Microsoft®
Technology Associate

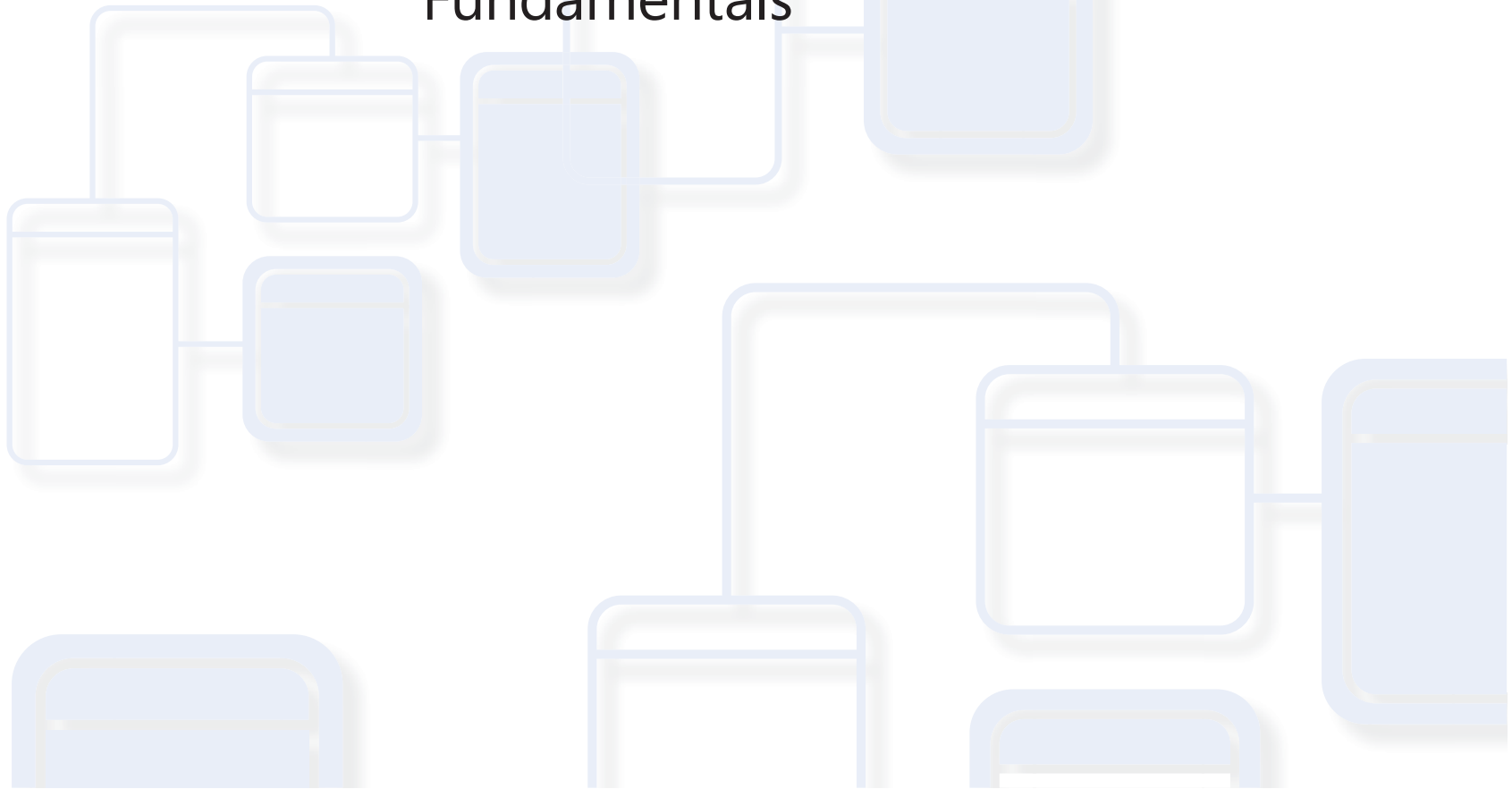# Student Study Guide

EXAM 98-361
Software Development Fundamentals

Microsoft®

Preparing for MTA Certification

MICROSOFT TECHNOLOGY ASSOCIATE (MTA)
STUDENT STUDY GUIDE FOR DEVELOPERS

98-361   Software Development
Fundamentals

Authors

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Introduction

MTA validates building-block technology concepts and helps students explore, discover and pursue successful careers in Information Technology (IT) in an exciting and rewarding way! As the first step in the Microsoft Technology Certification Series, this new, entry-level certification provides students with confidence, credibility, and differentiation.

Explore IT career options without committing a lot of time and resources MTA exams validate the core technology knowledge that is in demand today by businesses around the world. Whether you want to explore becoming a network administrator, software engineer, web developer, or database analyst, MTA gets you started on the right path.

Prepare to compete A little investment in IT can go a long way in today's job market. Becoming MTA certified helps you build a solid foundation to prepare for intermediate technology studies and for Microsoft Certified Technology Specialist (MCTS) certifications. It can also help you compete on college admissions and jumpstart your IT career planning!

Empower yourself As the first step toward becoming an MCTS, MTA shows your commitment to technology while connecting you with a community of more than five million Microsoft Certified Professionals. Learn from them and show them what you know by becoming MTA certified!

This MTA Student Study Guide serves as a study tool to help students prepare for their MTA certification exam. Students are challenged with real-life situations for each of the major topics covered in the exam. Although successful completion of the study guide exercises does not guarantee that you will pass your MTA exam, it is an excellent way to gauge your readiness to take the exam and build confidence that you know your stuff on exam day.

I wish you all the best as you prepare for a successful career in technology!

Victoria Pohto

Victoria Pohto
MTA Product Marketing Manager

Career Planning

Most IT solutions or infrastructure built on Microsoft technologies require proficiency with one or all of the following products, often referred to as "The Microsoft Stack."

- Microsoft Windows® Server® as the data center or development platform
- Microsoft SQL Server® as the data and business intelligence (BI) platform
- Microsoft Visual Studio® as the suite of application life-cycle management tools

MTA is the starting point of Microsoft technology certifications, providing aspiring technologists with the fundamental knowledge essential to succeed with continued studies and a successful career with technology.

Preparing for and becoming MTA certified helps you explore a variety of career paths in technology without investing a lot of time and money in a specialized career path. When you find a path that is right for you, Microsoft learning products and certification can help you prepare and guide your longer-term career planning.

If you already know that you want to start building a career in technology, MTA preparation and certification is the recommended entry point. Becoming MTA certified shows that you have a firm working knowledge of the fundamental IT concepts critical for success with intermediate learning and certifications such as Microsoft Certified Technology Specialist (MCTS). Moreover, Microsoft certifications demonstrate an individual's commitment of self-investment and confidence to take his or her knowledge and skills to the next level with an industry-recognized credential.

MTA is not a "career certification," meaning that employers recognize you as "job ready," but it is the first step toward that career goal and can help differentiate you for an internship or to college admissions committees. As you prepare for your first job focusing on technology, be sure that you are equipped with an MCTS credential—the intermediate level certification that validates Microsoft product and technology skills.

The MTA Certification path on the next page shows you the MTA exams that are recommended prior to taking on some of Microsoft's intermediate technology certification, MCTS.

Microsoft Technology Associate Certification Paths

MTA is the recommended first step in the Microsoft IT Certification Program, and does not require pre-requisite exams. MTA certifications are not a pre-requisite for MCTS exams. *One MTA exam = One certification.*

IT PRO

Entry Level Jobs in:	*Entry Level Jobs in:*
Network Administration Server Administration	Security Administration Identity and Access Management

SPECIALIST

MCTS Windows Server 2008, Network Infrastructure **EXAM 72-642**	**MCTS** Windows Server 2008, Active Directory **EXAM 72-640**

ASSOCIATE

MTA Windows Server Administration Fundamentals **EXAM 98-365**

MTA Security Fundamentals **EXAM 98-367**

MTA Networking Fundamentals **EXAM 98-366**

DEVELOPER

Entry Level Jobs in:	*Entry Level Jobs in:*
Windows Development Software Engineering	Web Development Software Engineering

MCTS .NET Framework 4, Windows Applications **EXAM 72-511**	**MCTS** .NET Framework 4, Web Applications **EXAM 72-515**

MTA Windows Development Fundamentals **EXAM 98-362**	**MTA** Web Development Fundamentals **EXAM 98-363**

MTA Software Development Fundamentals **EXAM 98-361**

DATABASE

Entry Level Jobs in:	*Entry Level Jobs in:*
Database Administration Database Engineering	Database Development Business Intelligence Development

MCTS SQL Server 2008, Implementation and Maintenance **EXAM 72-432**	**MCTS** SQL Server 2008, Database Development **EXAM 72-433**

MTA Database Administration Fundamentals **EXAM 98-364**

For full Microsoft Certification roadmaps, visit **http://www.microsoft.com/learning/certification**

Exploring Job Roles

Choosing a career path is a big decision and it's not always easy, but you're not alone! Microsoft created a career site to help students understand the options and possibilities of pursuing a career in IT. The site also connects you with learning resources, student techie communities, and much more to help you prepare for a career in technology.

