to the Web service class. You already can instantiate the `StatusService` class, so the `WebService` attribute is not a problem here. The methods of a Web service can return any type of data.

15. You have created a new Web service that provides mapping data. You are working in a Visual Studio environment and use C# as your programming language. You need to test the Web service to ensure that it is returning correct results. What is the easiest way to test your new Web service?
a) Copy and paste the Web service code into an ASP.NET Web Application. Run the Web application to see the results.
b) Invoke the Web service from an ASP.NET client. Run the Web application to see the results.
c) Run the Web services project from within Visual Studio and use the test page that is displayed in the Web browser.
d) Have a large number of beta testers use the Web service and check for incorrect results.

Answer: c
Difficulty: Easy
Section Reference: Understanding Web Service Development
The easiest way to test a Web service is to use the built-in test page that you get when you run the Web service project within Visual Studio. The other answers are incorrect because they require additional efforts to test the Web service.

16. You are developing an ASP.NET application that calls a Web service to retrieve earthquake predictions for a given geographical area. The Web service performs complex, time-consuming calculations to generate the predictions. It is hosted on a government Web server, where you have permission only to invoke the Web service. The users of your Web application complain that the user interface freezes when they attempt to retrieve the predictions. You have full access to the Web server that hosts your ASP.NET application. Which of the following approach should you use to resolve this issue?
a) Move the ASP.NET application to a faster computer.
b) Connect to the Web service over a faster Internet connection.
c) Install additional memory on the Web server that hosts the ASP.NET application.
d) Use asynchronous calls to invoke the Web service from within your ASP.Net application

Answer: d
Difficulty: Medium
Section Reference: Understanding Web Service Development
An asynchronous call to the Web service returns control to users without waiting for the complete execution of the Web service. This approach of invoking Web services helps make the user interface responsive. Having a faster computer or a computer with more memory does not solve the problem because these upgrades to the client computer do not improve Web service performance. Having a faster Internet connection also does not help because the server will still take time to process and return the results.

17. You are developing an ASP.NET application that calls a Web service to retrieve inventory information. You know the URL of the Web service. You need to invoke the methods of this Web service within your Web application. How can you generate the client-side proxy classes so that you can use the Web methods?
a) Use the Web service discovery tool.
b) Copy the .ASMX file from the Web server to the ASP.NET application project.
c) Copy the build output from the Web server to the ASP.NET application project.
d) Set a Web reference to point to the Web service.

Answer: d
Difficulty: Medium
Section Reference: Understanding Web Service Development
Set the Web Reference to point to the Web Service. This creates a client-side proxy class that you can use to invoke Web service methods. The Web service discovery tool can locate the files related to a Web service, but it does not generate any proxy classes. Copying files from the Web server does not generate a client-side proxy.

18. You are invoking a Web service method that returns an `ArrayList` object. The client application is written in C#, whereas the Web service is written in Visual Basic. The Web service is outside your corporate firewall. You receive an "object not found" error when you call the method that returns the `ArrayList` object but can call other methods successfully from the same Web service. What could be the problem?
a) The client and the Web service are not written in the same programming language.
b) The firewall is blocking all SOAP calls.
c) The client project does not contain a reference to the `System.Collection` namespace.
d) The `ArrayList` class cannot be serialized.

Answer: c
Difficulty: Medium
Section Reference: Understanding Web Service Development
The client applications must contain a reference to the objects that they are going to manipulate. So the client project must contain a reference to the `System.Collection` namespace before it can use a Web service method that returns `ArrayList`. The client and the server code can be written in different languages. If the firewall is blocking SOAP calls, you could not call any methods on the Web service. The `ArrayList` class is marked with a `Serializable` attribute and can be serialized.

19. You are developing an ASP.NET application that uses a Web service created by one of your large customers. This Web service provides you with the `Order` object, which has several properties. The developer of the Web service has informed you that a new property named `Priority` has been added to the `Order` object. What should you do to be able to use the `Priority` property in your code with minimum effort?
a) Create a new ASP.NET application and add a Web reference to the Web service in the new application.
b) Delete and re-create the Web reference in the existing ASP.NET application.
c) Update the Web reference in the existing ASP.NET application.
d) Ask the developer of the Web service for the updated DLL file of the Web service. Add a reference to the DLL in your ASP.NET project.

Answer: c
Difficulty: Medium
Section Reference: Understanding Web Service Development
You should be able to get the `Priority` property available in your code just by updating the Web reference to the Web service. Creating a new client application is not needed. Deleting and re-creating the Web reference is essentially the same as updating but requires more effort. You don't need to ask for the DLL of the Web service because the code is not executing locally but remotely on the Web server.

