



Microsoft

Microsoft® Technology Associate

STUDENT STUDY GUIDE

preparing for MTA certification

Microsoft
Technology
Associate



EXAM 98-374
Gaming Development Fundamentals

PREPARING FOR MTA CERTIFICATION

MICROSOFT TECHNOLOGY ASSOCIATE (MTA) STUDENT STUDY GUIDE FOR DEVELOPERS

98-374 Gaming Development
Fundamentals

AUTHORS

Peggy Fisher Peggy teaches computer science at Indian Valley High School (IVHS), a rural high school in central Pennsylvania, including courses in programming (C#, Visual Basic, and Java), and web design with Microsoft Expression Studio. Prior to beginning her teaching career, Peggy worked for a large insurance company near Philadelphia. She started as a job coordinator, moved to development, became a systems analyst and manager, and then was promoted to director. She has been at IVHS for the past eight years and truly enjoys her new career. Peggy also teaches part-time at Pennsylvania State University in the Continuing Education program. Her goal in teaching is to instill the love of learning so that her students will not only graduate, but also become life-long learners. Peggy is an author of the Database Management Fundamentals MTA Exam Review Kit.

Deborah Moerland Deb teaches a variety of courses in computer science and mathematics at Chelsea High School in Chelsea, Michigan. Topics include programming (Visual Basic, C++, and Java), multimedia, game design, robotics, networking, web design, algebra, and geometry. In addition to teaching at the high school, Deborah also teaches online courses for the Art Institute of Pittsburgh Online, American Public University, Lansing Community College, and the Ultimate Medical Academy. She has a Master's degree from Michigan State University in Educational Technology and Instructional Design and a doctorate degree from Argosy University in Educational Leadership.

Pat Yongpradit Who actually gets to live out their dream job? Pat Yongpradit does... he teaches computer science at Springbrook High School in Silver Spring, Maryland. He has been involved in technology curricula at the local, state, and national level, has presented at multiple national conferences (ISTE, SIGCSE, CSTA, NBC's Education Nation), and is a 2010 Microsoft Worldwide Innovative Educator. Pat's current projects include helping students create video games for social causes and promoting women in technology. His goal as a teacher is to develop students that dream and create technology that will improve our world. He is also the author of the Software Development Fundamentals MTA Exam Review Kit. His favorite quote is: "The man who finds a job he loves will never work a day in his life."

Patricia Phillips Patricia taught computer science for 20 years in Janesville, Wisconsin. She served on Microsoft's National K-12 Faculty Advisory Board and edited the Microsoft MainFunction website for technology teachers. For the past five years, she has worked with Microsoft in a variety of roles related to K-12 curriculum development and pilot programs, including Expression Studio web design, XNA game development, and MTA Exam Review Kits. She is currently the editor of the Computer Science Teachers Association newsletter, the *Voice*.

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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.

A visual mapping of the MTA Certification paths can be found at <http://www.microsoft.com/learning/en/us/certification/mta.aspx> and will show you the MTA exams that are recommended prior to taking on some of Microsoft’s intermediate technology certification, MCTS. MTA is the first step to Microsoft® Technology Certification Series. MTA is a recommended but not required pre-requisite to MCTS exams. One certification is earned for each exam passed. Free Student Study Guides are available for download at www.certipoint.com/mta.



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 98-374
GAMING
DEVELOPMENT
FUNDAMENTALS**



OBJECTIVE 1

Understand Game Design

IN THIS CHAPTER

- 1.1 Differentiate among game types
- 1.2 Differentiate among game genres
- 1.3 Understand player motivation
- 1.4 Design the user interface
- 1.5 Understand components
- 1.6 Capture user data
- 1.7A Work with XNA
- 1.7B Work with XNA





OBJECTIVE

understand game design 1.1

DIFFERENTIATE AMONG GAME TYPES

SCENARIO: Erin M. Hagens has just started an after-school job at Southridge Video. Southridge is new in town and specializes in offering a wide selection of video games for nearly every taste and budget. There are thousands of games of all types in the inventory. Erin has been tasked with revamping how the store organizes its game selection. She has created a list of all the various game types. How will she classify these games into the defined game types?

- 1. Which game type is played on an Xbox 360?®**
 - a. Mobile
 - b. Console
 - c. Arcade
- 2. Which game type requires a payment per use and has customized controls that are specific to the application?**
 - a. PC
 - b. MMORPG
 - c. Arcade
- 3. Which game type requires an Internet connection?**
 - a. MMORPG
 - b. Console
 - c. Mobile

HINT 

An Xbox 360 requires a display. Games can be played offline or online using the Xbox Live service.