To chart your career with Microsoft technology, visit *www.microsoft.com/learning/career/en/us/career-org-charts.aspx*.

Database Administrator

As a database administrator, you are in charge of important databases that span multiple platforms and environments. You are a strong team player who thrives in a fast-paced environment. You build complex, highly scalable databases that meet business needs and security requirements. You are an expert in optimizing, maintaining, and troubleshooting databases, but also in designing archival, data distribution, and high-availability solutions.

Server Administrator

As a server administrator, you are in charge of implementing and managing some of the most important technology in your organization—the servers. You use extensive monitoring and profiling tools to manage the network and tune systems so they perform at optimal levels. You are an expert in Active Directory®, and you have an in-depth understanding of network protocols, and file and directory security.

Computer Support Technician

Consider starting your IT career by becoming a consumer support technician. You don't need any formal work experience, but a company might require that you know how to install, administer, and troubleshoot operating systems in a home network environment that has desktop computers, laptops, and printers. As a consumer support technician, you'll also handle network, virus, malicious software, and hardware support issues. You'll typically find this position in small to medium-sized organizations.

Exploring Job Roles

Web Developer

As a web developer, you are an expert in using the dynamic programming tools and languages that fuel the web. You might work independently or be part of a team that builds and integrates interactive web sites, applications, and services for both internal and public sites. Your role is to make it work, which means developing web applications and testing them on various browsers, enhancing and modifying them as necessary to ensure the best experience for the user. As a web developer, you might also architect websites, design data-driven applications, and find efficient client-server solutions. You must have an in-depth understanding of the software development life cycle and be able to communicate project status, issues, and resolutions.

Windows Developer

As a Windows client developer, knowing how to optimize Windows code and track bugs is a given. But you also know how to use Microsoft Visual Studio® and the Microsoft .NET framework to design, develop, test, and deploy Windows-based applications that run on both corporate servers and desktop computers. Your key talents include understanding multiple Windows application models and n-tier applications, and knowing how to work with object-oriented programming, algorithms, data structures, and multithreading. Windows developers have an in-depth understanding of software engineering principles, software life cycles, and security principles.

Additional Online Resources for New Developers:

http://msdn.microsoft.com/beginner

http://msdn.microsoft.com/rampup

Imagine Cup

The Imagine Cup is the world's premier student technology competition where students from around the world can learn new skills, make new friends, and change the world. Competitions include Software Design, Embedded Development, Game Design, Digital Media and Windows Phone 7. The brightest young minds harness the power of technology to take on the world's toughest problems.

www.imaginecup.com

Value of Certification

Technology plays a role in virtually everything we do. In the 20-plus years since Microsoft has been certifying people on its products and technologies, millions of people have gained the knowledge, expertise, and credentials to enhance their careers, optimize business solutions, and create innovation within just about every business and social sector imaginable. Today's Information Technology (IT) hiring managers are more often using professional credentials, such as Microsoft certification, to identify properly skilled IT candidates. Certification becomes a way to easily differentiate qualified candidates in a sea of resumes.

The job outlook for IT professionals, as reported in a study prepared by the U.S. Department of Labor's Bureau of Labor Statistics (BLS), is positive! The BLS indicates an increase that will be "faster than the average for all occupations through 2014" for Computer Support Specialists, Systems Engineers, Database Administrators, and Computer Software Engineers. One significant message resulting from this study is that information and communications technology (ICT) skills are the entry ticket to the job market, regardless of the country, industry, or job function. Information Technology is clearly an area worth investing time, resources, and education in – and technology certification is a key part of the education process, validating product and technology expertise as a result of their learning experiences.

Microsoft IT Certifications provide objective validation of the ability to perform critical IT functions successfully for worldwide IT professionals, developers, and information workers. Microsoft certifications represent a rich and varied spectrum of knowledge, job roles, and responsibilities. Further, earning a specific certification provides objective validation of the candidate's ability to perform critical IT functions successfully. Embraced by industry professionals worldwide, Microsoft certification remains one of the most effective ways to help reach long-term career goals.

MTA 98-361

SOFTWARE DEVELOPMENT FUNDAMENTALS

1

Understanding Core Programming

Understand computer storage and data types

SCENARIO: Ken is a soccer coach who has a difficult time keeping track of all of his players: At the beginning of the season, each of his players filled out a paper with personal data, but it always takes him a long time to find the information he needs.

Cassie is one of his brightest players, and Ken knows that she's a computer programmer. Tired of shuffling through the huge stack of papers, he asks her to create a program to keep track of his records. The program will need to store each player's full name, jersey number, age, gender, height and weight, as well as goals scored and number of games played.

Cassie agrees to develop the software for him, but she has some decisions to make . . .

1. **Which of the following data types would be the best choice for keeping track of players' ages and jersey numbers using the least amount of memory?**
   a. short
   b. byte
   c. int

2. **As with any program, some data will be stored on the *heap*, while other data is placed on the *stack*. Which of the following will be stored on the heap?**
   a. player's name
   b. height
   c. age

3. **It would make sense to store one of these variables as a `char`. Which one?**
   a. player's name
   b. weight
   c. gender

> ## hint
>
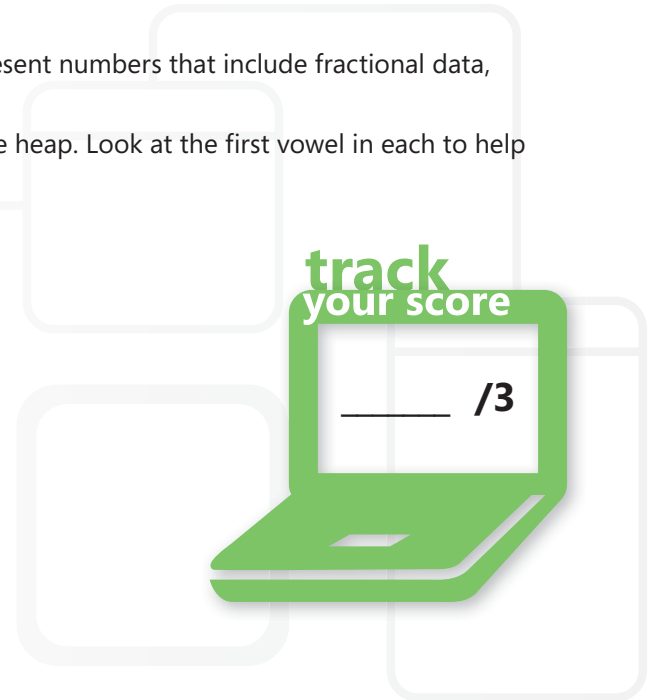> *Remember: String is a reference data type.*

Answers

1. A good choice for keeping track of jersey numbers and ages is:
   b. **byte.** It uses the least amount of memory, but still holds numbers up to 255—more than enough for ages or jersey numbers!

2. Player data that will be stored on the heap includes:
   a. **player's name.** This will be stored as a `String`.

3. The variable that could be stored as a `char` is:
   c. **gender.** 'M' for males, 'F' for females!

Essential details

- Integral data types, such as byte, integer, short, and long store whole numbers—such as the number of goals a player has scored.

- Floating point data types, like float, single, and double can represent numbers that include fractional data, such as a player's height.

- Value data types go on the stack; reference data types go on the heap. Look at the first vowel in each to help you remember: V<u>a</u>lue = st<u>a</u>ck. R<u>e</u>ference = h<u>e</u>ap.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/ff715351.aspx**
- **http://msdn.microsoft.com/en-us/library/ms173104.aspx**
- **http://msdn.microsoft.com/en-us/library/asz1fz8b.aspx**

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Understand computer decision structures

SCENARIO: Reina has created a simple DVR application to record her favorite television programs, but her code has some bugs. She's a big sports fan and always wants to record the broadcasts of sporting events, even if they conflict with another of her favorite programs.

For non-sport favorites, she does not want to record reruns; however, if the scheduled time of a favorite program conflicts with another favorite and will be broadcast again later, she wants to wait and record it in the future.

Unfortunately, her program is not working correctly. Many television programs that she doesn't want are being recorded; the programs she DOES want are only being recorded if they are broadcast later.

