Programming with C#

This Exam contains all Questions from the Book:

Exam Ref 70-483: Programming in C# by Wouter de Kort

It is for general purpose study.

Chapter 1: Manage program flow

QUESTION 1
You have a lot of items that need to be processed. For each item, you need to perform a complex calculation. Which technique should you use?

A. You create a Task for each item and then wait until all tasks are finished.
B. You use Parallel.For to process all items concurrently.
C. You use async/await to process all items concurrently.
D. You add all items to a BlockingCollection and process them on a thread created by the Thread class.

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: Manually creating and managing tasks is not necessary. The Parallel class takes care of this and uses the optimal configuration options.
B. Correct: Parallel.For is ideal for executing parallel operations on a large set of items that have to do a lot of work.
C. Incorrect: async/await does not process items concurrently. Instead it waits until the current task has finished and then continues executing the code.
D. Incorrect: The BlockingCollection can be used to share data between multiple threads. Using one producer and one consumer thread, however, won't improve scalability. The Parallel class is designed for this scenario and should be used.

QUESTION 2
You are creating a complex query that doesn't require any particular order and you want to run it in parallel. Which method should you use?

A. AsParallel
B. AsSequential
C. AsOrdered
D. WithDegreeOfParallelism

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: AsParallel makes a sequential query parallel if the runtime thinks this will improve performance.
B. Incorrect: AsSequential is used to make a parallel query sequential again.
C. Incorrect: AsOrdered is used to make sure that the results of a parallel query are returned in order.
D. Incorrect: WithDegreeOfParallelism is used to specify how many threads the parallel query should use.

QUESTION 3
You are working on an ASP.NET application that retrieves some data from another web server and then writes the response to the database. Should you use async/await?

A. No, both operations depend on external factors. You need to wait before they are finished.

B. No, in a server application you don't have to use async/await. It's only for responsiveness on the client.

C. Yes, this will free your thread to serve other requests while waiting for the I/O to complete.

D. Yes, this put your thread to sleep while waiting for I/O so that it doesn't use any CPU.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: Because you have to wait for external factors (the database and web response), you should use async/await to free your thread. That way your thread can do some other work while waiting for the external responses to come back.
B. Incorrect: Async/await can be used to improve responsiveness on the client but it can also be used in server scenarios. Especially when waiting for an I/O-bound operation, you can use asynchronous code to free the thread from waiting.
C. Correct: The operating system waits for the I/O request to complete and then activates a thread that can process the response. In the meantime, the thread can do other work.
D. Incorrect: Async/await does not put your thread to sleep in an I/O-bound situation. Instead, your thread can process other work while the operating system monitors the status of the request. When the request finishes, a thread is used to process the response. With a CPU-bound operation, your thread waits for the operation to finish on another thread.

QUESTION 4
You want to synchronize access by using a lock statement. On which member do you lock?

A. this

B. string _lock = "mylock"

C. int _lock = 42;

D. object _lock = new object();

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: You should never lock on this. Another part of your code may already be using your object to execute a lock.
B. Incorrect: You shouldn't use a string for locking. With string-interning, one object can be used for multiple strings, so you would be locking on an object that is also in use in other locations.
C. Incorrect: Locking on a value type will generate a compile error. The value type will be boxed each time you lock on it, resulting in a unique lock each time.
D. Correct: A private lock of type object is the best choice.

QUESTION 5
You need to implement cancellation for a long running task. Which object do you pass to the task?

A. CancellationTokenSource
B. CancellationToken
C. Boolean isCancelled variable
D. Volatile

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: The CancellationTokenSource is used to generate a CancellationToken. The token should be passed to the task, and the CancellationTokenSource can then be used to request cancellation on the token.
B. Correct: A CancellationToken generated by a CancellationTokenSource should be passed to the task.
C. Incorrect: A Boolean variable can be used to cancel a task, but it's not the preferred way. A CancellationToken offers more flexibility and should be used.
D. Incorrect: The volatile keyword should be used to signal to the compiler that the order of reads and writes on a field is important and that the compiler shouldn't change it.

QUESTION 6
You are implementing a state machine in a multithreaded class. You need to check what the current state is and change it to the new one on each step. Which method do you use?

A. Volatile.Write(ref currentState)
B. Interlocked.CompareExchange(ref currentState, ref newState, expectedState)
C. Interlocked.CompareExchange(ref currentState, ref newState, expectedState)
D. Interlocked.Decrement(ref newState)

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: Volatile.Write is used to signal to the compiler that writing the value to a field should happen at that exact location.
B. Correct: CompareExchange will see whether the current state is correct and it will then change it to the new state in one atomic operation.
C. Incorrect: Exchange only changes the value; it doesn't check to see whether the current state is correct.
D. Incorrect: Decrement is used to subtract one off the value in an atomic operation.

QUESTION 7
You need to iterate over a collection in which you know the number of items. You need to remove certain items

from the collection. Which statement do you use?

A. switch
B. foreach
C. for
D. goto

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: switch is used as a decision statement. You map a value to certain labels to execute specific code; it doesn't iterate over collections.
B. Incorrect: Although the foreach statement can be used to iterate over a collection; it doesn't allow changes to the collection while iterating.
C. Correct: With for, you can iterate over the collection while modifying it. It's your own job to make sure that the index stays correct.
D. Incorrect: goto is a jump statement that should be avoided.

QUESTION 8
You have a lot of checks in your application for null values. If a value is not null, you want to call a method on it. You want to simplify your code. Which technique do you use?

A. for
B. Conditional operator
C. Null-coalescing operator
D. The short-circuiting behavior of the and operator

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: for is an iteration statement that can't be used to check for null values.
B. Incorrect: The conditional operator can be used to shorten if statements. It's not useful to conditionally call a method.
C. Incorrect: The null-coalescing operator does check for null values but it's used to provide a default value. It's not useful when calling a method if the value is not null.
D. Correct: Short-circuiting enables you to see whether a value is null and call a member on it in one and statement. If the left value is null, the right operand won't be executed.