20. You develop a new ASP.NET inventory application on the Northwind Web server. You deploy the files in the folder c:\WebInventory. The application should be available via the URL www.northwind.com/inventory. The URL www.northwind.com is already set up to point to the

Northwind Web server. What should you do to make your inventory application available at the expected URL?
a) Change the name of the directory c:\WebInventory to c:\Inventory.
b) Create a virtual directory named Inventory and point it to c:\WebInventory.
c) Create a virtual directory named WebInventory and point it to c:\Inventory.
d) Move the directory c:\WebInventory to the c:\inetpub\wwwroot directory.

Answer: b
Difficulty: Medium
Section Reference: Understanding IIS Web Hosting
To have your application available at the expected URL, you should create a virtual directory named Inventory and point it to c:\WebInventory. Just changing the name of the physical directory does not map it to the correct URL. If you name your virtual directory as WebInventory, the application is available at www.northwind.com/WebInventory, which is not what is expected. Moving the WebInventory directory to c:\inetpub\wwwroot does not create a virtual directory by the name Inventory.

Lesson 5: Understanding Desktop Applications

1. You are developing a Windows forms application used by a government agency. You need to develop a distinct user interface element that accepts user input. This user interface will be reused across several other applications in the organization. None of the controls in the Visual Studio toolbox meets your requirements; you need to develop all your code in house. Which of the following actions should you take?
a) Develop a Windows Forms application for the user interface.
b) Develop a custom control for the user interface.
c) Buy the control from a third-party.
d) Develop a console application for the user interface.

Answer: b
Difficulty: Medium
Section Reference: Designing a Windows Form
You need to develop a custom control because you need reusable functionality but also want to develop the code in house. You cannot use Windows Forms because they cannot be reused easily. You cannot use console applications because they do not provide distinct user interface. You cannot buy a control from third-party because you need to develop the code in house.

2. You are developing a user interface component that responds to user actions such as keystrokes. Which of the following programming constructs should you use to accomplish this requirement?
a) event
b) class
c) delegate
d) property

Answer: a
Difficulty: Medium
Section Reference: Designing a Windows Form
Events are generated when users take an action such as pressing keystrokes. You need to handle these events to respond to user actions.

3. You need a Windows Form similar to the `W_RecForm` form that is being already used by the application. However, you need a couple of extra controls on your form that are not available on `W_RecForm`. You need to make sure that you accomplish this requirement with the least coding effort. In future, if the `W_RecForm` is enhanced, you need to make sure that those enhancements are available in your form as well. What should you do?
a) Copy the code for `W_RecForm` to a new form. Modify the code for the new form.
b) Use visual inheritance to inherit the new form from `W_RecForm`. Add the new functionality to the new control.
c) Modify the code for `W_RecForm`. Copy the code to create a new form.
d) Convert the code in the `W_RecForm` to a custom control. Use the new custom control in all places.

Answer: b
Difficulty: Medium
Section Reference: Using Visual Inheritance
You need to use visual inheritance to inherit the new form from `W_RecForm`. Add the new functionality to the new control. Copying the code for `W_RecForm` does not work because future changes to the `W_RecForm` aren't automatically carried forward to the new form. Modifying the code for `W_RecForm` does not work because you don't need to change anything that is already working. Converting the `W_RecForm` to a custom control requires additional programming efforts.

4. You are developing a Windows application. The user needs to work with multiple windows of the application at the same time and needs a simplified interface. The application needs to be compatible with different display configurations, such as multiple monitors. Which of the following interfaces should you create?
a) Create a Multiple Document Interface (MDI) Application. Open a single instance of the application.
b) Create a Single Document Interface (SDI) Application. Open a single instance of the application.
c) Create a Single Document Interface (SDI) Application. Open multiple instances of the application.
d) Create a Multiple Document Interface (MDI) Application. Open multiple instances of the application.

Answer: c
Difficulty: Hard
Section Reference: Understanding Multiple Document Interface (MDI) Applications
MDI applications are complex, and implementing support for multiple monitors is tricky in an MDI application. Because the user wants a simple interface, creating a single document interface (SDI) application and opening multiple instances of the application make up the best course of action. You can switch between multiple application windows by using the Windows taskbar.

5. You need an application that updates the inventory every morning when you log in to the workstation. If an error occurs during update, the application needs to log messages to a text file. The application doesn't need any user interaction. You want to automate the process that launches the application. You want to minimize the efforts for developing, installing, and updating the application. Which type of application should you create?
a) Windows Service
b) Windows Form
c) Web Form
d) console application

Answer: d
Difficulty: Easy
Section Reference: Understanding Console-Based Applications
You need to develop a console-based application. A console-based application provides minimal or no user interface and requires the least effort to program, install, and update. You can use the

Windows Startup settings to launch the console application automatically when the user logs in. Finally, the console application can also log messages to a test file.