The C# code (with line numbers added) of Reina's DVR program looks like this:

```
1:  if (isSportsEvent) {
2:         RecordShowNow();
3:  }
4:  else {
5:         if (!isConflict || !isRerun) {
6:                RecordShowNow();
7:         }
8:         if (isConflict && isOnLater); {
9:                RecordShowLater();
10:        }
11: }
```

1. **Which line is causing shows to be recorded now even if there is a conflict?**

   a. line 4

   b. line 5

   c. line 8

2. **How should line 8 be rewritten?**

   a. `if (isOnLater); {`

   b. `if (isConflict || isOnLater); {`

   c. `if (isConflict && isOnLater) {`

3. **Reina has placed two control structures (lines 5–7 and lines 8–10) inside her first control structure. This technique is known as:**

   a. parenting

   b. encapsulating

   c. nesting

hint

Indentation used in the code is good programming style, but it has no effect on the execution of the statement.

Answers

1. Shows are being recorded now even if there is a conflict because:

    b. Line 5. The conditional-OR (||) returns true if the show isn't a rerun, even if `isConflict` is true.

2. Line 8 should read:

    c. `if (isConflict && isOnLater) {`

    The semicolon at the end of the line terminates the conditional—`RecordShowLater()` will always be called.

3. Placing control structures inside other control structures is called:

    c. nesting

Essential details

- The code in the parentheses of an if-statement must be a complete Boolean ("conditional") expression. Example:
    - "If a person is at least 18 years old, that person will vote"
      ```
      if (age > 18) vote();
      ```
- Logical operators allow programmers to join two expressions. Examples:
    - "I will stay home if it's raining OR if it's snowing." (logical-OR)
      ```
      if (isRaining | isSnowing) stayHome();
      ```
      If EITHER is true, the entire expression is true; `stayHome` is called.
    - We will buy a new computer if the current one is more than three years old AND computers are on sale. (logical-AND)
      ```
      if (computerAge > 3 & isOnSale) buyComputer();
      ```
      If BOTH are true, the entire expression is true; `buyComputer` is called.

track
your score

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FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308749.aspx**
- **http://msdn.microsoft.com/en-us/library/8y82wx12.aspx**
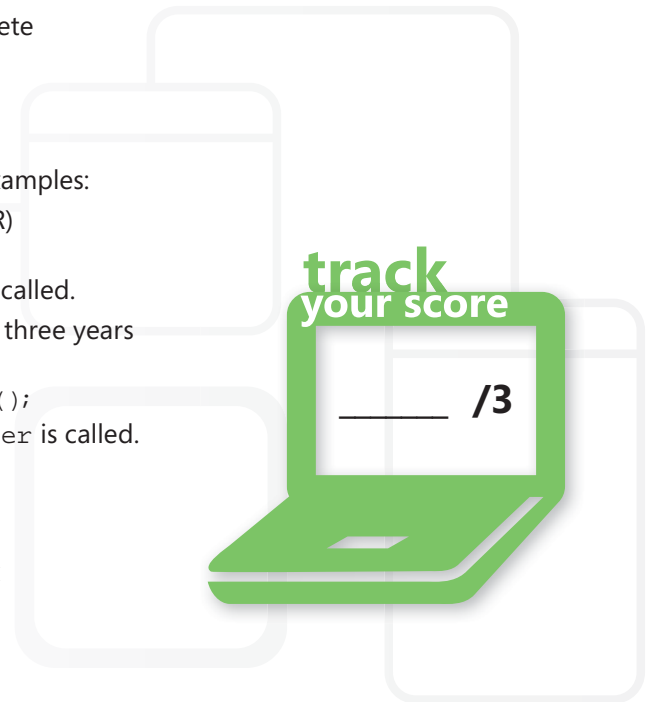
Identify the appropriate method for handling repetition

SCENARIO: Adriana is creating a point-of-sale (cash register) application for Fourth Coffee. Her responsibility is to create a password-protected login system to ensure security of the system. She has finished the login window and password check, but she is having trouble implementing it correctly.

Adriana's project manager wants the system to give the user three attempts to login correctly before locking the system. In Adriana's most recent version, the system prompts the user for a name and password three times—even if the user correctly logs in on the first try. After the third attempt, the system always locks—even if the input is correct.

1. **Adriana is using a `for` loop, which works best when:**
   a. the number of iterations is known and is unlikely to change during execution
   b. the number of iterations is known but is likely to change during execution
   c. the number of iterations is unknown

2. **What control structure would be best for Adriana's login system?**
   a. `for` loop
   b. `while` loop
   c. a recursive method

3. **How many times does a `do..while` loop execute?**
   a. at least zero times
   b. at least one time
   c. at least two times

hint

An "iteration," in this context, is one trip through the loop.

Answers

1. `for` loops work best when:
   a. **the number of iterations is known and is unlikely to change**

2. The best control structure for this situation is:
   b. **`while loop`.** The number of times the loop will need to be executed is uncertain: It depends on the data entered by the user. In this case, `a while loop (or do..while)` is usually the best choice.

3. How many times does a `do..while` loop execute?
   b. **at least one time.** Unlike a do..while loop, a while loop may not execute at all!

Essential details

- The `for` loop executes a statement, or a block of statements, based on the value of a control variable (also called a counter). Example:

```
for (int i = 0; i < 10; i++)
    Console.WriteLine(i);
```

   Note: `i` (the control variable) is initialized to zero. The loop will continue as long as `i` is less than 10. After each iteration, `i` is incremented.

- The `while` loop executes a statement or block of statements repetitively based on a Boolean expression. You can think of it as a repeating `if` statement. Example:

```
int i = 0;
while (i < 10)
{ Console.WriteLine(i);
    i++;}
```

Note: This loop is essentially identical to the `for` loop example. The Boolean expression is checked before the loop executes, so it may never run at all. For instance, if `i` was initialized to 20, the expression would evaluate to false and the loop would not execute.

- The `do..while` loop is similar to a `while` loop, but the Boolean expression is not checked until after the code executes. Example:

```
int i = 0;
do { Console.WriteLine(i);
    i++;} while (i < 10);
```

Note: Even if `i` is initialized to 20 (instead of 0), the loop will execute one time before the Boolean expression is evaluated.

track your score

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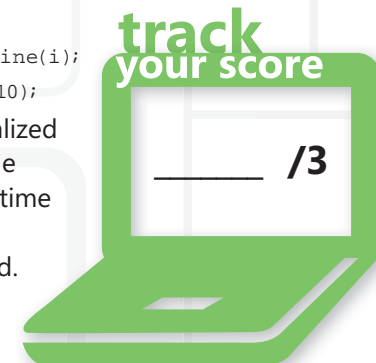
Understand error handling

SCENARIO: Lionel is a student at the School of Fine Art. To help pay his tuition, he took a job in the school's student records department. He developed a program that calculates each student's grade point average (GPA). He thought it would be simple, because he knows that the formula is:

total grade points divided by total credit hours attempted

However, Lionel's program crashes with new students who have not attempted any credit hours, instead of just giving them a GPA of 0.0. Here is his code in C# (line numbers added):

```
1: double GPA;
2: GPA = totalGP / creditHoursAttempted;
3: Console.WriteLine(GPA);
```

1. **Given what we know about the problem, what is the most likely exception this code will throw?**
   a. DivideByZeroException
   b. NullReferenceException
   c. StackOverflowException

2. **What structure should Lionel use to handle the exception?**
   a. do-catch
   b. catch-exception
   c. try-catch

3. **Which of the following should Lionel's catch-block probably include?**
   a. creditHoursAttempted = 1.0;
   b. totalGP = 4.0;
   c. GPA = 0.0;

hint

An exception is an error that cannot be detected by the compiler but occurs when the program is executed. It is referred to as a "run-time error."
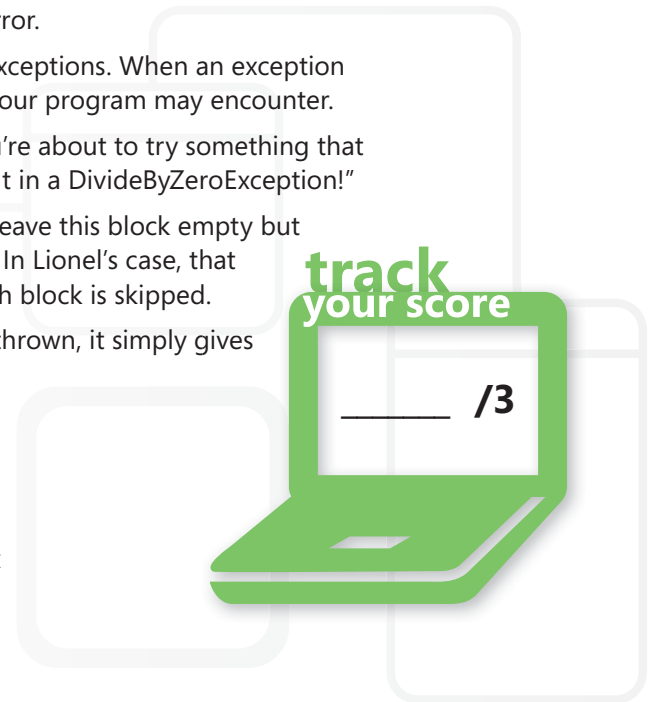
Answers

1. The exception most likely creating the problem is:
   a. **DivideByZeroException.** If a student's `creditHoursAttempted` is zero, an exception will occur.