QUESTION 9
You are processing some data from over the network. You use a HasNext and Read method to retrieve the data. You need to run some code on each item. What do you use?

A. for
B. foraech
C. while
D. do-while

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: A for statement is most useful when iterating over a collection in which you know the number of items beforehand.
B. Incorrect: foreach can be used only on types that implement IEnumerable. It can't be easily used with your two custom methods.
C. Correct: You can use while (o.HasNext) { var i = o.Read(); } to process the items. When o.HasNext returns false, you automatically end the loop.
D. Incorrect: Do-while will run the code at least once. If there are no items on the network, the code doesn't have to run.

QUESTION 10
You have a private method in your class and you want to make invocation of the method possible by certain callers. What do you do?

A. Make the method public.
B. Use an event so outside users can be notified when the method is executed.
C. Use a method that returns a delegate to authorized callers.
D. Declare the private method as a lambda.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: Making the method public gives access to all users of your class.
B. Incorrect: This doesn't give users of your class the ability to execute the method.
C. Correct: The method can see whether the caller is authorized and then return a delegate to the private method that can be invoked at will.
D. Incorrect: Changing the method to a lambda doesn't change the fact that outside users can't access the method.

QUESTION 11
You have declared an event on your class, and you want outside users of your class to raise this event. What do you do?

A. Make the event public.
B. Add a public method to your class that raises the event.
C. Use a public delegate instead of an event.
D. Use a custom event accessor to give access to outside users.

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: The compiler restricts the use of events outside of the class where it's defined. They can only add and remove subscribers. Only the class itself can raise the event.
B. Correct: The public method can be called by outside users of your class. Internally it can raise the event.
C. Incorrect: Using a delegate does allow it to be invoked from outside the class. However, you lose the protection that an event gives you. A public delegate can be completely modified by outside users without any restrictions.
D. Incorrect: Canonical name (CNAME) records map an alias or nickname to the real or canonical name that might lie outside the current zone.

QUESTION 12
You are using a multicast delegate with multiple subscribers. You want to make sure that all subscribers are notified, even if an exception is thrown. What do you do?

A. Manually raise the events by using GetInvocationList.
B. Wrap the raising of the event in a try/catch.
C. Nothing. This is the default behavior.
D. Let subscribers return true or false instead of throwing an exception.

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: You can handle each individual error and make sure that all subscribers are called.
B. Incorrect: Wrapping the raising of the event in one try/catch will still cause the invocation to stop at the first exception. Later subscribers won't be notified.
C. Incorrect: By default, the invocation of subscribers stops when the first unhandled exception happens in one of the subscribers.
D. Incorrect: Exceptions are the preferred way of dealing with errors. Returning a value from each event still requires you to invoke them manually one by one to check the return value.

QUESTION 13
You are checking the arguments of your method for illegal null values. If you encounter a null value, which exception do you throw?

A. ArgumentException.
B. InvalidOperationException.
C. NullReferenceException.
D. ArgumentNullException.

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: Although the exception has to do with an argument to your method, you should throw the more specialized ArgumentNullException.
B. Incorrect: InvalidOperationException should be used when your class is not in the correct state to handle a request.
C. Incorrect: NullReferenceException is thrown by the runtime when you try to reference a null value.
D. Correct: ArgumentNullException is the most specialized exception that you can use to tell which argument was null and what you expect.

QUESTION 14
Your code catches an IOException when a file cannot be accessed. You want to give more information to the caller of your code. What do you do?

A. Change the message of the exception and rethrow the exception.
B. Throw a new exception with extra information that has the IOException as InnerException.
C. Throw a new exception with more detailed info.
D. Use throw to rethrow the exception and save the call stack.

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: The Message property of an exception is read-only. You can't change it after the exception is created.
B. Correct: The new exception can contain extra info. Setting the InnerException makes sure that the original exception stays available.
C. Incorrect: Throwing a brand-new exception loses the original exception and the information that it had.
D. Incorrect: Using throw without an identifier will rethrow the original exception while maintaining the stack trace, but it won't add any extra information.

QUESTION 15
You are creating a custom exception called LogonFailedException. Which constructors should you at least add? (Choose all that apply.)

A. LogonFailed()
B. LogonFailed(string message)
C. LogonFailed(string message, Exception innerException)
D. LogonFailed(Exception innerException)

Correct Answer: ABC
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, B, C

A. Correct: You should always add a default empty constructor.
B. Correct: A second constructor should take a descriptive message of why the error occurred.
C. Correct: An InnerException can be set to correlate two exceptions and show what the original error was.
D. Incorrect: You don't have to define a constructor that only takes an InnerException without a message.

Chapter 2: Create and use types

QUESTION 1
You are creating a new collection type and you want to make sure the elements in it can be easily accessed. What should you add to the type?

A. Constructor
B. Indexer property
C. Generic type parameter
D. Static property

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: A constructor is used to create an instance of a new type.
B. Correct: An indexer property enables the user of the type to easily access a type that represents an array-like collection.
C. Incorrect: Making the type generic enables you to store multiple different types inside your collection.
D. Incorrect: A static property cannot access the instance data of the collection.

QUESTION 2
You are creating a generic class that should work only with reference types. Which type constraint should you add?

A. where T : class
B. where T : struct
C. where T : new()
D. where T : IDisposable

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: Constraining your generic type parameter to class allows the class to be used only with a reference type.
B. Incorrect: This will constrain the class to be used with a value type, not a reference type.
C. Incorrect: This will constrain the class to be used with a type that has an empty default constructor. It can be both a value and a reference type.
D. Incorrect: This constrains the class to be used with a type that implements the IDisposable interface.