6. You are developing a data-entry application that receives user input in multiple data fields. The application allows users to enter the data either by using a keyboard or by using a bar-code scanner. When a code is entered, a picture of the product appears onscreen. The application also needs to log its operation to a console window. Occasionally, the operator will look at the console window to monitor communication with the scanner. What project should you choose to create such an application?
a) a console application project
b) a console application project with the Output type set to Windows Application
c) a Windows Forms application project
d) a Windows Forms application project with the Output type set to Console Application

Answer: d
Difficulty: Medium
Section Reference: Understanding Console-Based Applications
To enable reading from or writing to the console from a Windows Forms application, set the project's Output type to Console Application in the project's properties. If you set the Output type to Windows Application, you lose any input or output that you send to the command line.

7. You are developing an application that receives orders over the Internet via Electronic Data Interface (EDI). The application needs to run constantly the background and wait for orders. There is no user interface. The application writes messages to the Windows application event log. The application must continue to run even after a user logs off from the computer. Which type of application should you develop for this requirement?
a) Windows Service application
b) Windows Forms application
c) console application
d) Web application

Answer: a
Difficulty: Medium
Section Reference: Understanding Windows Services
The nature of Windows services make them ideal for creating long-running programs that run in the background and do not provide any direct user interaction. Because a Windows service can run in the background, it does not need a logged-on user to function. Windows services run in their own Windows session in the specified security context.

8. You are developing an application that writes messages to the Windows application event log for the local machine. What should you use to view the messages written by the application?
a) Event Viewer
b) Notepad
c) XPS Viewer
d) Remote Desktop Connection

Answer: a
Difficulty: Medium
Section Reference: Understanding Windows Services
Use the Windows Event Viewer utility to view the messages in event logs. The event viewer messages cannot be opened directly by Notepad. The XPS Viewer can open only the XPS files. The Remote Desktop Connection utility is used to connect to remote computers, but the question is in the context of a local computer.

9. You are developing a new Windows service application. The application contains three different Windows services. Each service will have a different start type. Which of the following classes will help you perform the installation tasks specific to each service? You must suggest a solution that requires the least coding effort.
a) `System.ServiceProcess.ServiceProcessInstaller`
b) `System.ServiceProcess.ServiceInstaller class`
c) `System.Configuration.Installer class`
d) `System.Configuration.Installer.ComponentInstaller class`

Answer: b
Difficulty: Medium
Section Reference: Understanding Windows Services
The `System.ServiceProcess.ServiceInstaller` class performs the installation tasks specific to a single Windows service, such as setting the `ServiceName` and `StartType`. The `ServiceProcessInstaller` class performs installation tasks common to all the Windows services in an application. The `Installer` and `ComponentInstaller` classes are not specifically useful for configuring a Windows service application.

10. You are developing a new Windows service application that process orders. The system administrator must be able to suspend order processing while maintenance operations are in progress. When maintenance operations are completed, order processing must be resumed without the loss in any information. How should you configure this Windows service?
a) Override the `OnPause` method of the `ServiceBase` class.
b) Set the `CanPauseAndContinue` property of the service to true.
c) Set the `CanPauseAndContinue` property of the service to false.
d) Override the `OnContinue` method of the `ServiceBase` class.

Answer: b
Difficulty: Medium
Section Reference: Understanding Windows Services
The value of the `CanPauseAndContinue` property indicates whether the service can be paused and resumed without losing information. When you override the `OnPause` and `OnContinue` methods, you can specify the actions that need to be taken when a Windows service is paused or resumed.

11. You are developing a new Windows service application. The application contains three different Windows services. Before these services can be used, they must be installed in the

Windows service database. What action should you take to ensure that your services can be installed by a Windows installer tool?
a) Copy the service assembly to the global assembly cache.
b) Add an event log installer to the Windows service project.
c) Inherit the service from a `ServiceBase` class.
d) Add a service installer to the Windows service project.

Answer: d
Difficulty: Medium
Section Reference: Understanding Windows Services
Before a Windows service can be used, it must be installed in the Windows service database by adding a service installer to the Windows service project. The other answer choices do not directly relate to the installation of a Windows service.

12. You are developing a new Windows application that needs to write messages to the event log. You use the `EventLog` class to write these messages. Each event log message must specify the name of the application writing to an event log. Which property of the `EventLog` class should you use?
a) `Source`
b) `Log`
c) `Site`
d) `MachineName`

Answer: a
Difficulty: Medium
Section Reference: Understanding Windows Services
The `Source` property of the `EventLog` class is used to specify the application name to use when writing to an event log. The `Log` property specifies the name of the log to read from or write to. The `Site` property specifies the `ISite` of the Component. The `MachineName` property specifies the name of the computer on which to read or write events.