2. The structure that will handle the exception is:
   c. **try-catch**

3. Lionel's catch-block should probably include:
   c. **GPA = 0.0;.** Because the division has already been attempted, there's no reason to change the values used in the calculation.

Essential details

- An **exception** is an object that contains information about an error.

- Developers use the terms *throw* and *catch* when talking about exceptions. When an exception occurs it is *thrown*. Therefore, you should *catch* any exceptions your program may encounter.

- Think of a `try` statement as a warning to the computer that you're about to try something that may not work. "I'm going to do some division, and it might result in a DivideByZeroException!"

- The `catch` block executes if the exception does occur. You can leave this block empty but generally it's good to put your "backup plan" in the catch block. In Lionel's case, that means setting the GPA to 0.0. If no exception is thrown, the catch block is skipped.

- A try-catch structure doesn't prevent the exception from being thrown, it simply gives the developer a chance to keep the program from crashing.

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FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/ms173160.aspx**
- **http://msdn.microsoft.com/en-us/beginner/bb308817.aspx**

2

Understanding Object Oriented Programming

Understand the fundamentals of classes

SCENARIO: Tailspin Toys is developing a simple, robotic dog for small children. The dog will connect to a computer via a USB cable, and kids will be able to use a simple application to personalize the toy to their liking. Although the hardware is nearly complete, Tailspin has not yet created the software that owners will use to customize their toy dog. Viktor has been hired to begin work on the software.

Initially, Viktor will need to design a class to represent the dogs. Naturally, the class will be named `Dog`. The toy—and therefore the `Dog` class—will need to keep track of the dog's name, age, and gender, and it will be able to bark, walk, wag its tail, and sit.

So far, he has written the following C# code

```
public class Dog {
public Dog() {
    name = "Hugo";
    age = 1;
    gender = 'M';
}
}
```

1. **Which of the following would be a property in the `Dog` class?**

   a. bark

   b. name

   c. Dog()

2. **To create a `Dog` with a different name, age, or gender, Viktor should add:**

   a. another constructor

   b. more properties

   c. a creation event

3. **Which line of code correctly creates a new `Dog` in C#?**

   a. `Dog hugo = Dog.new();`

   b. `Dog hugo = new Dog();`

   c. `new Dog hugo = Dog();`

hint

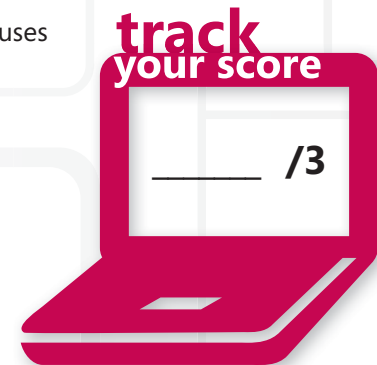*Many classes have more than one constructor.*

Answers

1. Which member is a property?

    b.   name

2. To create a different `Dog`, Viktor should add:

    a.   another constructor

3. Which C# code creates a `Dog`?

    b. Dog hugo = new Dog();

Essential details

- An object often represents something from the real world; in this case, the `Dog` class represents the robotic toy (or, it simply represents a dog).
- In object-oriented design, verbs (such as barking, walking, tail-wagging, and sitting) are typically **methods**; attributes (such as name, age, and gender) are **properties** or **fields**.
- A **field** is a variable declared within a class; a **property** provides a simple way to access the data stored in a field.
- A **class** is like a blueprint. It defines the properties and methods that all objects of that class will have in the same way a blueprint defines the attributes of a house.
- Multiple objects can be created from a class, or **instantiated**. Similarly, many houses can be built from one blueprint.
- Objects are instantiated (created) with the `new` keyword.

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FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/ms173109.aspx**
- **http://msdn.microsoft.com/en-us/library/x9afc042.aspx**
- **http://msdn.microsoft.com/en-us/library/x9fsa0sw.aspx**

Understand inheritance

SCENARIO: As Tailspin Toys continues to develop its robotic dog toy, early marketing tests reveal that customers would like to choose from different breeds of robotic dogs. As a result, Tailspin has decided to create three
variations: a poodle, a bulldog, and a golden retriever. The company has indicated that they will con-sider adding additional breeds in the future. The breeds will have a set of common attributes and behaviors, but each breed may have some unique capabilities.

This presents some challenges for Viktor as he designs the software children will use to customize the dogs.
He doesn't want to write all of his code three times—once for each breed. He also doesn't want future programmers to create new breeds that are not compatible with his original design. Since Viktor realizes that a poodle "is a" dog, and the same is true for the other breeds, Viktor decides to use inheritance.

1. **In Viktor's new design, `Poodle`, `Bulldog`, and `GoldenRetriever` are all:**
   a. abstract classes
   b. base classes
   c. derived classes

2. **To allow breeds to reuse code, and to help ensure that future breeds are compatible, `Dog` could be declared as:**
   a. abstract
   b. derived
   c. sealed

3. **Which of the following are NOT going to be inherited by the three derived classes?**
   a. constructors
   b. properties
   c. methods

hint

Base classes are referred to as "parent" classes or "superclasses;" derived classes are referred to as "child" classes or "subclasses."

Answers

1. In this design, the three breeds are:

   c. derived classes

2. To take advantage of code reuse, the `Dog` should be declared as:

   a. abstract. Abstract classes cannot be instantiated, but implemented methods will be shared by all derived classes.

3. Which of these will NOT be inherited by the derived classes?

   a. constructors

Essential details

- **Inheritance** allows you to create new classes that reuse, extend, and modify the behavior that is defined in other classes.

- **Derived** classes inherit all the members of the base class, except for constructors and destructors.

- Use the "is a" test to see if inheritance is appropriate. In Viktor's case, a `Poodle` *is a* `Dog`, a `Bulldog` *is a* `Dog`, and a `GoldenRetriever` *is a* `Dog`; therefore, his use of inheritance is correct. However, a `Tarantula` is *not* a `Dog`, so if Tailspin decides to make robotic spiders, they'll need a new base class. Otherwise, the spider would bark and wag its tail!

- An **abstract** class cannot be instantiated. In other words, Tailspin can no longer make a robotic dog—each toy will have to be a poodle, bulldog, or golden retriever.

- **Interfaces** are similar to abstract classes, but it does not have to adhere to the "is a" guideline. If Tailspin *did* decide to make robotic spiders, Viktor could create an interface that both dogs and spiders could implement. Perhaps it would be called `IRobotic`.

- In C#, a colon is used to indicate inheritance, as in this example:

```
public class Poodle : Dog
```

track your score

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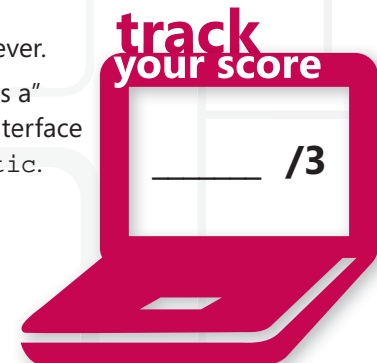
Understand polymorphism

SCENARIO: Viktor's work with Tailspin Toys' robotic dogs is progressing well. He knows that his software for personalizing the dogs will be popular with customers. Viktor feels that his basic class design ideas are good and he's ready to think about the details, as long as the engineers and marketers stop making changes!

Viktor knows that while all dogs share some common behaviors, such as barking, that bark may be very different from one breed to the next. The `Bark` method he creates for a `Poodle` will need to be different from the `Bark` method he implements for a `GoldenRetriever`.