Answers

1. Which game type is played on an Xbox 360?
 - b. **Console.** A console game is played on a machine made specifically for playing video games.
2. Which game type requires a payment per use and has customized controls that is specific to the application?
 - c. **Arcade.** You must pay for each play of an arcade game. Arcade games such as Dance Dance® Revolution have customized control schemes, such as a dance pad.
3. Which game type requires an Internet connection?
 - a. **MMORPG.** Massively Multiplayer Online Role-Playing Games (MMORPGs) require an Internet connection to play within the virtual world housed on a web server.

Essential details

- An arcade game requires a machine dedicated to playing one game housed in a specialized case.
- A mobile game is played on a mobile device, such as a cell phone.
- A PC game is played on a personal computer.
- A console is a machine dedicated to playing video games. A handheld console is a portable console that fits in a player's hands.
- Xbox is a video game console produced by Microsoft.
- MMORPG is a Massive Multiplayer Online Role Playing Game played online in a virtual world.

FAST TRACK HELP

- **Rogers, Scott.** *Level Up: The Guide to Great Video Game Design* (West Sussex, UK: John Wiley & Sons, 2010)
- **Schell, Jesse.** *The Art of Game Design: A Book of Lenses* (Burlington: Morgan Kauffman, 2008)



OBJECTIVE

understand game design 1.2

DIFFERENTIATE AMONG GAME GENRES

SCENARIO: Erin M. Hagen's new after-school job at Southridge Video is very rewarding; she is learning a lot about video games and enjoying the interactions with customers. She has reorganized the store inventory according to game type. But she now realizes that she must get more specific and develop a way to organize the games further within each type. Can she differentiate each game type according to genre? Classify the games below according to their description.

- 1. Basketball Buddies: Play basketball with cartoon characters.**
 - a. Sports
 - b. Board
 - c. Card
- 2. Liberty Battle: Play from the perspective of a soldier battling for freedom! Play in competitive matches of two to four players.**
 - a. Fantasy
 - b. Sports
 - c. First Person Shooter
- 3. End World XV: Use supernatural powers and magical spells to move through a mythical world to rescue the princess!**
 - a. Sports
 - b. Fantasy
 - c. Card

HINT 

A game can be listed under multiple genres, but it usually has a dominant classification based on its description.

Answers

1. Basketball Buddies: Play basketball with cartoon characters.
 - a. **Sports**
2. Liberty Battle: Play from the perspective of a soldier battling for freedom! Play in competitive matches of 2 to 4 players.
 - a. **First Person Shooter**
3. End World XV: Use supernatural powers and magical spells to move through a mythical world to rescue the princess!
 - a. **Fantasy**

Essential details

- In a board game, pieces are moved on a board with delineated sections.
- A card game uses playing cards that are general or specific to the game rules.
- A fantasy game takes place in a magical or supernatural world.
- In a fighting game, players combat one another, with an emphasis on one-on-one or multiplayer combat.
- In a First-Person Shooter game, the player shoots or fights from the character's perspective.
- In a role-playing game, a player takes the role of one or many characters with specific skill sets.
- A simulation game is designed to mimic reality.
- A sports game simulates a sport.
- The way a player interacts with a game and encompasses the game's rules, goals, and controls is called the gameplay.

FAST TRACK HELP

- **Rogers, Scott. *Level Up: The Guide to Great Video Game Design* (West Sussex, UK: John Wiley & Sons, 2010)**
- **Schell, Jesse. *The Art of Game Design: A Book of Lenses* (Burlington: Morgan Kauffman, 2008)**



OBJECTIVE

understand game design 1.3

UNDERSTAND PLAYER MOTIVATION

SCENARIO: Defendor: Protector of the People is a fantasy role-playing game in which a player inhabits the character Defendor, a young soldier. Defendor must rid his country of the evil Bull Riders by defeating their leader, Bull-E. To gain access to Bull-E's magical castle, Defendor must journey through three dangerous lands and find the three broken key fragments. He must attack with his sword and defend with his shield. As he progresses in the game, he must make character decisions that will turn him to the good or dark side. The time that it takes players to defeat Bull-E is recorded and posted on an online leaderboard.

- 1. Attacking enemies with the sword and defending with a shield represent:**
 - a. Goals
 - b. Achievements
 - c. Activities
- 2. Defeating Bull-E represents a(n):**
 - a. Quest
 - b. Task
 - c. Activity
- 3. The leaderboard that displays the time that it takes a player to win the game is an example of:**
 - a. Character connection
 - b. Story
 - c. Competition

HINT 

A leaderboard displays the rank order of leaders in a competition.