13. You are updating an existing Windows Forms application. The form hosts a `DateTimePicker` control named `dateTimePicker1`. You need to write code that executes when the value of the `dateTimePicker1` control is changed. You write a method, `ProcessValueChanged`, that contains the code you want to execute. What code should you write to invoke the `ProcessValueChanged` method? Any code that your write must not affect existing functionality of the application.
a)
```
dateTimePicker1.ValueChanged += new System.EventHandler(
    ProcessValueChanged);
```

b)
```
dateTimePicker1.ValueChanged = new System.EventHandler(
    ProcessValueChanged);
```

c)
```
dateTimePicker1.Value += new System.EventHandler(
    ProcessValueChanged);
```

d)
```
dateTimePicker1.Value = new System.EventHandler(
    ProcessValueChanged);
```

Answer: a
Difficulty: Medium
Section Reference: Understanding Windows Forms Event Model
The correct answer is to write the following code:

```
dateTimePicker1.ValueChanged += new System.EventHandler(
    ProcessValueChanged);
```

If you use the = assignment operator rather than the += operator, you lose the existing functionality. The `Value` member is a property; `ValueChanged` is an event.

14. You have developed a Windows service that needs to access data stored in the Windows Registry. Which of the following accounts should you use for running this Windows service?
a) `LocalSystem`
b) `NetworkService`
c) `LocalService`
d) `User` (where the `UserName` property is set to a member of non-administrator role)

Answer: a
Difficulty: Medium
Section Reference: Understanding Windows Services
The `LocalSystem` value specifies a highly privileged account. The Windows service will need these privileges to access Windows Registry. The other answer choices are incorrect because these accounts do not have access to Windows Registry.

15. You have developed a Windows Forms application that stockbrokers will use. The stockbrokers need to view data for multiple stocks at the same time. You need to change the display and behavior of a Windows Form so that it can contain multiple child windows. What should you do?
a) Set the `IsMdiChild` property of the form.
b) Set the `MdiParent` property for all the child windows.
c) Set the `MdiChild` property of the form.
d) Set the `IsMdiContainer` property of the form to true .

Answer: d
Difficulty: Medium
Section Reference: Understanding Multiple Document Interface (MDI) Applications
You need to set the `IsMdiContainer` property of the form to true. The `IsMDIContainer` property indicates whether the form is a container for multiple-document interface (MDI) child forms. The `IsMDIChild` property is a read-only property that specifies whether a form is an MDI child window. The `MdiParent` property specifies the current multiple-document interface (MDI) parent form for the given form. In the question, you want the given form to be an `MdiParent`.

16. You are developing a Windows Form with a multiple document interface (MDI). You need to write code that arranges the child windows vertically within the client region of the MDI parent form. Which of the following `MdiLayout` values should you pass to the `LayoutMdi` method?
a) `MdiLayout.TileVertical`
b) `MdiLayout.Cascade`
c) `MdiLayout.TileHorizontal`
d) `MdiLayout.ArrangeIcons`

Answer: a
Difficulty: Medium
Section Reference: Understanding Multiple Document Interface (MDI) Applications
When the value is `MdiLayout.TileVertical`, all MDI child windows are tiled vertically within the client region of the MDI parent form. When the value is `MdiLayout.TileHorizontal`, all MDI child windows are tiled horizontally within the client region of the MDI parent form. When the value is `MdiLayout.Cascade`, all MDI child windows are cascaded within the client region of the MDI parent form. When the value is `MdiLayout.ArrangeIcons`, all MDI child icons are arranged within the client region of the MDI parent form.

17. You are developing an application that will be run from the command line. Which of the following methods would you use for getting input from to the command line?
a) `File.Read`
b) `File.Write`
c) `Console.Read`
d) `Console.Write`

Answer: c
Difficulty: Easy
Section Reference: Understanding Console-Based Applications
Console-based applications do not have a graphical user interface but use a text-mode console window to interact with users. Use the `Read` method to get input from the console and the `Write` method to send output to the console.

18. You have developed two console applications. The first, DisplayFile.exe, accepts the name of a text file as a command-line argument and displays the file's contents. The second, ToUpper.exe, accepts text from users and converts the text to uppercase letters. You need to combine both commands so that contents of a given file (sample.txt) can be displayed in uppercase letters. Which of the following commands would you choose?
a) `ToUpper | DisplayFile Sample.txt`
b) `DisplayFile Sample.txt | ToUpper`
c) `ToUpper > DisplayFile Sample.txt`
d) `DisplayFile Sample.txt > ToUpper`

Answer: b
Difficulty: Medium
Section Reference: Understanding Console-Based Applications

The `|` character works as a pipe between commands, so the console output from DisplayFile.exe works as console input to the ToUpper.exe. By using pipes, you can chain multiple simple commands to accomplish complicated tasks. The answer `ToUpper | DisplayFile Sample.txt` is incorrect because you first need to display the file's contents before you can convert them to uppercase letters. The > symbol is a redirection operator that can save the output to a file.