QUESTION 3
You pass a struct variable into a method as an argument. The method changes the variable; however, when the method returns, the variable has not changed. What happened?

A. The variable was not initialized before it was passed in.
B. A value type cannot be changed inside a method.
C. Passing a value type makes a copy of the data. The original wasn't changed.

D. The method didn't return the changes.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: Passing a noninitialized struct will result in a compile error of using an unassigned local variable.
B. Incorrect: A struct can be changed inside a method. It won't change the original struct that was passed in, however.
C. Correct: Passing a struct will make a copy of the data. The copy can be changed; the original won't change with it.
D. Incorrect: With a reference type, the method can make changes that will reflect on the original. Because a value type is copied, it won't change the original. Returning the changes from the method will again create a new instance that will overwrite the original.

QUESTION 4
You are creating a custom Distance class. You want to ease the conversion from your Distance class to a double. What should you add?

A. Nothing; this is already possible.
B. An implicit cast operator.
C. An explicit cast operator.
D. A static Parse method.

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: A conversion between a custom class and a value type does not exist by default.
B. Correct: Adding an implicit operator will enable users of your class to convert between Distance and double without any extra work.
C. Incorrect: Although adding an explicit cast operator will enable users of the class to convert from Distance to double, they will still need to explicitly cast it.
D. Incorrect: A Parse method is used when converting a string to a type. It doesn't add conversions from your type to another type.

QUESTION 5
You want to determine whether the value of an object reference is derived from a particular type. Which C# language feature can you use? (Choose all that apply.)

A. An as operator
B. An implicit cast
C. An is operator
D. A dynamic keyword

Correct Answer: AC
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, C

A. Correct: The as operator will return null if the conversion failed. If it succeeds, it will return the converted object. Seeing whether the result is null enables you to check for a valid conversion.
B. Incorrect: Implicitly casting something of type object to another type is not possible. It would require an explicit cast.
C. Correct: The is keyword will see whether a type is derived from another type.
D. Incorrect: The dynamic keyword can be used when you want weakly typing. It will still throw errors at runtime if an action is not possible.

QUESTION 6
You are using an ArrayList as a collection for a list of Points, which are a custom struct. You are experiencing performance problems when working with a large amount of Points. What do you have to do?

A. Use a generic collection instead of ArrayList.
B. Change Point to be a reference type.
C. Add an implicit conversion from Point to object.
D. Make the collection of type dynamic.

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: Using a generic collection will eliminate the need to box and unbox values. This will improve performance, especially when working with a large number of items.
B. Incorrect: Changing Point to be a reference type could increase memory usage. You will still have to convert from object to Point when using the nongeneric ArrayList.
C. Incorrect: Point is a struct that inherits from System.ValueType, which in turn inherits from System.Object. The implicit conversion is already present; adding it won't improve performance.
D. Incorrect: Making the collection dynamic will loosen compile-time checking. It won't improve performance because the runtime has to do extra work.

QUESTION 7
What access modifier should you use to make sure that a method in a class can only be accessed inside the same assembly by derived types?

A. Make the class public and its members public.
B. Make the class public and its members protected.
C. Make the class internal and its members internal.
D. Make the class internal and its members protected.

Correct Answer: D
Section: (none)

Explanation

QUESTION 8
You need to expose some data from a class. The data can be read by other types but can be changed only by derived types. What should you use?

A. A protected field
B. A public property with a protected set modifier
C. A protected property
D. A protected property with a public get modifier

Correct Answer: B
Section: (none)
Explanation

QUESTION 9
You have a class that implements two interfaces that both have a method with the same name. Interface IA should be the default implementation. Interface IB should be used only in special situations. How do you implement those interfaces?

A. Implement IA implicitly and IB explicitly.
B. Implement both IA and IB explicitly.
C. Implement both IA and IB implicitly.
D. Implement IA explicitly and IB implicitly.

Correct Answer: A
Section: (none)
Explanation

dealing with a reference to the IB interface.
B. Incorrect: When both IA and IB are implemented explicitly, you need to cast a reference to the class to one or both interface types to invoke the method.
C. Incorrect: Implementing both IA and IB implicitly won't allow for a different implementation for IB.
D. Incorrect: Implementing IB implicitly makes IB the default implementation instead of IA.

QUESTION 10
You want to create a hierarchy of types because you have some implementation code you want to share between all types. You also have some method signatures you want to share. What should you use?

A. An interface
B. A class with virtual methods
C. An abstract class
D. A sealed class

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: An interface won't let you share any implementation code, only the public member signatures.
B. Incorrect: A class requires you to have an implementation for every member. It doesn't give you the option to only declare a member signature.
C. Correct: An abstract class enables you to share both implemented methods and method signatures that a derived class needs to implement.
D. Incorrect: A sealed class can't be inherited.

QUESTION 11
You want to create a type that can be easily sorted. Which interface should you implement?

A. IEnumerable
B. IComparable
C. IDisposable
D. IUnknown

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: IEnumerable should be implemented on collection-like types so they can be easily iterated over.
B. Correct: IComparable enables objects to be compared to each other. It returns an integer value that represents the relative position as smaller than 0, 0 or larger than 0.
C. Incorrect: IDisposable should be implemented on types that access unmanaged resources and that need to release them.
D. Incorrect: IUnknown is used only when working with the COM.

QUESTION 12
You want to inherit from an existing class and add some behavior to a method. Which steps do you have to take? (Choose all that apply.)

A. Use the abstract keyword on the base type.
B. Use the virtual keyword on the base method.
C. Use the new keyword on the derived method.
D. Use the override keyword on the derived method.