Answers

1. Attacking enemies with the sword and defending with a shield represent:
 - c. **Activities**
2. Defeating Bull-E represents a(n):
 - a. **Quest**
3. The leaderboard that displays the time it takes a player to win the game is an example of:
 - c. **Competition**

Essential details

- A goal in a game is a desired outcome condition. Game goals relate to the gameplay.
- A quest is an adventure with a goal that follows a storyline. A quest describes the overall journey to a goal. It encompasses many tasks and activities.
- Motivation provides a reason and desire for achieving a goal. Players are motivated when they feel an emotional connection to a character.
- A leaderboard is a rank-order list of the most successful players (leaders) in a game.

FAST TRACK HELP

- **Rogers, Scott.** *Level Up: The Guide to Great Video Game Design* (West Sussex, UK: John Wiley & Sons, 2010)
- **Schell, Jesse.** *The Art of Game Design: A Book of Lenses* (Burlington: Morgan Kauffman, 2008)



OBJECTIVE

understand game design 1.4

DESIGN THE USER INTERFACE

SCENARIO: Just in Time is a social-causes PC game about pet health. The intent is that players will learn about the needs of their pets and learn to be more responsible pet owners.

The player must feed their pets on schedule, locate missing pets, and transport them to the veterinarian when they need medical attention. The player finds the pets with a special mobile device. The user interface (UI) of the device has multiple screens that allow the player to access information including geographic location, pet needs, and statistics concerning pet health. The intended audience is children between the ages of 5 and 8.

- 1. What will increase the “unity” of this UI design for navigating between different screens?**
 - a. Use the same background colors.
 - b. Decrease any irrelevant content.
 - c. Place the forward and back arrow buttons in the same place on each screen.
- 2. How can colors be used to enhance the user interface?**
 - a. Rely only on color to express the most significant information.
 - b. Draw light text on a dark background for large amounts of text.
 - c. Use different colors to distinguish different content.
- 3. Which UI feature is best designed for the game’s intended audience?**
 - a. Display multiple buttons with text per screen.
 - b. Use large buttons with picture icons.
 - c. Display few buttons and have the player use the keyboard to control the interface instead.

HINT 

Children between the ages of 5 and 8 have less-developed hand-eye coordination.

Answers

1. What will increase the “unity” of this UI design for navigating between different screens?
 - c. **Place the forward and back arrow buttons in the same place on each screen.** Using the same background colors increases unity, but it does not affect navigation.
2. How can colors be used to enhance the user interface?
 - c. **Use different colors to distinguish different content.** Relying on color only to distinguish significant content in the user interface can prevent people who are color-blind from receiving the information. Color should be combined with other features for enhancing the user interface.
3. Which UI feature is best designed for the game’s intended audience?
 - b. **Use large buttons with picture icons.** Large buttons allow children to activate them easier, and pictures alleviate the need for text.

Essential details

- The principles of UI design are simplicity, unity, flexibility, intended audience, color, and feedback.
- An asset includes art assets, such as textures, sprites, meshes, effects, and font, and sound assets, such as music or brief sound effects.
- The term **game state** refers to a phase of the game, such as the title screen, loading, pausing, gameplay, and so on.
- Gamer services include a library of code for working with Xbox Live®.
- The term **graphical user interface** (GUI) refers to the use of pictures rather than just words to represent the input and output of a program.
- The term **user interface** includes the aspects of a computer system or program that can be seen or heard or otherwise perceived by the human user, and the commands and mechanisms the user utilizes to control its operation and input data.

FAST TRACK HELP

- **XNA Game Studio:** <http://msdn.microsoft.com/en-us/library/cc178930.aspx>
- **Windows User Experience Interaction Guidelines:** <http://msdn.microsoft.com/en-us/library/windows/desktop/aa511258.aspx>
- **Miles, Rob. Microsoft XNA Game Studio 4.0: Learn Programming Now!** (Redmond: Microsoft Press, 2011)



OBJECTIVE

understand game design 1.5

UNDERSTAND COMPONENTS

SCENARIO: The students in Karel Florian's class have just completed an artificial intelligence (AI) game design project. Blast Master is a side-scrolling shooter game in which the player pilots a spaceship that is armed with missiles. The goal of the game is to get to the end of each level and destroy the level boss. The spaceship must either avoid or shoot space debris. There are also enemy ships that will shoot at the player. Enemy ships will track the player's movement and move towards the player. Whenever debris or an enemy ship gets hit with a missile, a coin appears. Picking up the coin earns the player points.