19. You need to start a Windows service named `ProcService` from the command line. Which command should you use?
a) `net start ProcService`
b) `net pause ProcService`
c) `net continue ProcService`
d) `net stop ProcService`

Answer: a
Difficulty: Medium
Section Reference: Understanding Windows Services
The net.exe command-line utility comes installed with Windows. This utility allows you to perform various networking commands, including control of Windows services. Use the `start` parameter to start a Windows service.

20. You have developed a Windows service and need to install it to implement its functionality. Which of the following options should you use to accomplish this task?
a) Visual Studio Server Explorer
b) Services node in the Computer Management window
c) InstallUtil.exe
d) gacutil.exe

Answer: c
Difficulty: Medium
Section Reference: Understanding Windows Services
The Installer tool (installutil.exe) allows you to install and uninstall server resources such as Windows services by executing the installer components in a specified assembly.

Lesson 6: Understanding Databases

1. Your application needs to store the customer list in a text file. You want to minimize the size of this disk file and be able to open it in common text editors. Which of the following classes should you use to write the file?
a) `StreamReader`
b) `StreamWriter`
c) `BinaryWriter`
d) `XmlWriter`

Answer: b
Difficulty: Medium
Section Ref: Working with Flat Files
The `StreamWriter` class provides you with an easy way to manipulate text files. The `StreamReader` class lets you read the contents of a test file. The `BinaryWriter` class writes the file in a binary format, which is not readable with common text editors. The `XmlWriter` class creates a text file but inserts XML tags, which increases the file size.

2. Your C# program needs to return the total number of customers in a SQL Server database. The program will be used several times a day. What is the fastest way to return this information from your program? (Select all answers that apply.)
a) Write a SQL query.
b) Write a stored procedure.
c) Use the `SqlDataAdapter.Fill` method.
d) Use the `SqlCommand.ExecuteScalar` method.
e) Use the `OleDbDataAdapter.Fill` method.

Answer: b and d
Difficulty: Medium
Section Ref: Understanding Database Connection Methods
Because the program will be executed several times a day, creating a stored procedure will give better performance over a query. Also, because you are retrieving only a single value as the result, using `SqlCommand.ExecuteScalar` provides better performance over the `SqlDataAdapter.Fill` method.

3. You need to update the Products table and remove all discontinued products. When the products are discontinued, the value of the field Discontinued is set to true. Which of the following SQL statements should you use to make changes to the Products table?
a) `INSERT`
b) `SELECT`
c) `UPDATE`
d) `DELETE`

Answer: d
Difficulty: Medium
Section Ref: Introducing Algorithms

Use the `DELETE` statement to remove records you don't need. The `UPDATE` statement changes an existing record but cannot remove it. The `INSERT` statement is used to insert new data to the table, and the `SELECT` statement is used to retrieve data from the table.

4. You need to update the Region fields for customers whose reference code is `"TKY"`. The updated Region should be set to `"Japan"`. Also, this change should affect only customers who live in Tokyo. Which of the following SQL statement should you use?

a)
```
UPDATE Customers
SET Region = 'Japan'
WHERE RefCode = 'TKY'
AND City = 'TOKYO'
```

b)
```
UPDATE Customers
SET Region = 'Tokyo'
WHERE RefCode = 'TKY'
AND City = 'Japan'
```

c)
```
UPDATE Customers
SET Region = 'Tokyo'
WHERE RefCode = 'TKY'
```

d)
```
UPDATE Customers
SET Region = 'Japan'
WHERE RefCode = 'TKY'
```

Answer: a
Difficulty: Medium
Section Ref: Working with SQL Queries
According to the question's requirements, the `SET` clause should set the region to `'Japan'`. This change should be done for records where `RefCode` equals `'TKY'` and `City` equals `'TOKYO'`. Your queries should address both conditions.

5. You are developing an application that needs to retrieve a list of customers and their orders from a SQL Server database. After the list is retrieved, you should be able to display this data, even when a connection to the SQL Server is not available. Which of the following classes should you use to hold the data?

a) `DataAdapter`
b) `DataSet`
c) `DataView`
d) `SqlDataReader`

Answer: b
Difficulty: Medium
Section Ref: Working With DataSet
`DataSet` is very useful for creating disconnected applications, which can continue to function without a constant connection to network resources such as databases. `DataAdapter` is not a correct answer because it only stores the data connection and data commands needed to connect to the data source. `DataView` and `SqlDataReader` cannot work in a disconnected scenario.