Correct Answer: BD
Section: (none)
Explanation

Explanation/Reference:
Correct answers: B, D

A. Incorrect: When you mark the base type as abstract, you can't create an instance of it. You can't use both the base and the derived type as concrete types in your code.
B. Correct: Marking the method in the base class as virtual enables it to be overridden by derived classes.
C. Incorrect: The new keyword hides the method in the base class. You shouldn't use it when you want to extend the behavior from the base class.
D. Correct: The override keyword enables you to override a method marked as virtual in a base class.

QUESTION 13
You want to read the value of a private field on a class. Which BindingFlags do you need? (Choose all that apply.)

A. Instance
B. DeclaredOnly
C. Static
D. NonPublic

Correct Answer: AD
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, D

A. Correct: The field is a nonstatic instance field.
B. Incorrect: DeclaredOnly is used when you don't want to include inherited members.
C. Incorrect: The field is not static; it's a per-instance field.
D. Correct: Nonpublic is necessary because the field is private.

QUESTION 14
You need to create an attribute that can be applied multiple times on a method or a parameter. Which syntax should you use?

A. [AttributeUsage(AttributeTargets.GenericParameter | AttributeTargets.Method,AllowMultiple = true)]
B. [AttributeUsage(AttributeTargets.Method | AttributeTargets.Parameter, AllowMultiple = true)]
C. [AttributeUsage(AttributeTargets.All)]
D. [AttributeUsage(AttributeTargets.Method | AttributeTargets.Parameter)]

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: The AttributeTargets.GenericParameter can be applied to generic parameters. It's not used for regular method arguments.
B. Correct: The Attribute targets both Methods and Parameters. It can also be applied multiple times.
C. Incorrect: With AttributeTargets.All, the attribute can be applied to all types. It also can't be applied multiple times.
D. Incorrect: Because AllowMultiple is false by default, this attribute can't be applied multiple times.

QUESTION 15
You want to create a delegate that can filter a list of strings on a specific value. Which type should you use?

A. Action<bool, IEnumerable<string>>.
B. Func<IEnumerable<string>, IEnumerable<string>>.
C. Func<string, IEnumerable<string>, IEnumerable<string>>.
D. Func<IEnumerable<string>>.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: An Action doesn't return a value. It also takes a Boolean input instead of the list of strings and the filter value.
B. Incorrect: This delegate doesn't have a parameter for the value to filter on.
C. Correct: It takes both the input list and the value to filter on and returns the filtered list.
D. Incorrect: This returns only a list of strings. It doesn't have an argument for the filter parameter or the original list.

QUESTION 16
You are about to execute a piece of code that is performance-sensitive. You are afraid that a garbage collection will occur during the execution of this code. Which method should you call before executing your code?

A. GC.RemoveMemoryPressure()
B. GC. SuppressFinalize()
C. GC.Collect()
D. GC.WaitForPendingFinalizers()

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: RemoveMemoryPressure should be called only after calling AddMemoryPressure to inform the runtime that a managed object uses a large amount of unmanaged memory.
B. Incorrect: SuppressFinalize should be called in the Dispose method of an object to inform the runtime that the object doesn't need to be finalized any more.
C. Correct: Collect will execute a garbage collection, freeing as much memory as possible at that time, which can be a very expensive process. This won't prevent the garbage collector from executing during your time-sensitive code, but it will make it less likely to happen.

D. Incorrect: WaitForPendingFinalizers suspends the current thread so all finalizers that are on the finalization queue can run. This will free some memory (for all objects that are waiting for finalization). Normally, however, you call this code after calling Collect if you want to make sure that all finalizers have run.

QUESTION 17
An object that is implementing IDisposable is passed to your class as an argument. Should you wrap the element in a using statement?

A. Yes, otherwise a memory leak could happen.
B. No, you should call Close on the object.
C. No, you should use a try/finally statement and call Dispose yourself.
D. No, the calling method should use a using statement.

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: A memory leak won't happen because the finalizer of the class will eventually execute and dispose of the element. Disposing of the object in your method will cause an ObjectDisposedException to be thrown in other code that uses the object.
B. Incorrect: The Close method is sometimes used as a secondary method that internally calls Dispose. It's implemented on types such as File. The same reasoning applies as with answer A.
C. Incorrect: A using statement is equivalent to a try/finally statement with a Dispose call. However, you don't want to dispose of the item because the calling code could depend on the object being in a usable state.
D. Correct: The calling code knows what the lifetime of the object should be and should decide when to dispose of the object.

QUESTION 18
Your application is using a lot of memory. Which solution should you use?

A. Turn all references into WeakReferences.
B. Set all references to null when you are done with them.
C. Use a caching algorithm to decide which objects can be freed.
D. Use a background thread to call GC.Collect() on a scheduled interval.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: A WeakReference is not an equivalent to an efficient caching strategy. Turning all items into WeakReferences will complicate your code (you have to see whether the memory is cleared). It could potentially increase your memory usage because the WeakReference itself also takes up memory.
B. Incorrect: Setting references to null is optimized away by the compiler. Unlike some other languages, it doesn't explicitly free any memory.
C. Correct: A caching strategy is the best solution. You can decide whether you want to free memory based on usage, a timestamp, or some other criteria.
D. Incorrect: Calling GC.Collect on a scheduled interval won't improve your memory usage. Memory is freed only when there are no root references to an object. GC.Collect will stall your execution thread, making things slower, while not freeing any more memory than waiting for a regular Collect to take place.

QUESTION 19
You want to display only the date portion of a DateTime according to the French culture. What method should you use?

A. dt.ToString(new CultureInfo("fr-FR"))
B. dt.ToString("M", new CultureInfo("fr-FR"));
C. dt.ToString("d");
D. dt.ToString("d", new CultureInfo("fr-FR"));

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: Only specifying the culture will give you the full date and time.
B. Incorrect: Specifying "M" as the format string results in "22 avril" without the year.
C. Incorrect: This will give the date in the correct format, but not with the French culture.
D. Correct: This will give the date in the correct French format.