- 1. Which aspect of the game is an example of AI?**
 - a. Debris explodes when hit with a missile.
 - b. Coins increase the score of the player when touched.
 - c. Enemies move where the player moves.
- 2. What is an aspect of a game enemy's AI that must be curtailed purposefully?**
 - a. Reaction time
 - b. Sensing
 - c. Both
- 3. What is a negative consequence of a predictable AI?**
 - a. The AI's knowledge of the game world is restricted, such as its vision and hearing.
 - b. It can interact with the player's character.
 - c. The same technique can be used to defeat the AI for every interaction.

HINT 

AI within a game world suffers from perfect knowledge of the game world and must be flawed purposefully in order to provide a surmountable challenge to the player.

Answers

1. Which aspect of the game is an example of AI?
 - c. **Enemies move where the player moves.** The enemy movement responds to the player's position and shows intelligence by sensing, planning, and acting.
2. What is an aspect of a game enemy's AI that must be curtailed purposefully?
 - c. **Both.** If reaction time and the enemy's hearing and vision are perfect, the challenge to the player would be overwhelming.
3. What is a negative consequence of a predictable AI?
 - c. **The same technique can be used to defeat the AI for every interaction.** In this case, the game would be too easy and the idea of an AI would not make the game sufficiently challenging.

Essential details

- AI is a subfield of computer science and can be seen as an attempt to model aspects of human thought on computers. It often is used in games to reflect the algorithms that control enemy behavior.
- AIs sense the game world, plan, and act.
- A tool is a specialized application used to make an aspect of a game, such as a map or level. A tool is programmed mainly for content creation and used in conjunction with existing programming tools and environments.

FAST TRACK HELP

- **Video Games and Artificial Intelligence**
<http://research.microsoft.com/en-us/projects/ijcaiigames>
- **Millington, Ian, and John Funge. *Artificial Intelligence for Games***
(Burlington: Morgan Kauffman, 2009)
- **Rogers, Scott. *Level Up: The Guide to Great Video Game Design***
(West Sussex, UK: John Wiley & Sons, 2010)
- **Schell, Jesse. *The Art of Game Design: A Book of Lenses***
(Burlington: Morgan Kauffman, 2008)



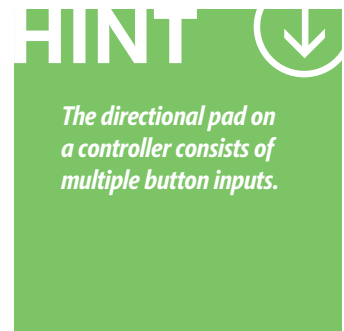
OBJECTIVE

understand game design 1.6

CAPTURE USER DATA

SCENARIO: Blast Master is a side-scrolling shooter game in which the player pilots a spaceship that is armed with missiles. The game begins with a title screen. The player can select to start a new game or load a saved game using the directional pad on the controller and the Start button. Once the Start button is pressed, the game moves to the gameplay screen. The goal of the game is to get to the end of each level and destroy the level boss. The player uses the directional pad on the controller to move the spaceship, the A button to shoot missiles, and the X button for a temporary speed burst. The spaceship must either avoid or shoot space debris. There are also enemy ships, which will shoot at the player. Whenever debris or an enemy ship gets hit with a missile, a coin or power-up appears. The player can pause the game at any time by pressing the Start button and resume the game by pressing Start. The player can choose to save a game when a level is completed and end the game at any point by pressing the Back button.

- 1. What is an example of user data that would be saved in Blast Master?**
 - a. Current level
 - b. Score
 - c. Both
- 2. During which state does the player query the controller for only one button input?**
 - a. Gameplay screen state
 - b. Title screen state
 - c. Pause screen state
- 3. At what point in the game should user data be restored?**
 - a. When a player loads a saved game
 - b. When a player starts a game for the first time
 - c. When a player ends a game



Answers

1. What is an example of user data that would be saved in Blast Master?
 - a. **Both.** The number of lives would also be important to save.
2. During which state does the player query the controller for only one button input?
 - a. **Pause screen state.** The only button input that needs to be queried during the pause screen is whether the Start button has been pressed or not.
3. At what point in the game should user data be restored?
 - a. **When a player loads a saved game.**

Essential details

- User data generally consists of the user's profile and game progress.
- User data is saved and restored so a player can continue where he or she left off.
- User storage is read-write storage supported by the game platform for saving information from the game at run time. The data can be associated with a particular player's profile, or available to all players.
- The game state describes the phase of a game, such as the title screen, loading, pausing, gameplay, and so on.
- A state machine is a design pattern defined by a set of game states and actions that are executed only within those states, where only one state is active at a time.