6. The application you are developing needs to write data to a flat file that include items such as a five-digit integer key, followed by a 20-character customer name, followed by two date and time fields. Your solution should be as fast as possible and should create smallest size data file. Which of the following classes should you use?
a) `FileStream`
b) `StreamWriter`
c) `BinaryWriter`
d) `DataWriter`

Answer: c
Difficulty: Medium
Section Ref: Working With Flat Files
Flat files can be in either plain-text or binary format. `BinaryWriter` works very quickly and creates the smallest data files when compared to a text-only file.

7. You are developing an application that needs to copy data from a SQL Server table to a `DataSet`. Which of the following methods should you use to copy the data?
a) `Fill`
b) `FillSchema`
c) `GetFillParameters`
d) `Update`

Answer: a
Difficulty: Medium
Section Ref: Introducing Algorithms
The `Fill` method connects to the data source and retrieves data via the `SELECT` command. Use the `Fill` method to copy data from SQL Server to the `DataSet` object.

8. You are developing an application that manages customers and their orders. Any solution that you develop must take the least amount of effort but offer the best performance.. Which of the following situations is not a good candidate for implementation with stored procedures in your application?
a) Retrieving the list of all customers in the database
b) Retrieving the list of all orders for particular customers
c) Inserting a new order into the Orders table
d) Ad hoc querying by the database administrator

Answer: d
Difficulty: Medium
Section Ref: Working with SQL Queries
Ad hoc queries are best run standalone. Running a query multiple times takes less effort and provides better performance when using a stored procedure.

9. Your application connects to a SQL Server database that contains a table called Employees with the following columns:

```
EmployeeID (int, identity)
EmployeeType (char(1))
EmployeeDate (datetime)
```

You need to write a query that selects all rows from the table where the `EmployeeType` value is either `C` or `T`. Which statement should you use?

a)
```
SELECT  * FROM Employees
WHERE EmployeeType LIKE '[CT]'
```

b)
```
SELECT  * FROM Employees
WHERE EmployeeType LIKE '[C-T]'
```

c)
```
SELECT  * FROM Employees
WHERE EmployeeType LIKE 'C' OR 'T'
```

d)
```
SELECT  FROM Employees
WHERE EmployeeType IN ('C', 'T')
```

Answer: a
Difficulty: Medium
Section Ref: Running SQL Queries
The correct `SELECT` statement to use in the given case is the following:

```
SELECT  * FROM Employees
WHERE EmployeeType LIKE '[CT]'
```

The other forms of the `SELECT` statements will not get you the desired results.

10. Your application includes a `SqlDataAdapter` object named `sqlDataAdapter` and an `OleDbDataAdapter` object named `oledbdataAdapter`. You need to connect to the Employees table of a SQL Server database. Your application also includes a `DataSet` object named `dsEmployees`. You need to load the data from the database into the `DataSet` object. You must select a solution that gives you the best performance. Which of the following lines of code should you choose?

a) `dsEmployees = sqlDataAdapter.Fill("Employees");`
b) `dsEmployees = oledbDataAdapter.Fill("Employees");`
c) `oledbDataAdapter.Fill(dsEmployees, "Employees");`
d) `sqlDataAdapter.Fill(dsEmployees, "Employees");`

Answer: d
Difficulty: Medium
Section Ref: Working with DataSet
The correct syntax is to pass the name of the dataset and the name of the table to the `Fill` method. For best performance while connecting to a SQL Server database, you should use the `SqlDataAdapter` object. Although `OleDbDataAdapter` will work, it will have less performance when compared to `SqlDataAdapter`.

11. Your application includes a `SqlDataAdapter` object named `sqlDataAdapter` that connects to the Employees table. You use the `Fill` method to retrieve the data from the Employees table. The `SqlDataAdapter`'s `Connection` property is set to a valid connection to the SQL Server database, but the connection is in the closed state. Which of the following statements is true about the working of the `Fill` method?
a) The `Fill` method will throw an exception because the connection is closed.
b) The `Fill` method will open the connection, read the data, and leave the connection open.
c) The `Fill` method will open the connection, read the data, and leave the connection closed.
d) The `Fill` method will return an empty resultset because the connection is closed.

Answer: c
Difficulty: Medium
Section Ref: Working with DataSet
The connection object associated with the `Fill` method doesn't need to be open. If the connection is closed before `Fill` is called, it is opened to retrieve data, and then closed. If the connection is open before `Fill` is called, it remains open. In the given example, the connection was closed before the `Fill` method was called, so the `Fill` method opens the connection, retrieves data, and then closes the connection.