In his `Dog` class, he's created a few methods. Here are the headers, written in C#:

```
public void Bark() { … }
public void WagTail() { … }
public void Walk() { … }
```

1. **To be able to override these methods in the derived classes, what modifier should Viktor add to all three headers?**

   a. `new`
   b. `static`
   c. `virtual`

2. **How can Viktor invoke the Bark method in the Dog class from within a derived class?**

   a. `Bark()`
   b. `Dog.Bark()`
   c. `base.Bark()`

3. **What should Viktor do if he wants the `Bulldog` class to just use the `Walk` method from `Dog`?**

   a. Implement `Walk` in `Bulldog`, copying and pasting the code from `Dog`
   b. Implement `Walk` in `Bulldog` and simply call `Dog`'s `Walk` method
   c. Do not implement `Walk` in `Bulldog`

hint

Overriding a method allows a derived class to have its own implementation, different from other derived classes.

Answers

1. What modifier should Viktor add to the three methods?

   c. virtual

2. How can Viktor invoke the Dog's `Bark()`method?

   c. `base.Bark()`. The `base` keyword is used to access members of the base class.

3. How should Viktor retain the base class's `Walk` method in a derived class?

   c. Do not implement `Walk` in `Bulldog`. No need to call `base.Walk()`—if a derived class does not override an inherited method, the base class's method will automatically be used.

Essential details

- Important keywords:
  - `base`: Used to access members of the base class from within a derived class.
  - `virtual`: Allows a method's implementation to be overridden in a derived class.
  - `sealed`: When applied to a class, prevents other class from inheriting from it; when applied to a member, prevents that member from being overridden by other classes.
  - `new`: When used as a modifier, this hides a base class member; the new member replaces the implementation in the base class. *Note: This is different than the `new` operator used to instantiate an object!*
  - `override`: Required to replace an inherited member.
- The following C# code shows how Viktor can replace `Dog`'s methods in his derived classes (assuming he corrects `Dog` as indicated by question 1):

```
public override void Bark() { … }
public override void WagTail() { … }
public override void Walk() { … }
```

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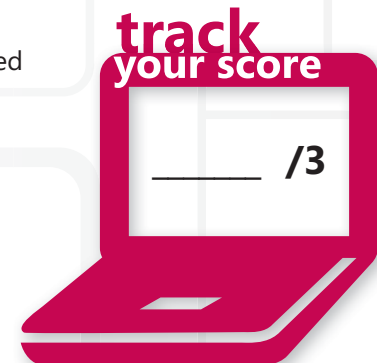
Understand encapsulation

SCENARIO: Viktor has done a great job designing software to customize Tailspin Toys' robotic dogs. So great, in fact, that his boss wants to give him a promotion. Unfortunately, that means Viktor won't be able to finish writing the software himself; instead, a new developer will take over the project. On the new developer's first day, however, she accidentally sets the robot's `age` to -237 and crashes the program.

To ensure that the new developer doesn't damage code that already works, Viktor decides to "black box" the code he's already implemented. This means that the new developer won't need to see Viktor's code, but will be able to use it as she continues the project. Viktor can also ensure that values are checked before any changes are made so that a dog doesn't end up with a negative age.

1. **Viktor has implemented several methods in the `Dog` class that he uses for `Bark`, such as `OpenMouth` and `CloseMouth`. He doesn't want those methods to be called by any derived classes. Which access modifier should he use for those "black-boxed" methods?**

   a. `public`

   b. `protected`

   c. `private`

2. **Viktor's primary methods, `Bark, Sit, Walk`, and `WagTail` should be accessible from anywhere in the project. Which access modifier should he use for those methods?**

   a. `public`

   b. `protected`

   c. `private`

3. **Which of the following provides a means for reading and/or modifying `private` attributes?**

   a. an interface

   b. a constructor

   c. a property

hint

In C# and Visual Basic, properties provide "getter" and "setter" (also called "accessor" and "mutator") functionality for instance variables.

Answers

1. Which accessibility should Viktor's "black boxed" methods use?

    c. `private`

2. Which accessibility level should Viktor use for his primary methods?

    a. `public`

3. Reading and/or modifying `private` attributes is provided by:

    c. a property

Essential details

- This type of "black boxing" is often referred to as **encapsulation**.

- In keeping with the principle of encapsulation, instance variables (attributes or fields) should be given the most restrictive accessibility level possible. That means making instance variables `private` whenever possible.

- Instance variables of base classes are often defined as `protected`; this allows derived classes (such as the `Poodle` class) access to the data, while still hiding the data from other parts of the program.

- One important reason for restricting access to data is to ensure validity when data is changed. Remember when the new developer tried to set the `age` attribute to a negative number? Likewise, the `gender` attribute should not accept a value of "green."

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- **http://msdn.microsoft.com/en-us/library/ms173121.aspx**
- **http://msdn.microsoft.com/en-us/beginner/bb308891.aspx**

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3

Understanding General Software Development

Understand application life-cycle management

SCENARIO: Nupur has been named Project Manager of a new reservation system for Blue Yonder Airlines. She will lead a team of developers tasked with all phases of the application life cycle.

Napur and her team met with managers from each branch of the company and discussed the company's needs and the basic features that everyone requires. The application will be web-based, and will allow Blue Yonder's customers to search flights, book reservations, and check in online.

After the meeting, Napur and her developers began outlining the program from their perspective. Although they haven't begun coding, the developers are beginning to sketch out the classes and objects of the project using UML. Their outline is not complete, but a plan for accomplishing the required tasks is coming together. Napur wants to divide the job in such a way that team members can work on different parts of the program at the same time.

1. Napur's meeting with the company's managers is part of which stage of the application life cycle?
   a. Design
   b. Development
   c. Planning

2. The use of UML in this scenario:
   a. is a waste of time because they haven't started writing code.
   b. helps ensure that different components will work together when finished.
   c. helps ensure that the clients understand how the team will create the software.

3. As the team writes code, Napur will ask each team to test their classes independently. What is this strategy called?
   a. Load testing
   b. Unit testing
   c. Integration testing

hint

Developers may use different names for the stages or phases of managing the application life cycle, but the basic process is the same!

Answers

1. Napur's meeting was the:

    c. **Planning** stage of the application life cycle. Planning (also called *envisioning*) includes gathering the client's needs and requirements; in this case, the rest of the company is Napur's client.

2. Napur's use of UML:

    b. **helps ensure that different components will work together when finished.** The clients probably don't need to know how to organize the actual development!

3. Testing individual components separately is called:

    b. **Unit testing**

Essential details

- The phases of application life cycle management (ALM) are: planning, designing, developing, testing, and maintenance.

- The ALM process is iterative, meaning that it repeats. When the application is deployed, new issues or feature requests are likely to come up, so the process starts again.

- Notice that actually writing code (developing) is only a small part of the overall process.

- UML stands for Unified Modeling Language. It provides a way to create visual models of the different components of an application.

- Many programmers are familiar with "class diagrams" in object-oriented programming—these are generally drawn as UML diagrams.

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Interpret application specifications

SCENARIO: Ari has just completed an internship with Contoso Pharmaceuticals, working with their developers on software used by the company's employees. His supervisor is very impressed, and has offered Ari a job on the development team for Contoso's next-generation application. The company has decided to start from scratch, allowing the new team to develop the application while employees continue to use the old system.

The company currently produces more than 1,000 products and plans to expand. The new application will track all of the company's inventory as well as some basic shipping and receiving details. Employees should be able to search through the company's product catalog and view product details such as product description, a product image, in-stock quantity, and cost.

1. **What type of application will be a good fit for these requirements?**
   a. console application
   b. database application
   c. Windows service application

2. **Many of the company's computers are old, with limited RAM and hard drive space, but are all connected to the company's intranet. How can Ari ensure the new version will work on all of the systems?**
   a. Write the program in an older programming language, such as C.
   b. Develop the program in an older operating system, such as Windows 98®.
   c. Make the program a web application so that it can be accessed by a browser.

3. **Ari's supervisor has asked him to prepare a non-functioning demonstration of what the new application will look like so that department managers understand what is being developed and how they will interface with the application. This is called:**
   a. a mock-up
   b. alpha testing
   c. diagramming

hint

Application specifications help developers understand the needs of the client or user.

Answers

1. The most appropriate type of application is:

    b. database application. The program will need to store, view, and update a large number of inventory records.

2. Ari can make sure the software will run on old systems by:

    c. making the program a web application. Any computer with a reasonably current web browser should be able to access the web application without a problem.

3. A non-functioning demonstration is referred to as:

    a. a mock-up. A mock-up may not do anything, but it shows the client what the user interface will look like.

Essential details

- The application specification describes the problem that needs to be solved and communicates the requirements to the developer.
- Developers take this set of requirements, which are usually created from the perspective of a client or user, and translate them into a program design.