QUESTION 20
You want your type to be able to be converted from string. Which interface should you implement?

A. IFormattable
B. IFormatProvider
C. IComparable
D. IConvertible

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: IFormattable provides the functionality to format the value of an object into a string representation.
It is also used by the Convert class to do the opposite.
B. Incorrect: IFormatProvider is used to retrieve an object that controls formatting, not the actual formatting.
C. Incorrect: IComparable is used to sort items.
D. Incorrect: IConvertible defines methods to convert a type to an equivalent CLR type.

QUESTION 21
You are parsing a large piece of text to replace values based on some complex algorithm. Which class should you use?

A. StringReader
B. StringBuilder
C. StringWriter
D. String

Correct Answer: B

Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: StringReader is an adapter of the StringBuilder class so that it can be used in places where a TextReader is required.
B. Correct: The StringBuilder class is most efficient when changing large amounts of strings.
C. Incorrect: The StringWriter is used in places where a TextWriter is required. It's an adapter of the StringBuilder.
D. Incorrect: The regular String class is immutable, so it's not efficient to use when changing large amounts of strings.

Chapter 3: Debug applications and implement security

QUESTION 1
A user needs to enter a DateTime in a text field. You need to parse the value in code. Which method do you use?

A. DateTime.Parse
B. DateTime.TryParse
C. Convert.ToDateTime
D. Regex.Match.

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: Parse will throw an exception when the user enters an invalid date,, which is not uncommon.
B. Correct: TryParse will see whether the entered value is a valid date. If not, it will return gracefully instead of throwing an exception.
C. Incorrect: Convert.ToDateTime uses Parse internally. This will throw an exception when entered data is in the wrong format.
D. Incorrect: RegEx.Match can be used to see whether the input is a valid date. It can't convert the input string to a DateTime object.

QUESTION 2
You are working on a globalized web application. You need to parse a text field where the user enters an amount of money. Which method do you use?

A. int.TryParse(value, NumberStyles.Currency, UICulture);
B. decimal.TryParse(value, NumberStyles.Currency, UICulture);
C. decimal.TryParse(value, ServerCulture);
D. decimal.TryParse(value)

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: Money should not be stored in an integer because it can't store decimal numbers.
B. Correct: You need to specify the NumberStyles.Currency and the culture that the user is using to parse the DateTime correctly.
C. Incorrect: Using the server culture doesn't account for the differences in user culture. You also need the NumberStyles.Currency parameter to make sure the user can enter a currency symbol.
D. Incorrect: Leaving off the culture defaults to the culture of the operating system. You also need the NumberStyles.Currency parameter to make sure the user can enter a currency symbol.

QUESTION 3
You need to validate an XML file. What do you use?

A. JavaScriptSerializer
B. RegEx

C. StringBuilder

D. XSD

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: That is a C#. not a JavaScript.
B. Incorrect: RegEx validates regular expressions.
C. Incorrect: String Builder is not an option, because it works with strings.
D. Correct: XSD is a validation schema for XML.

QUESTION 4
Bob and Alice are using an asymmetric algorithm to exchange data. Which key should they send to the other party to make this possible?

A. Bob sends Alice his private key, and Alice sends Bob her public key.

B. Bob sends Alice his private key, and Alice sends Bob her private key.

C. Bob sends Alice his public key, and Alice sends Bob her public key.

D. Bob sends Alice his public key, and Alice sends Bob her private key.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: The private key should always be kept confidential.
B. Incorrect: The private key should always be kept confidential.
C. Correct: By sending each other their public key, they can then encrypt data with the other party's public key to send them data.
D. Incorrect: The private key should always be kept confidential.

QUESTION 5
You need to encrypt a large amount of data. Which algorithm do you use?

A. SHA256

B. RSACryptoServiceProvider

C. MD5CryptoServiceProvider

D. AesManaged

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: SHA256 is a hashing algorithm. It can't be used to encrypt data.
B. Incorrect: RSACryptoServiceProvider is an asymmetric encryption algorithm. Asymmetric algorithms are not

suited for encrypting large amounts of data.
C. Incorrect: MD5CryptoServiceProvider is a hashing algorithm. It can't be used to encrypt data.
D. Correct: AesManaged is a symmetric algorithm that can be used to encrypt large amounts of data.

QUESTION 6
You need to send sensitive data to another party and you want to make sure that no one tampers with the data.
Which method do you use? (Choose all that apply.)

A. X509Certificate2.SignHash
B. RSACryptoServiceProvider.Encrypt
C. UnicodeEncoding.GetBytes
D. Marshal.ZeroFreeBSTR

Correct Answer: AC
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, C

A. Correct: Using the digital certificate X509 can be used to sign hashed data. If the other party uses the Verify
method, it can check that the hash hasn't changed.
B. Incorrect: This method encrypts the data with an asymmetric algorithm. It doesn't ensure that the data
hasn't been tampered with.
C. Correct: UnicodeEncoding.GetBytes converts a string to a byte sequence. It doesn't protect the data in any
way.
D. Incorrect: The Marshal class should be used when working with System.SecureString. The ZeroFreeBSTR
method can be used to zero out an area of memory that contained an insecure string.

QUESTION 7
You are building a strong-named assembly and you want to reference a regular assembly to reuse some code
you built. What do you have to do?