FAST TRACK HELP

- **Miles, Rob.** *Microsoft XNA Game Studio 4.0: Learn Programming Now!* (Redmond: Microsoft Press, 2011)
- **Rogers, Scott.** *Level Up: The Guide to Great Video Game Design* (West Sussex, UK: John Wiley & Sons, 2010)
- **Schell, Jesse.** *The Art of Game Design: A Book of Lenses* (Burlington: Morgan Kauffman, 2008)



OBJECTIVE

understand game design 1.7A

WORK WITH XNA

SCENARIO: Cristina Potra is studying game design at Graphic Design Institute. She has passed several classes in game design and now is taking the next course, *Introduction to Game Programming with XNA*. Cristina is particularly excited about this course because she loves playing Xbox 360 games and now she will be able to create her own game for the Xbox®. She has it all planned out in her head. Her friends will be so envious!

One of the first steps in creating an XNA® game is to plan the structure of the game and determine which of the built-in XNA methods and tools will be useful in producing the project.

1. The **LoadContent** method is used to:
 - a. Load images
 - b. Load sounds
 - c. Both
2. Which of the following methods will be called more than once per game execution?
 - a. *Initialize*
 - b. *LoadContent*
 - c. *Update*
3. Which tool is used to create an audio project?
 - a. The XNA Game Studio Device Center
 - b. XACT
 - c. The XNA Framework Remote Performance Monitor

HINT 

XACT stands for
"Cross-Platform Audio
Creation Tool."

Answers

1. The *LoadContent* method is used to:
 - a. **None.** *LoadContent* only loads textures and fonts.
 - b. **Both.** *LoadContent* also loads videos and fonts.
 - c. **Update.** A standard XNA game will call *Update* 60 times per second.
2. Which of the following methods will be called more than once per game execution?
 - a. **None.** *LoadContent* is called only once.
 - b. **XACT.** The Cross-Platform Audio Creation Tool (XACT) is used to create audio projects.
 - c. **Update.** A standard XNA game will call *Update* 60 times per second.
3. Which tool is used to create an audio project?
 - a. **None.** *LoadContent* only loads textures and fonts.
 - b. **XACT.** The Cross-Platform Audio Creation Tool (XACT) is used to create audio projects.
 - c. **Update.** A standard XNA game will call *Update* 60 times per second.

Essential details

- An **Integrated Development Environment (IDE)** is a system for supporting the process of writing software. Such a system may include a syntax-directed editor, graphical tools for program entry, and integrated support for compiling and running the program and relating compilation errors back to the source.
- **Visual Studio®** is an IDE for use with the .NET Framework.
- A **Software Developers Kit (SDK)** is software provided by a hardware or software vendor to enable other developers to create software for their products.
- **XNA Game Studio** is a framework of code and a runtime environment for game development.
- The **Cross-Platform Audio Creation Tool (XACT)** is a system for creating, organizing, and playing audio.

FAST TRACK HELP

- **XNA Game Studio**
<http://msdn.microsoft.com/en-us/library/cc178930.aspx>
- **Miles, Rob. *Microsoft XNA Game Studio 4.0: Learn Programming Now!***
(Redmond: Microsoft Press, 2011)



OBJECTIVE

understand game design 1.7B

WORK WITH XNA

SCENARIO: Jay Hamlin, a game designer at Trey Research, has been assigned to assist a senior developer who is working on a game to teach geometry fundamentals to middle school students. Jay's task is to program a portion of the game that will move rectangles around a screen based on keyboard input. He is aware that the XNA® methods (*Initialize*, *Update*, *Draw*) can provide much of the functionality he needs for this task. Before he wastes valuable time writing code that might need to be revised later, Jay decides it is wise to evaluate which method is the most appropriate location for code that will control various actions related to the rectangle movements.

For each situation below, select the most appropriate method for including the code that will control the action described.

- 1. Set the starting location of the rectangle to (50,100).**
 - a. *Initialize*
 - b. *Update*
 - c. *Draw*
- 2. Display the rectangle in the game window.**
 - a. *Initialize*
 - b. *Update*
 - c. *Draw*
- 3. Increment the x-coordinate of the rectangle when the right arrow key is pressed.**
 - a. *Initialize*
 - b. *Update*
 - c. *Draw*

HINT 

A Rectangle object has four properties: the x and y coordinates of the upper-left corner, width, and height.