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- **http://msdn.microsoft.com/en-us/library/aa984771%28VS.71%29.aspx**

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Understand algorithms and data structures

SCENARIO: Some time ago, Cassie agreed to help her soccer coach, Ken, keep track of the team by creating a software program especially for the task. The roster application will make it much easier for the coach to keep track of his players' personal information and some simple statistics.

Now that Cassie has completed some initial planning, she needs to decide how to organize all of the data in her program. The application will need to keep track of many players, allowing the user to search through and pull up any individual's data. And of course the coach will need to print a few reports, such as a complete roster sorted by jersey numbers, a phone list arranged alphabetically by the players' last names, and the team's leaders in goals.

1. **Which of the following data structures would be a good choice for organizing the players?**
   a. stack
   b. array
   c. linked List

2. **Which of the following would help Cassie arrange the players in alphabetical order?**
   a. a binary search
   b. a queue
   c. a bubble sort

3. **Which data structure could Cassie use if she only wanted to retrieve players using a "last in, first out" model?**
   a. stack
   b. queue
   c. linked List

hint

Data structures are classes used to organize data and perform various operations upon that data.

Answers

1. The data structure Cassie should use is:

   b. **array.** Arrays are well-suited for programs that need to access the data in any order, as when the user performs a search.

2. Cassie will easily be able to put the collection into a specified order with:

   c. **a bubble sort**

3. The data structure that uses a "LIFO" pattern for adding and retrieving records is:

   a. **stack**

Essential details

- Common data structures:
  - **array:** A list of data values or objects, all of the same type, any element of which can be referenced by an expression consisting of the array name followed by an indexing expression.
  - **linked list**: A list of nodes or elements of a data structure connected by pointers. Linked lists are great for collections that require many insertions in the middle of the list because such insertions simply require updating a couple of pointers.
  - **queue**: A structure from which elements can be removed only in the same order in which they were inserted; that is, it follows a "first-in, first-out" (FIFO) logic.
  - **stack**: A structure from which elements can be removed only in the reverse order in which they were inserted; this is referred to as "last-in, first-out" (LIFO).
- A sort algorithm puts a collection of data elements into a sequenced order, sometimes based on one or more key values in each element. Common sort algorithms include bubble sort, selection sort, and insertion sort.

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- **http://msdn.microsoft.com/en-us/vcsharp/aa336800.aspx**
- **http://msdn.microsoft.com/en-us/library/ms379570.aspx**
- **http://msdn.microsoft.com/en-us/library/aa288453.aspx**

4

Understanding Web Applications

Understand Web page development

SCENARIO: Tanja owns a small dance studio and is looking for ways to bring in new customers and improve communications with her existing customers. She is not particularly knowledgeable about web design, but several years ago one of her dance students offered to create a website for the studio. That student has moved on to the university, so Tanja has relied on a few different volunteers to maintain the site. As a result, the site is disorganized and lacks consistency—the volunteers all used different colors and fonts that resulted in a very non-professional website.

Knowing that she can't fix the site herself, she has asked her nephew, Maxim, to help. Before Maxim creates a page, he wants Tanja to have at least a basic understanding of the technology involved.

1. **Which technology uses "tags" to indicate how information should be displayed in a web browser?**
   a. HTML
   b. XML
   c. JavaScript

2. **Which of the following is a key advantage of using CSS?**
   a. It allows a web page to be interactive.
   b. It allows a site to incorporate multimedia clips, such as videos and music.
   c. It simplifies the formatting of multiple pages within a site.

3. **What is JavaScript?**
   a. a markup tag that manages various font settings
   b. a server-side technology for running Java applications
   c. a client-side technology for making web pages interactive

hint

CSS stands for Cascading Style Sheet.

Answers

1. What uses tags to specify how data should be displayed on a web page?

    a. HTML

2. An advantage of CSS is:

    c. It simplifies the formatting of multiple pages within a site.

3. JavaScript is:

    c. a client-side technology for making web pages interactive

Essential details

- HTML stands for **HyperText Markup Language** and uses markup tags to specify how information should be displayed on a web page.
  - HTML **tags** are surrounded by angle brackets. The `<p>` tag indicates a paragraph.
  - Most HTML tags work in pairs—an opening tag and a closing tag.
- **CSS** works in conjunction with HTML to indicate how data should be presented, including colors and fonts.
  - Although styles can be defined for an individual page, they can also be defined in a separate document and shared by each web page in a site. That means a developer can make a change to the CSS document and the look of the entire site will change! This makes it easy to ensure that each page in a site looks consistent.
- **JavaScript** is a scripting language that allows developers to write code that goes beyond the markup limitations of HTML.
  - JavaScript is frequently used to make web pages more interactive.
  - Although JavaScript itself is a client-side technology, it is often used in conjunction with server-side technologies such as ASP.NET.

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Understand Microsoft ASP.NET Web application development

SCENARIO: Maxim has spent quite a bit of time talking with his aunt, Tanja, about a new website for her dance studio and he is beginning to get ideas on how to update and improve the site. Tanja's old site is pretty basic, and Maxim believes he can add a lot of exciting features that will appeal to younger, web-savvy customers.

One of his first priorities is to make the site a little more interactive with buttons that respond to mouse rollovers and a slideshow to display images of the studio. He also wants to implement online shopping for dance apparel. That update would include a "wish list" feature for users to "save" items they're interested in purchasing at a later time.

1. **Maxim's mouse rollover effect can be accomplished with a client-side script. Which of the following is a client-side technology?**
   a. PHP
   b. ASP.NET
   c. JavaScript

2. **In a standard HTML site, page information is lost each time the user refreshes a page or moves to a different page. Which of the following allows page information to be retained?**
   a. state management
   b. page life cycle
   c. CSS

3. **Maxim wants to use cookies to keep track of users' wish lists. What is a cookie?**
   a. text data stored by the users' web browser
   b. a back-end database for storing user information
   c. a server-side scripting tool for saving session data

hint

Client-side scripts are run by the user's web browser.

Answers

1. A client-side technology is:

   c. JavaScript

2. The process that allows page information to be retained is:

   a. state management

3. A cookie is:

   a. text data stored by the users' web browser

Essential details

- In a web application, a program or script can be either **client-side** or **server-side.**
  - A client-side script is downloaded by the user's web browser and executed on that user's computer (the "client") when the page is loaded.
  - A server-side script is executed by the web server *before* the web page is sent to the user's computer.

- The **event model** in a web application is similar to that of a client application. One significant difference is that an event is *raised* on the client side (for example, when the user clicks a button), but the event is *handled* on the server side.

- When an ASP.NET page runs, the page performs a series of processing steps in what is called the **page life cycle**. These steps include initialization, instantiating controls, restoring and maintaining state, running event handler code, and rendering.

- **State management** refers to the process by which a developer maintains page information over multiple requests for the same or different pages.

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- **http://msdn.microsoft.com/en-us/beginner/bb308809.aspx**
- **http://msdn.microsoft.com/en-us/beginner/bb308818.aspx**

Understand Web hosting

SCENARIO: With plans for Tanja's dance studio website beginning to take shape, it's time for Maxim to think about how he will put the site on the Internet. Maxim doesn't have a lot of experience creating web applications—most of his experience is with traditional Windows® applications. He knows that a website is hosted on a server, but he's never worked with a server before. Plus, his aunt doesn't have a lot of money for this project, so he has to keep costs to a minimum until the site brings in some business.

1. **Why is an ISP probably a good choice for Maxim?**
   a. ISPs are always free.
   b. An ISP subscription includes a copy of Windows Server®.
   c. The ISP will provide technical support and maintenance.