A. You first need to put the assembly in the GAC.
B. Nothing. Referencing another assembly to use some code is always possible.
C. You need to sign the other assembly before using it.
D. You need to use the public key token of the other assembly to reference it.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: An assembly in the GAC needs to be strongly named. Your assembly still won't be able to
reference the nonsigned assembly.
B. Incorrect: A strong-named assembly cannot reference a non-strong-named assembly.
C. Correct: You need to strongly name the other assembly before you can reference it.
D. Incorrect: The public key token is a part of the manifest of a strong-named assembly. The non-strong-
named assembly doesn't have this key information. It needs to be strongly named first.

QUESTION 8
You are building an assembly that will be used by a couple of server applications. You want to make the update

process of this assembly as smooth as possible. Which steps should you take?

A. Create a WinMD Metadata file.
B. Deploy the assembly to the GAC.
C. Add an assemblyBinding section to each client application that points to the location of the assembly.
D. Strongly name the assembly.

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: A WinMD file is used by the WinRT in Windows 8. It shouldn't be used outside of this context.
B. Correct: A shared assembly can be deployed in the GAC. Other applications can reference it there. When you want to update it, you can do so by deploying the new version to the GAC. By using configuration files, you can then let other applications reference your new assembly.
C. Incorrect: You can use the assemblyBinding configuration element to add extra search locations for an assembly. This would ask for changes to each client application, however. The GAC is the location where a shared assembly needs to be deployed.
D. Incorrect: Strongly naming an assembly doesn't make it a shared assembly. Each application would still require its own copy.

QUESTION 9
You want to deploy an assembly to a shared location on the intranet. Which steps should you take? (Choose all that apply.)

A. Strongly name the assembly.
B. Use the codebase configuration element in the applications that use the assembly.
C. Deploy the assembly to the GAC.
D. Use the assemblyBinding configuration element with the probing option.

Correct Answer: AB
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, B

A. Correct: Strongly naming the assembly is required to be able to reference it on the intranet.
B. Correct: The codebase configuration element can be used to have local client applications know they can find an assembly on another location such as the intranet.
C. Incorrect: Deploying it to the GAC won't put the assembly on the intranet.
D. Incorrect: The probing option can be used only to give additional locations relative to the application path. It can't be used to point to the intranet.

QUESTION 10
You are ready to deploy your code to a production server. Which configuration do you deploy?

A. Debug configuration
B. Release configuration
C. Custom configuration with PDB files
D. Release configuration built with the /debug:full compiler flag

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: A debug configuration is not fully optimized and is not suitable for a production environment.
B. Correct: A release configuration is fully optimized and will give the best results in a production environment.
C. Incorrect: PDB files are necessary only when debugging an application.
D. Incorrect: The /debug:full flag adds extra information to your application for debugging purposes.

QUESTION 11
You are debugging an application for a web shop and are inspecting a lot of Order classes. What can you do to make your debugging easier?

A. Use the DebuggerDisplayAttribute on the Order class.
B. Override ToString on the Order class.
C. Use the ConditionalAttribute on the Order class.
D. Use the #line compiler directive to make sure you can find the correct location when an exception occurs.

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: The DebuggerDisplayAttribute helps you in supplying a more helpful description when inspecting an item through the debugger.
B. Incorrect: Overriding ToString does help, but a better solution is to use the DebuggerDisplayAttribute because this won't influence your code in production.
C. Incorrect: The ConditionalAttribute can be used to remove code from your compiled application. Most of the time, it's used to remove certain calls when doing a release build.
D. Incorrect: The #line directive is used to change the line numbers of your code. Normally, this won't be necessary.

QUESTION 12
You are using custom code generation to insert security checks into your classes. When an exception happens, you're having troubling finding the correct line in your source code. What should you do?

A. Use #error to signal the error from your code so that it's easier to find.
B. Use #line hidden to hide unnecessary lines from the debugger.
C. Use the ConditionalAttribute to remove the security checks from your debug build.
D. Use the #line directive with the correct line numbers in your generated code to restore the original line numbers.

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: #error will signal an error at compile time.
B. Incorrect: #line hidden will remove the extra generated lines from the debugger, but it won't restore your line numbers.
C. Incorrect: This is a dangerous solution because it creates different behavior between debug and release builds. You won't be able to test your security checks while working with a debug build.
D. Correct: The #line directive can be used to tell the compiler to change the line number of a line of code. This way, you can remove the line numbers for the generated code so that exceptions will match the original code.

QUESTION 13
You are using the TraceSource class to trace data for your application. You want to trace data when an order cannot be submitted to the database and you are going to perform a retry. Which TraceEventType should you use?

A. Information
B. Verbose
C. Critical
D. Error

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: A failing order is not something that should be seen as only an informative event. It should be treated as something critical.
B. Incorrect: Verbose should be used only for very detailed tracing messages.
C. Incorrect: You can still recover from the error, which makes it a severity of Error, not Critical.
D. Correct: You should let the operators know that something is wrong and that you are trying to recover. If recovery fails, you should log a Critical event.

QUESTION 14
Users are reporting errors in your application, and you want to configure your application to output more trace data. Which configuration setting should you change?

A. NumberOfItems32
B. Listener
C. Filter
D. Switch

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: NumberOfItems32 is an option for creating a performance counter.
B. Incorrect: A listener determines what is done with the tracing events. It doesn't influence which events are traced.
C. Incorrect: A filter is used to filter the message that a listener processes. It doesn't influence which events are traced.
D. Correct: The switch value determines which trace events should be handled. By lowering the severity for the switch, you will see more trace events in your output.

QUESTION 15
You are working on a global application with lots of users. The operation staff requests information on how many user logons per second are occurring. What should you do?

A. Add a TraceSource and write each logon to a text file.
B. Implement a performance counter using the RateOfCountsPerSecond64 type.
C. Instrument your application with the profiler so you can see exactly how many times the logon method is called.
D. Use the EventLog class to write an event to the event log for each logon.