Answers

1. Set the starting location of the rectangle to (50,100).
 - a. **Initialize**
2. Display the rectangle in the game window.
 - c. **Draw**
3. Increment the x-coordinate of the rectangle when the right arrow key is pressed.
 - b. **Update**

Essential details

- **XNA Game Studio** is a framework of code and a run-time environment for game development.
- The **game loop** is the update and draw cycle.
- The **Initialize** method controls the starting values of game data.
- The **Draw** method displays the game graphics.
- The **Update** method performs the game logic, such as updating the location of an image.

FAST TRACK HELP

- **XNA Game Studio**
<http://msdn.microsoft.com/en-us/library/cc178930.aspx>
- **Miles, Rob. Microsoft XNA Game Studio 4.0: Learn Programming Now!**
(Redmond: Microsoft Press, 2011)



OBJECTIVE 2

Understand Hardware

IN THIS CHAPTER

- 2.1 Choose an input device
- 2.2 Choose an output device
- 2.3 Work with the network
- 2.4 Manage game performance
- 2.5 Understand the different game platforms





OBJECTIVE

understand hardware 2.1

CHOOSE AN INPUT DEVICE

SCENARIO: Derek Brown, the CEO of Graphic Design Institute, has received a large contract from a prominent educational products company to design games that will provide an engaging way for students to learn concepts in a variety of topics. He has some possible game ideas and is eager to match the intended learners' experience accurately with the best input device. Derek recognizes that factors such as the goal of the game, the age of the player, and the expected player action are important considerations.

- 1. Which device is the best fit for a math game that teaches multiplication by allowing the user to shoot at the correct answers as the numbers fly across the screen?**
 - a. Xbox 360[®] Controller
 - b. Keyboard
 - c. Mouse
- 2. Which input device is the best fit for a chemistry quiz game in which the user jumps through a maze and grabs the correct formulas to match definitions?**
 - a. Kinect[®]
 - b. Xbox 360[®] Controller
 - c. Windows Phone[®] (Accelerometer Input)
- 3. Which device is the best fit for a geometry game in which the user matches a word to a shape by flying a plane through geometrically shaped clouds (triangle, square, rhombus, pentagon, and so on), thus enabling the user to match words to shapes?**
 - a. Kinect
 - b. Joystick
 - c. Xbox 360 Controller

HINT 

If you were to play the games described, what device would feel "natural?"

Answers

1. Which device is the best fit for a math game that teaches multiplication by allowing the user to shoot at the correct answers as the numbers fly across the screen?
 - a. **Xbox 360 Controller.** This would be the best option because the controller allows for more user control and precision when shooting.
2. Which device is the best fit for a chemistry quiz game in which the user jumps through a maze and grabs the correct formulas to match definitions?
 - a. **Kinect.** This would be the best option because the user is jumping through a maze and grabbing. The Kinect device will make the game more fun and realistic to play.
3. Which device is the best fit for a geometry game in which the user matches a word to a shape by flying a plane through geometrically shaped clouds (triangle, square, rhombus, pentagon, and so on) by enabling the student to match words to shapes?
 - b. **Joystick.** This would be the option because joysticks are made to maneuver easily.

Essential details

- A **peripheral** is any part of a computer other than the CPU or working memory; i.e., disks, keyboards, monitors, mice, printers, scanners, tape drives, microphones, speakers, and cameras.
- An **input device** is a peripheral used to transfer data from the outside world into a computer system.
- A **gamepad** is just another name for a video game controller.
- A **joystick** is a device consisting of a handheld stick that pivots about one end and transmits its angle in two dimensions to a computer.
- A **keyboard** is a hardware device consisting of a number of mechanical buttons (keys) which the user presses to input characters to a computer.
- The **Xbox 360 Controller** is a game control hardware device specifically designed for the Xbox 360.
- The **Kinect** is a device used with Xbox 360 that senses motions and uses voice recognition for gameplay.

FAST TRACK HELP

- **Windows Phone Development**
http://blogs.msdn.com/b/microsoft_press/archive/2010/10/28/free-ebook-programming-windows-phone-7-by-charles-petzold.aspx
- **Input on the XNA Framework (XBox 360 Controller)**
<http://blogs.msdn.com/b/xna/archive/2006/08/25/724607.aspx>



OBJECTIVE

understand hardware 2.2

CHOOSE AN OUTPUT DEVICE

SCENARIO: Derek Brown, the CEO of Graphic Design Institute, has received a large contract from a prominent educational products company to design games that will provide an engaging way for students to learn concepts in a variety of topics. He has come up with some possible games and is eager to match the intended learners' experience accurately with the best output device. Derek recognizes that factors such as the goal of the game, the game response anticipated by the player, and the age of the player are important considerations. Derek is also keenly aware of the need to engage players in deep sensory experiences.