12. You need to develop a C# program that exports the contents of the Customers table to an XML file. The exported data must be in the following format:

```
<Customer CustomerID="ALFKI" ContactName="Maria Anders" Phone="030-007-
4321" />
<Customer CustomerID="ANATR" ContactName="Ana Trujillo" Phone="(5) 555-
4729" />
```

Which of the following code segments should you use to export the Customers table to the specified XML format?

a)
```
foreach(DataColumn c in dataset1.tables["Customers"].Columns)
{
     c.ColumnMapping = MappingType.Attribute;
}
dataSet1.WriteXml("Customers.xml");
```

b)
```
foreach(DataColumn c in dataset1.tables["Customers"].Columns)
{
     c.ColumnMapping = MappingType.Element;
}
dataSet1.WriteXml("Customers.xml");
```

c)
```
foreach(DataColumn c in dataset1.tables["Customers"].Columns)
{
     c.ColumnMapping = MappingType.Attribute;
}
dataSet1.WriteXml("Customers.xml", XmlWriteMode.WriteSchema);
```

d)
```
foreach(DataColumn c in dataset1.tables["Customers"].Columns)
{
```

```
        c.ColumnMapping = MappingType.Element;
    }
    dataSet1.WriteXml("Customers.xml", XmlWriteMode.WriteSchema);
```

Answer: a
Difficulty: Medium
Section Ref: Working with XML
In the desired output, each table row is mapped as a single XML element in which each table field is an attribute. To get the output in this format, column mapping should be set to `MappingType.Attributes`. The desired output does not specify XML schema, so you must not include `XmlWriteMode.WriteSchema` as a `WriteMode` parameter in the `WriteXml` method.

13. You are designing a database for your company. You are reviewing the normalization for the database tables. You review the following Orders table:

OrderId	***CustomerId***	***OrderDate***	***FirstName***	***LastName***
101	1	10/1/2010	Jane	Doe
102	2	10/5/2010	John	Doe
103	1	10/4/2010	Jane	Doe

Which of the following statement is true for the Orders table?
a) It meets the requirements for the first normal form.
b) It meets the requirements for the second normal form.
c) It meets the requirements for the third normal form.
d) It meets the requirements for the fourth normal form.

Answer: a
Difficulty: Medium
Section Ref: Understanding Data Normalization
For a table to be in the first normal form (1NF), none of its columns should have multiple values in the same row of data. The given table meets this requirement and is therefore in the first normal form. The OrderId and CustomerId columns together identify a unique row and therefore make up a composite primary key. However, the OrderDate column is functionally dependent only on OrderId, and the CustomerName column is dependent only on CustomerId. This violates the second normal form because non-key columns are functionally dependent on only part of the primary key. A table must meet the requirements of second normal form before it can be in the third normal form.

14. You are designing a database for your company and are reviewing the normalization for the database tables. You review the following Customer table:

Id	***FirstName***	***LastName***	***PhoneNumber***
1	Jane	Doe	(503) 555-6874
2	John	Doe	(509) 555-7969, (509) 555-7970

3.	Howard	Steel	(604) 555-3392, (604) 555-3393

Which of the following statements is true?
a) The Customer table meets the requirements for the first normal form.
b) It meets the requirements for the second normal form.
c) It meets the requirements for the third normal form.
d) It is not normalized.

Answer: d
Difficulty: Medium
Section Ref: Understanding Data Normalization
For a table to be in the first normal form (1NF), none of the columns in the table should have multiple values in the same row of data. The Customer table is not in 1NF because the PhoneNumber column is storing more than one value in each row. Also, the table does not meet the requirements for 2NF and 3NF because to meet those requirements, the table must first satisfy the requirements of 1NF. As a result, the given table is not normalized.

15. You are designing a database for your company and are reviewing the normalization for the database tables. You review the following Customer table:

Id	***FirstName***	***LastName***
1	Jane	Doe
2	John	Doe
3	Howard	Steel

Which of the following statements is true?
a) The highest normal form of the Customer table is the first normal form.
b) The highest normal form of the Customer table is the second normal form.
c) The highest normal form of the Customer table is the third normal form.
d) The Customer table is not normalized.

Answer: c
Difficulty: Medium
Section Ref: Understanding Data Normalization
For a table to be in the first normal form (1NF), none of the columns in the table should have multiple values in the same row of data. The Customer table is in 1NF because none of the columns are storing more than one value in each row. For a table to be in second normal form (2NF), it must first meet the requirements for 1NF. Also, 2NF requires that all non-key columns be functionally dependent on the entire primary key. In the Customer table, all columns are functionally dependent on the Id column and therefore the table is in 2NF. The third normal form (3NF) requires that 2NF is met and that no functional dependency exists between non-key attributes. In the given table, the FirstName and LastName columns share no dependency. As the

result, the table is also in 3NF.As a result, the highest normal form of the Customer table is the third normal form.