2. **An employee at a reputable ISP tells Maxim that they use Windows Server and that he needs to understand the basics of Internet Information Services (IIS). Which of the following is NOT a role of IIS?**
   a. to deliver HTML documents to web browsers
   b. to enable server-side scripting, such as ASP.NET
   c. to enable client-side scripting, such as JavaScript

3. **The ISP tells Maxim they support Virtual Directories. What is a Virtual Directory?**
   a. a folder on Maxim's computer that maps to the ISP, so he can easily publish the site
   b. a directory name that maps to the physical location on the server
   c. a listing service that ensures that users can find the site with a search engine

hint

Web hosting allows a developer to publish a website so that it is accessible via the World Wide Web.
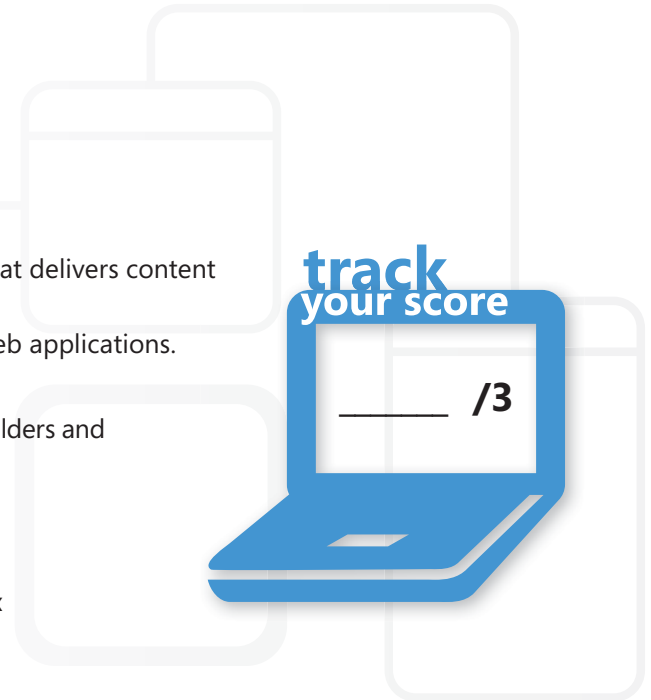
Answers

1. Maxim should use an ISP because:

   c. **The ISP provides technical support and maintenance.** With an ISP, a developer can focus on developing the site without worrying about setting up or maintaining a server.

2. The following is NOT a role of IIS:

   b. **to enable server-side scripting, such as ASP.NET**

3. A Virtual Directory is:

   b. **a directory name that maps to the physical location on the server**

Essential details

- An **ISP** (Internet Service Provider) is a business that supplies Internet connectivity services, often including web hosting.

- An ISP will generally provide:
  - space on a server
  - maintenance and support
  - email service
  - security and stability

- **IIS** (Internet Information Services) is a part of Windows Server that delivers content such as web pages by using HTTP over the World Wide Web.
  - IIS provides functionality essential for deploying ASP.NET web applications.
  - IIS also supports other server-side scripting, such as PHP.

- **Virtual Directories** can be configured in IIS and allow access to folders and files outside of the site's home folder.

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- **http://msdn.microsoft.com/en-us/beginner/bb308861.aspx**
- **www.iis.net**

Understand Web services

SCENARIO: Maxim has worked hard to publish an exciting, professional site for Tanja's dance studio. It's been available for more than a month now and customers have given Tanja great feedback. They love all of the interactive media and the simple consistency of the overall design.

Best of all, the new site has increased Tanja's income by attracting new students and by allowing customers to purchase items from home. With the extra money, she wants to pay Maxim to put a little more into the site—no major changes, just some catchy additions. She'd like her home page to display the current weather and traffic conditions, and she thinks a Bing search box would help users find information quickly.

Although Maxim has never programmed this type of functionality before, he knows he can use web services to help.

1. **In this context, what is a web service?**
   a. a process for running a script and serving the resulting HTML to a client
   b. a program that enables secure web-based interactions
   c. a system that allows multiple programs to interact via the Internet

2. **When using the Bing® API to add search capabilities to a site, what is the web service role of Bing?**
   a. requester
   b. provider
   c. processer

3. **Which of the following is a framework commonly used to access a web service?**
   a. Java
   b. SOAP
   c. ASP.NET

hint

An API (Application Programming Interface) provides a framework for accessing a program. The Bing API allows developers to add Bing to their sites.

Answers

1. A web service is:

    c. a system that allows multiple programs to interact via the Internet

2. The role of Bing in this implementation is as the:

    b. provider. The dance studio website is the requester.

3. The framework used to access a web service is:

    b. SOAP

Essential details

- **Web services** are frameworks that allow programs (or sites) to communicate with each other via the web.
- **SOAP** (Simple Object Access Protocol) is an XML-based protocol for exchanging structured and typed information via the web.
  - Numerous SOAP services are available, including searches (such as Bing), current weather, stock quotes, traffic conditions, and more.
- **WSDL** (Web Services Description Language) is an XML format that allows for better interoperability among web services and development tools.
  - WSDL uses SOAP to pass messages to the provider and interpret the results.

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5

Understanding Desktop Applications

IN THIS CHAPTER

- ■ **5.1/5.2 Understand Windows Forms applications; Understand console-based applications**

- ■ **5.3 Understand Windows services**

Understand Windows Forms applications; Understand console-based applications

SCENARIO: Julia doesn't have a lot of free time while she's studying computer science at her university, but in the evenings she enjoys playing online role-playing games (RPGs). She plays several games on a regular basis, and she enjoys "leveling-up" her characters and completing quests for special items.

However, because her playing time is both limited and fragmented, she has difficulty keeping track of the status of each of her characters. So she decides to create an application to keep track of the progress of her different characters, including levels and quests. She envisions a simple application that will allow her to select a character and then view and edit relevant information (a picture of the character, its current level, XP needed to advance, current quest item, and so on).

1. **What type of application would best fit Julia's needs?**
   a. console application
   b. Windows Forms application implementing SDI
   c. Windows Forms application implementing MDI

2. **For which one of the following situations would visual inheritance be useful?**
   a. several different forms displaying the same data in different ways
   b. several different forms displaying data from tables in the same database
   c. several different forms using the same basic layout and UI features

3. **Which of the following describes how the event model might function in Julia's program?**
   a. A Button click event is handled by code that creates a new character.
   b. A new character event is handled by code that asks for user input.
   c. A loop event cycles through the various characters, displaying each on the form.

hint

SDI is Single Document Interface. MDI is Multiple Document Interface.

Answers

1. Julia should make a:
   b. **Windows Forms application with SDI.** Although any application could work, SDI is ideal because the user only needs one window at a time. Note that a console application could not display images of Julia's characters.

2. Visual inheritance would be useful when:
   c. **Several different forms use same the same basic layout and UI features.**

3. The event model could function in Julia's program when:
   a. **A Button click event is handled by code that creates a new character.**

Essential details

- **Windows® Forms** is a rich Windows client library for building Windows client applications.
- A **console application** uses a text-only interface and usually requires only a keyboard for input.
- The **user interface** is the portion of a program with which a user interacts. Different types of UIs include graphical user interfaces (GUIs), such as the Windows user interface, as well as command-line interfaces used by console applications.
- The two basic styles of Windows interfaces are SDI and MDI.
  - **Single Document Interface** (**SDI**) is an interface in which each document frame window is separate from others and contains its own menu and toolbar.
  - **Multiple Document Interface** (**MDI**) is an interface in which multiple document frame windows may be open in the same instance of an application; the application features a parent window in which multiple child windows can reside.
  - More recent applications tend to favor the SDI approach.
- An **event** is an action or occurrence, often generated by the user, to which a program might respond. Examples include key presses, button clicks, and mouse movements.
  - Code that is executed in response to an event is called an **event handler**.

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- **http://msdn.microsoft.com/en-us/beginner/bb308740.aspx**
- **http://msdn.microsoft.com/en-us/beginner/bb308743.aspx**

Understand Windows Services

SCENARIO: Employees at Contoso, Ltd., engage in extensive word processing sessions while preparing manuscripts for publication. Managers are worried that employees who type for extended periods of time may have problems with repetitive motion injuries and eye strain, as well as general fatigue. They have asked the IT department to come up with a way to help reduce the chance of such injuries.

Anna is developing an application that will monitor keystrokes. When a user has typed 2,000 words in fewer than 30 minutes, the application will display a notification reminding the user to take a brief break and stand up for a stretch. Anna has decided to write the application as a Windows® Service.