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: Writing the events to a text file will still require a tool to parse the text file and give results to the operation staff.
B. Correct: This performance counter will help the operation staff to see exactly what happens every second.
C. Incorrect: Profiler instrumentation will really slow down the performance of your application. It's also something that's not easy readable by your operations staff.
D. Incorrect: Although the event log can be read by the operation staff, they will have to manually count all events to calculate the logons per second.

Chapter 4: Implement data access

QUESTION 1
You are creating a new file to store some log data. Each time a new log entry is necessary, you write a string to the file. Which method do you use?

A. File.CreateText
B. FileInfo.Create
C. File.Create
D. File.AppendText

Correct Answer: D
Section: (none)
Explanation

Explanation/Reference:
Correct answer: D

A. Incorrect: File.CreateText would create a new file each time. You only want to append some text.
B. Incorrect: FileInfo.Create would return a FileStream to a newly created file. You would need to encode your data to a byte array to write it to the stream.
C. Incorrect: File.Create is the static equivalent of FileInfo.Create. It returns a FileStream that would require encoding to write your log entries.
D. Correct: File.AppendText adds some text to the end of a file.

QUESTION 2
You have built a complex calculation algorithm. It takes quite some time to complete and you want to make sure that your application remains responsive. What do you do?

A. Use async/await.
B. Run the code synchronously.
C. Use Task.Run.
D. Use a BackgroundWorker.

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: async/await is not usable when working with a CPU-bound algorithm.
B. Incorrect: Running the code synchronously would make the user interface unresponsive.
C. Correct: Task.Run will run the CPU-bound code on a separate thread. This will free the user interface thread to make sure that the application remains responsive.
D. Incorrect: BackgroundWorker is retired. The new Task Parallel Library replaces it.

QUESTION 3
You are writing an application that will be deployed to Western countries. It outputs user activity to a text file. Which encoding should you use?

A. UTF-8
B. UTF-7
C. ASCII

D. UTF-32

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: UTF-8 is a general-purpose encoding format that works on many operating systems.
B. Incorrect: UTF-7 is used as a protocol for newsgroup and e-mail. It's not as secure (see http://en.wikipedia.org/wiki/UTF-7#Security) as the other encodings, requires more space, and it's slower in encoding/decoding. UTF-8 should be used whenever possible.
C. Incorrect: Because ASCII supports only a limited range of characters, it is inadequate in most cases for international applications.
D. Incorrect: UTF-32 requires a lot of space for storing characters (4 bytes for each character). It is used when applications want to encode Unicode supplementary characters (for example, Chinese characters) as one single glyph. You need this only when the encoded space of such characters is important to you. If you don't need the Unicode supplementary characters, you can use UTF-8. If you do need them. UTF-16 can be used except when you have strict space requirements.

QUESTION 4
You want to update a specific row in the database. Which objects should you use? (Choose all that apply.)

A. SqlCommand
B. SqlDataReader
C. SqlConnection
D. TransactionScope

Correct Answer: AC
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, C

A. Correct: You need a SqlCommand to execute your update query against the database.
B. Incorrect: A SqlDataReader is used when you select some data from your database. You don't use it when executing an update command.
C. Correct: You need a SqlConnection to establish a connection to your database. The SqlCommand uses this connection to execute the update query.
D. Incorrect: A Transaction is not necessary when executing only a single command. If an exception occurs, no other queries have to be canceled.

QUESTION 5
You are planning to build an application that will use an object-oriented design. It will be used by multiple users at the same time. Which technology should you use?

A. XML files
B. Entity Framework
C. ADO.NET
D. Web service

Correct Answer: B
Section: (none)

Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: Storing your data in a plain XML file doesn't allow multiple users to read and update it at the same time.
B. Correct: A relational database that stores the data with the Entity Framework mapping it to your objects helps you with quickly developing your application.
C. Incorrect: A relational database is the best option to store your data. Using plain ADO.NET code would require you to manually map your objects to the database, and vice versa.
D. Incorrect: The dynamic keyword can be used in scenarios in which you want weak typing. It will still throw errors at runtime if an action is not possible.

QUESTION 6
You need to process a large number of XML files in a scheduled service to extract some data. Which class should you use?

A. XmlReader

B. XmlDocument
C. XmlWriter
D. FileStream

Correct Answer: A
Section: (none)
Explanation

Explanation/Reference:
Correct answer: A

A. Correct: XmlReader is the fastest option when processing a lot of data. Because you only have to read it and not make any changes, this is the best choice.
B. Incorrect: XmlDocument is not fast enough when working with a large XML file.
C. Incorrect: The XmlWriter is used to create XML files, not to read them.
D. Incorrect: Using a FileStream would treat the XML file as plain text. You lose the benefits of the hierarchical nature of your document. Furthermore, parsing it as plain text is not a trivial task.

QUESTION 7
You have a list of dates. You want to filter the dates to the current year and then select the highest date. Which query do you use? (Choose all that apply.)

A. DateTime result = dates.Where(d => d == DateTime.Now).OrderBy(d => d).First();
B. DateTime result = dates.Where(d => d.Year == DateTime.Now.Year).OrderByDescending(d => d).FirstOrDefault();
C. DateTime result = dates.Where(d => d.Year == DateTime.Now.Year).OrderByDescending(d => d).First();
D. DateTime result = dates.Where(d => d.Year == DateTime.Now.Year).OrderByDescending(d => d).Single();

Correct Answer: BD
Section: (none)
Explanation

Explanation/Reference:
Correct answers: B, D

A. Incorrect: Comparing DateTime.Now to the dates will give you only the dates for today, not for the whole year. Also, using OrderBy instead of OrderByDescending will give you the lowest date, not the highest.
B. Correct: This will return the highest date for the current year. If your filter can't find a value for the current year, it will return '1-1-0001 00:00:00' (DateTime.MinValue).
C. Incorrect: If your filter doesn't return a value, you will get an error. You should use FirstOrDefault instead.
D. Correct: Using Single will throw an exception if there are multiple dates for the current year.