- 1. In addition to visual feedback, what other sense can provide the next most effective feedback from a math game that teaches multiplication by allowing the user to shoot at the correct answers as the numbers fly by? When a level is completed, a car racing game will be accessible.**
 - a. Vocal auditory
 - b. Sound effect auditory
 - c. Kinetic

- 2. In addition to vocal auditory feedback, what other sense can provide the next most effective feedback from a chemistry quiz game in which the user jumps through a maze and grabs the correct formulas to match definitions? When a level is completed, the user will get a matching puzzle game to learn more about the formulas.**
 - a. Visual
 - b. Sound effect auditory
 - c. Kinetic
- 3. In addition to sound effect auditory feedback, what other sense can provide the next most effective feedback from a geometry game in which the user matches a word to a shape by flying a plane through geometrically shaped clouds (triangle, square, rhombus, pentagon, and so on), thus enabling the student to match words to shapes? When a level is completed, the user will get to shoot through the clouds to gain more points.**
 - a. Visual
 - b. Vocal auditory
 - c. Kinetic

HINT

Think about what types of feedback provide the best information about your performance.

Answers

1. In addition to visual feedback, what other sense can provide the next most effective feedback from a math game that teaches multiplication by allowing the user to shoot at the correct answers as the numbers fly by? When a level is completed, a car racing game will be accessible.
 - a. **Sound effect auditory.** The sound of hitting targets and the racing car would enhance the game play.
2. In addition to vocal auditory feedback, what other sense can provide the next most effective feedback from a chemistry quiz game in which the user jumps through a maze and grabs the correct formulas to match definitions? When a level is completed, the user will get a matching puzzle game to learn more about the formulas.
 - a. **Visual.** It would be important to see the puzzle.
3. In addition to sound effect auditory feedback, what other sense can provide the next most effective feedback from a geometry game in which the user matches a word to a shape by flying a plane through geometrically shaped clouds (triangle, square, rhombus, pentagon, etc.), thus enabling the student to match words to shapes? A correct answer is rewarded with a drum roll.
 - a. **Kinetic.** The shaking of a controller can enhance the sound effect of a drum roll.

Essential details

- An **output device** is used to transfer data out of the computer in the form of text, images, sounds, motion, or other media to a display screen, control device, printer, loudspeaker, or storage device.
- **Kinetic** feedback involves the sense of touch and motion.
- **Auditory** feedback involves the sense of hearing.
- **Visual** feedback involves the sense of sight.

FAST TRACK HELP

- **Computer Dictionary Online**
<http://www.computer-dictionary-online.org/?q=~a>
- **It's Time to Take Mobile Gaming Seriously**
<http://www.thetechlabs.com/tech-news/its-time-to-take-mobile-gaming-seriously/>




OBJECTIVE

understand hardware 2.3

WORK WITH THE NETWORK

SCENARIO: Michael Allen has just graduated from the Graphic Design Institute with a degree in game design. He has been searching for a job and has his first interview scheduled with a prominent game design company. The company is interested in hiring only employees with knowledge of networking as it relates to game design. Michael knows he is not ready for the interview but has found several online resources that will help him prepare.

- 1. What is the best networking option for an online multiplayer football game?**
 - a. TCP
 - b. UDP
 - c. LAGN
- 2. What is the best networking option for an online single-player arcade game?**
 - a. TCP
 - b. UDP
 - c. LAGN
- 3. What is the best networking option for a Massive Multiplayer Online Role Playing Game (MMORPG)?**
 - a. TCP
 - b. UDP
 - c. LAGN

HINT 

*TCP is more reliable;
UDP transfers data
more quickly.*

Answers

1. What is the best networking option for a multiplayer football game?
 - b. **UDP.** UDP is the best option for any multiplayer game because the data is transferred faster and the game does not stall while waiting for missing packets.
2. What is the best networking option for a single-player arcade game?
 - a. **TCP.** TCP is the best option because the scores and achievements are processed at the end of the game and the information is not necessary during the game to continue game play.
3. What is the best networking option for a Massive Multiplayer Online Role Playing Game (MMORPG)?
 - b. **UDP.** UDP is necessary for a MMORPG game so that the game continues smoothly in real time without delays caused by missing packets of information.