1. **What type of user interface (UI) do most Windows Services—including Anna's reminder application—employ?**
   a. little or no UI
   b. a console UI
   c. a standard Windows GUI

2. **Which of the following is NOT a characteristic of many Windows Services?**
   a. intended to run continuously while the computer is on
   b. can be configured to start when the operating system is booted
   c. generally designed to require user intervention at timed intervals

3. **A Windows Service generally has three different states after being started: running, stopped, and:**
   a. interrupted
   b. completed
   c. paused

hint

You've probably used many Windows Services applications—a common example is antivirus software!
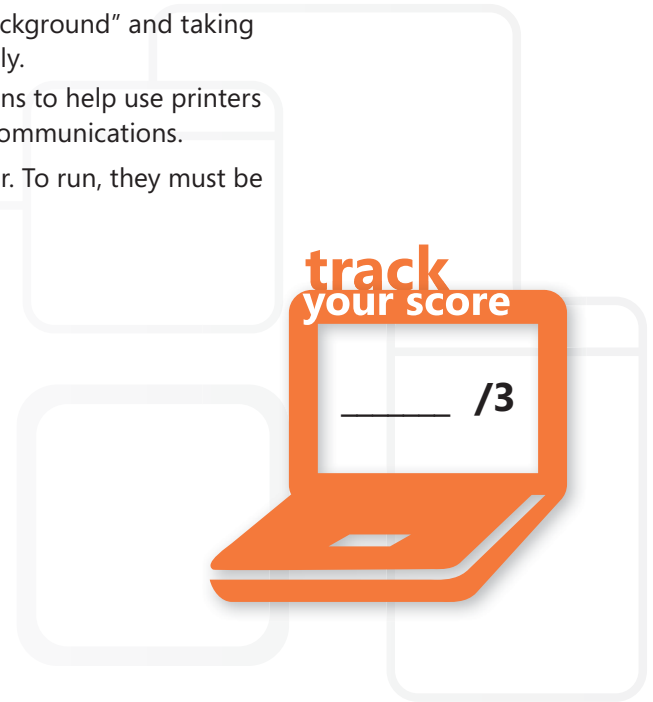
Answers

1. Typically Windows Services use:

   a. little or no UI

2. All are true of Windows Services except that they are not:

   c. generally designed to require user intervention at timed intervals

3. The three possible states of a Windows Service after being started include running, stopped, and:

   d. paused

Essential details

- A Windows Service application is a long-running program that generally does not show a user interface.
  - Many users think of Windows Services as running "in the background" and taking care of tasks necessary to keep the system running smoothly.
  - Common examples include antivirus applications, applications to help use printers and other hardware, and applications that aid in network communications.
- Services are managed by the Windows Services Control Manager. To run, they must be installed via this manager and then started.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/library/d56de412.aspx**
- **http://msdn.microsoft.com/en-us/library/zt39148a.aspx**

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6

Understanding Databases

Understand relational database management systems

SCENARIO: Jesper pays for school by working part-time in a vintage record shop that sells music albums on vinyl. The store has thousands of albums by thousands of different artists, but the owner does not have an inventory system—he simply organizes the albums by artist on the store shelves. That means when a customer asks if a particular album is in stock, Jesper must go out to the shelves and look for the album.

Jesper wants to put together a simple inventory system so that he can look up which albums are in stock from a computer behind the counter. He'll set up a relational database to store the information. He'll start by giving each artist a random and unique *Artist ID* number. Likewise, each album will get an *Album ID* number.

1. **What function do Artist ID and Album ID fulfill in Jesper's relational database, as described above?**
   a. relationships
   b. constraints
   c. primary keys

2. **Jesper will link albums to artists by adding an Artist ID field to his Albums table. In this Albums table, what is the Artist ID?**
   a. primary key
   b. foreign key
   c. link key

3. **Which of the following will result from the use of a relational database for this project?**
   a. minimize or eliminate redundant (repetitive) data
   b. increase processing time resulting from inefficient storage of data
   c. require the use of a web server

hint

There will be two tables in the database: Artists *will store artist information;* Albums *will hold data related to individual albums.*

Answers

1. Artist ID and Album ID *are:*

   c. primary keys

2. The Artist ID field in the Albums table is a:

   b. foreign key. A foreign key from one table (Albums) refers to a primary key in another table (Artists). This establishes a relationship between the two tables.

3. The use of a relational database in this project will:

   a. minimize or eliminate redundant (repetitive) data

Essential details

- A **relational database** is a system for storing potentially large amounts of data. Relational databases consist of one or more *tables* that can be visualized as columns and rows.

- One of the primary advantages of a relational database is the reduction of data redundancy—data in multiple tables can be linked instead of stored twice.

- In a table, a **primary key** defines a column that uniquely identifies each row.

- A relationship can be established by setting up a **foreign key constraint.** Each album in the store includes the corresponding Artist ID. That foreign key establishes a link between the album and the artist who recorded it.

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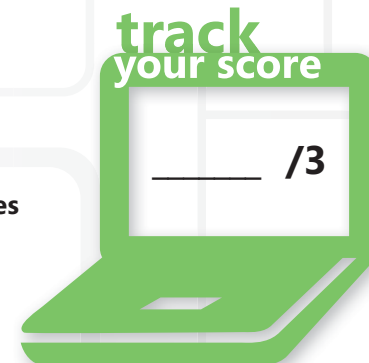
Understand database query methods

SCENARIO: Now that Jesper has designed and implemented a relational database to keep track of the inventory at the record shop, he needs to be able to read and modify the data itself. He'll use SQL queries for his database operations.

The application must enable Jesper to add to the database when the store gets a new album, and to modify data such as the quantity in stock and the price. Additionally, he will need to pull data from the database: find artists or albums, list the current inventory, and list albums that are currently out of stock. Reviewing SQL concepts will help Jesper quickly complete the project.

1. **Which SQL command should Jesper use to add a new album to his database?**
   a. ADD
   b. INSERT
   c. UPDATE

2. **Jesper can save frequently used queries as:**
   a. UPDATE files
   b. database methods
   c. stored procedures

3. **Which query could retrieve the artist "U2" from the table of artists?**
   a. SELECT "U2" FROM Artists
   b. SELECT * FROM Artists WHERE ArtistName = "U2"
   c. SELECT * FROM Artists WHERE "U2" IN ArtistName

hint

SQL stands for Structured Query Language and is used to execute most common actions on a relational database.
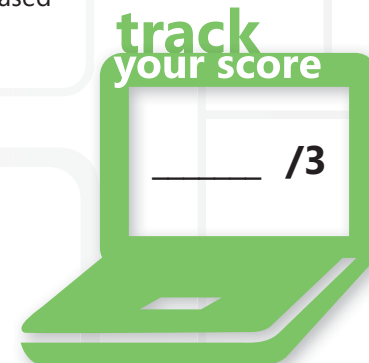
Answers

1. A new row can be added to the database with:
   b. INSERT

2. Queries can be saved to the database as:
   c. stored procedures

3. "U2" can be retrieved from the table of artists with:
   b. SELECT * FROM Artists WHERE ArtistName = "U2"

Essential details

- **Structured Query Language (SQL)** is used to manage data in a relational database.

- SQL queries can be used interactively with the database itself or implemented in an application that accesses the database. Basic statements in SQL queries include:
  - SELECT to retrieve data
  - INSERT to add rows to the database
  - UPDATE to modify existing rows
  - DELETE to remove an existing row

- Other clauses can be added to indicate the desired table (FROM), to filter data based on comparisons (WHERE), and to sort (ORDER BY), among others.

FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308825.aspx**
- **http://www.w3schools.com/sql/default.asp**

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Understand database connection methods

SCENARIO: With a solid database design in place and a few stored procedures to help manage his SQL queries, Jesper turned his attention to a user interface for his application. Using Windows® Forms, he now has the essential elements in place to connect his application to the database.

Jesper decides to use a "disconnected" approach, meaning that he will copy what he needs from the database to memory, then disconnect from the database. When the user changes data, the application can connect again and update the database.

1. **What is the advantage of Jesper's use of a disconnected data access model?**
   a. It minimizes the impact on the database server.
   b. It does not require an Internet connection.
   c. It prevents unauthorized access to the database.

2. **What is the term used to describe an in-memory cache of the database?**
   a. dataset
   b. XML
   c. OLE DB

3. **What object contains the information ADO needs to connect to a database?**
   a. SQL Query
   b. file path
   c. connection string

hint

ActiveX Data Objects (ADO) is an interface that allows developers to access databases without worrying about details of database connections.

Answers

1. An advantaged of using a disconnected data access is:

   a. **It minimizes the impact on the database server.**

2. The name of the in-memory database object is:

   a. **dataset**

3. The information needed to connect to a database is stored in the:

   c. **connection string**

Essential details

- To bring data into your application (and send changes back to the data source), a two-way communication path needs to be established. This connection is usually configured with a **connection string** that stores information necessary to find and access the data source.

- Data sources don't have to be relational databases.
  - **Extensible Markup Language (XML)** files are common on the Internet. They share the same syntax as HTML, so many users are comfortable working with them.
  - **Language Integrated Query (LINQ)** allows developers to connect to a wide range of data sources, including arrays and other data structures.
  - Flat files are conventional computer files that store database information.

- Many developers use a disconnected data access model. By connecting to a data source only as long as it takes to retrieve or update data, the developer gains several advantages:
  - Reduced load on the database server.
  - Scalability, or the ability to continue to function as the work load increases.
  - Multiple users can access the same database without "locking" file access.

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FAST TRACK HELP

- **http://msdn.microsoft.com/en-us/beginner/bb308825.aspx**

- **http://www.w3schools.com/ado/default.asp**