16. As you design a database for your company, you review the normalization rules for the database tables. You need to ensure that your table design meets the requirements for the third normal form. Which of the following statements must be true for your tables? (Choose all that apply.)
a) None of the columns in the table should have multiple values in the same row of data.
b) All non-key columns are functionally dependent on the entire primary key.
c) At least one non-key column is functionally dependent on the entire primary key.
d) Non-key attributes don't share any functional dependency.
e) Non-key attributes share functional dependency.

Answer: a, b, and d
Difficulty: Medium
Section Ref: Understanding Data Normalization
For a table to be in the first normal form (1NF), none of the columns in the table should have multiple values in the same row of data. For a table to be in second normal form (2NF), it must first meet the requirements for 1NF, and then require that all non-key columns be functionally dependent on the entire primary key. The third normal form (3NF) requires that 2NF is met and that no functional dependency is shared between non-key attributes.

17. You are designing database for a new Web application. You need to identify appropriate relational database structure to satisfy business requirements. Which of the following activities should you *not* perform as part of the design process?
a) Identify tables and columns.
b) Choose primary keys for the tables.
c) Identify table relationships.
d) Apply the normalization process.
e) Write stored procedures.

Answer: e
Difficulty: Medium
Section Ref: Understanding Relational Database Design
You don't write stored procedures as part of the design process. Stored procedures are developed later as part of the database implementation. In the design process, your first priority is to create a database structure that ensures that you identify all the data elements that need to be stored and in a way that ensures data integrity.

18. You are developing a C# program for a bike rental company. The data is stored in a SQL Server 2000 server named BikeServer in a database named BikeDB. You must use the Windows Integrated authentication to connect to the BikeDB database. Which of the following connection strings should you choose in your C# program for connecting to the BikeDB database?
a) `"Provider=SQLOLEDB;Data Source=BikeServer;InitialCatalog=BikeDB;Integrated Security=SSPI;"`
b) `"Provider=SQLOLEDB;Data Source=BikeServer;InitialCatalog=BikeDB;User Id=sa;Password=gih6774y"`

c) `"Data Source=BikeServer;InitialCatalog=BikeDB;Trusted_Connection=true;"`
d) `"Data Source=BikeServer;InitialCatalog=BikeDB;User Id=sa;Password=gih6774y"`

Answer: a
Difficulty: Medium
Section Ref: Connecting to a SQL Server Database
The correct answer is to use the following connection string:

```
"Provider=SQLOLEDB;Data
Source=BikeServer;InitialCatalog=BikeDB;Integrated Security=SSPI;"
```

You must specify the provider, data source, and initial catalog to connect to. You don't need to specify the user ID and password because you must use the Windows Integrated authentication to connect to the BikeDB database.

19. You are developing a C# program for a bike rental company. Every night, your application needs to read data from a SQL Server 2000 database and write it to a flat file. This flat file will be transferred to your supplier. Which of the following classes shall you use to retrieve the data? Any solution that you suggest must have very little impact of the server while maximizing performance.
a) `DataSet`
b) `DataTable`
c) `SqlDataReader`
d) `OleDbDataReader`

Answer: c
Difficulty: Medium
Section Ref: Understanding the Database Connection Methods
You must use the `SqlDataReader` class to read data from a SQL Server very quickly. The `OleDbDataReader` is used to work with `OLEDB` data sources but offers slower performance than `SqlDataReader` when reading data from SQL Server.

20. You are developing an application that stores data in SQL Server 2005 database. You need to write a query that retrieves all orders in the orders table that were placed on January 1, 2011. You write the following query:

```
SELECT * FROM Orders
WHERE OrderDate = 01/01/2011
```

The statement executes without any error but does not return any data. You are certain that the database contains order from this date. How should you correct the SQL statement?

a)
```
SELECT * FROM Orders
WHERE OrderDate = #01/01/2011#
```

b)
```
SELECT * FROM Orders
```

```
WHERE OrderDate = %01/01/2011%
```

c)
```
SELECT * FROM Orders
WHERE OrderDate = '01/01/2011'
```

d)
```
SELECT * FROM Orders
WHERE OrderDate = "01/01/2011"
```

Answer: c
Difficulty: Medium
Section Ref: Running SQL Queries
The correct delimiter for writing dates in this format is a single quotation mark (`'`). You must write your query as follows:

```
SELECT * FROM Orders
WHERE OrderDate = '01/01/2011'
```