QUESTION 8
You are trying to use a LINQ query, but you are getting a compile error that the Where method cannot be found. What should you do? (Choose all that apply.)

A. Add a using System.Linq statement.
B. Check that you are using a type that implements IEnumerable.
C. Change your query from query to method syntax.
D. Change the type of your query to var.

Correct Answer: AB
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, B

A. Correct: You need to add a using statement for LINQ to make sure that all LINQ extension methods are available.
B. Correct: LINQ is implemented as extension methods on IEnumerable. If your type does not implement this, you can't use the extension methods.
C. Incorrect: The compiler changes your query syntax to method syntax. Using one or the other doesn't change anything.
D. Incorrect: Using implicit typing lets the compiler determine the result of your query. It doesn't help the compiler find the Where method.

QUESTION 9
You are using the following LINQ to Entities query:

```
var query = from p in myContext.Products
    where p.Price < 50
    select p;
int numberOfItems = query.Count();
var products = query.ToList();
```

You are suffering performance problems. How can you improve your query? (Choose all that apply.)

A. Avoid hitting the database multiple times.
B. Don't execute ToList() on the query.
C. Use paging.
D. Change the query to method syntax.

Correct Answer: AC
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, C

A. Correct: Because of the deferred execution nature of LINQ, you execute the query twice—one for getting the number of items, and one for getting all the products. You can change your query to get both these numbers in one call.
B. Incorrect: ToList() is necessary for running the query. If you never iterate the query, you won't get any results.
C. Correct: Paging can help limit the number of items that you retrieve.
D. Incorrect: Method syntax is compiled to query syntax. It doesn't make any functional difference.

QUESTION 10
You need to store a large amount of data, and you want to do this in the most optimal way. Which serializer should you use?

A. XmlSerializer
B. BinaryFormatter
C. DataContractSerializer
D. DataContractJsonSerializer

Correct Answer: B
Section: (none)
Explanation

Explanation/Reference:
Correct answer: B

A. Incorrect: Although XML is human-readable, it's not the most optimized format. It will result in larger files then using a binary format.
B. Correct: A binary format is the most efficient for storing a large amount of data.
C. Incorrect: The DataContractSerializer is used by WCF to serialize data to XML.
D. Incorrect: The DataContractJsonSerializer serializes your objects to JSON. JSON is used for communication between a web browser and the server.

QUESTION 11
You are serializing some sensitive data to a binary format. What should you use? (Choose all that apply.)

A. XmlSerializer
B. ISerializable
C. DataContractSerializer
D. BinaryFormatter

Correct Answer: BD
Section: (none)
Explanation

Explanation/Reference:
Correct answers: B, D

A. Incorrect: XmlSerializer outputs XML text, not binary data.

B. Correct: ISerializable should be implemented on types that have some sensitive data.
C. Incorrect: The DataContractSerializer is used by WCF to serialize data to XML.
D. Correct: The BinaryFormatter can be used to serialize data to a binary format.

QUESTION 12
You want to serialize some data to XML, and you need to make sure that a certain property is not serialized. Which attribute should you use?

A. XmlElement
B. XmlAttribute
C. XmlIgnore
D. NonSerialized

Correct Answer: C
Section: (none)
Explanation

Explanation/Reference:
Correct answer: C

A. Incorrect: XmlElement is used to configure how a member is serialized to an XML element.
B. Incorrect: XmlAttribute outputs a member as an attribute on its parent instead of as a separate node.
C. Correct: XmlIgnore makes sure that a member is not serialized.
D. Incorrect: The NonSerialized attribute is used with the BinaryFormatter or SoapFormatter.

QUESTION 13
You want to store a group of orders and make sure that a user can easily select an order by its order number. Which collection do you use? (Choose all that apply.)

A. List<Order>
B. Dictionary<int,Order>
C. HashSet<Order>
D. Queue<Order>

Correct Answer: BD
Section: (none)
Explanation

Explanation/Reference:
Correct answers: B, D

A. Incorrect: A List<Order> offers random access to elements. It's not fast at selecting specific Order items by id.
B. Correct: By using a Dictionary<int,Order>, you can easily select an Order by id.
C. Incorrect: A HashSet doesn't offer random access to its items. You need to enumerate the whole set to get to an order.
D. Correct: A Queue offers a FIFO set. You can't randomly access items, and an item is discarded after retrieving it.

QUESTION 14
You are using a queue and you want to add a new item. Which method do you use? (Choose all that apply.)

A. Push

B. Add
C. Dequeue
D. Enqueue

Correct Answer: BD
Section: (none)
Explanation

Explanation/Reference:
Correct answers: B, D

A. Incorrect: Push is used to add items to a Stack.
B. Correct: Add is used on types inheriting from ICollection<T>. A Queue does not inherit from ICollection<T> but from ICollection.
C. Incorrect: Dequeue is used to remove an item from a Queue.
D. Correct: Enqueue is used to add an item to a Queue.

QUESTION 15
You are working with a large group of family name objects. You need to remove all duplicates and then group them by last name. Which collections should you use? (Choose all that apply.)

A. List<T>
B. Stack<T>
C. Dictionary<string,T>
D. T[]

Correct Answer: AC
Section: (none)
Explanation

Explanation/Reference:
Correct answers: A, C

A. Correct: You need a list to store all duplicate family name items.
B. Incorrect: A Stack stores items in a LIFO basis. It's not suitable for storing the duplicated or nonduplicated items.
C. Correct: The Dictionary<string,T> can be used to store the nonduplicated items on family name.
D. Incorrect: You can't remove items from a regular array.