Essential details

- **Packets, datagrams, headers, and frames** are components of data carried over networks.
- **Transmission Control Protocol (TCP)** is one of the main protocols in Transmission Control Protocol/Internet Protocol (TCP/IP) networks. TCP delivers the packets in order and guarantees delivery.
- **User Datagram Protocol (UDP)** is an Internet protocol that is less reliable and delivers packets in random order.
- A **web service** is an application that enables access to a wide variety of data over the Internet.
- **Windows Communication Foundation (WCF)** is a modular collection of web protocol-based applications that can be mixed and matched to provide business functionality through an Internet connection.

FAST TRACK HELP

- **Receiving Network Data:** <http://msdn.microsoft.com/en-us/library/bb975894.aspx>
- **UDP vs. TCP:** <http://gafferongames.com/networking-for-game-programmers/udp-vs-tcp/>
- **What every programmer needs to know about game networking:** <http://gafferongames.com/networking-for-game-programmers/what-every-programmer-needs-to-know-about-game-networking/>



OBJECTIVE

understand hardware 2.4

MANAGE GAME PERFORMANCE

SCENARIO: Southridge Video is planning to create a video game to promote their new movie, A Tale of Two Gamers. The movie is about two high school students; one lives in a large city and the other lives in a remote village. They meet each other while playing as opponents in a variety of online role-playing games. The movie follows them as they become friends who decide to create their own video game that will change their lives forever.

The game being planned by Southridge Video relies heavily on graphics and allows users to choose from many different scenarios for game play.

- 1. Which of the following is a single-chip processor that renders 2-D and 3-D graphics and videos?**
 - a. CPU
 - b. GPU
 - c. transistor
- 2. If the new role-playing game were to be played on the Windows Phone®, which profile would be used?**
 - a. HiDef
 - b. MobilePro
 - c. Reach
- 3. Which of the following is required to use a HiDef profile?**
 - a. A computer with at least DirectX 10® or the Xbox 360®.
 - b. A computer with at least DirectX 9® or the Windows Phone.
 - c. The Windows Phone or the Xbox 360.



Answers

1. Which of the following is a single-chip processor that renders 2-D and 3-D graphics and videos?
 - b. **GPU.** GPU stands for Graphic Processing Unit, and it is used for rendering 2-D and 3-D graphics and videos.
2. If the new role-playing game were to be played on the Windows Phone, which profile would be used?
 - c. **Reach:** Reach is the default profile for Windows Phone.
3. Which of the following is required to use a HiDef profile?
 - a. **A computer with at least DirectX 10 or the Xbox 360.**

Essential details

- The **central processing unit (CPU)** is the “brains” of a computer, which processes instructions received from software.
- A **graphic processing unit (GPU)** is a single-chip processor that renders 2-D and 3-D graphics and videos.
- **HiDef** is a profile used for higher-performance computers with at least DirectX 10 and the Xbox 360 because of its higher graphics capabilities. It is the default profile for Microsoft Windows®-based computers and the Xbox 360.
- **Reach** is a profile used most often for limited hardware capabilities. Reach is the default profile used for the Windows Phone and can be used for Windows-based computers and the Xbox 360.
- **Shaders** are computer programs that control how the display will look on the screen.

FAST TRACK HELP

- **Difference Between CPU and GPU**
<http://www.differencebetween.net/technology/difference-between-cpu-and-gpu/>
- **What Is a Profile?**
<http://msdn.microsoft.com/en-us/library/ff604995.aspx>
- **Reach vs. HiDef**
<http://blogs.msdn.com/b/shawnhar/archive/2010/03/12/reach-vs-hidef.aspx>



OBJECTIVE

understand hardware 2.5

UNDERSTAND THE DIFFERENT GAME PLATFORMS

SCENARIO: Adventure Works is developing new video games for Windows Phone 7®. They are making amazing progress with one exception. Most of the teams working on the new games are running into problems related to memory management. While everyone understands the demands that exciting video games place on the memory capacity of mobile devices, they are still having problems fitting their projects into this demanding environment.

- 1. Mobile devices typically have:**
 - a. Large CPUs
 - b. Very limited memory
 - c. More RAM than PCs
- 2. Mobile devices:**
 - a. Usually run just one application at a time
 - b. Typically run four or five applications simultaneously
 - c. Are relatively impervious to being interrupted or terminated
- 3. Because mobile device can have limited connectivity:**
 - a. Only TCP network connectivity is suggested.
 - b. The user may be assessed user data charges for gaming.
 - c. Garbage collection strategies are unnecessary.

HINT 

Windows Phone 7 does not use the same processing power as a Windows PC or an Xbox 360.

Answers

1. Mobile devices typically have:
 - b. **Very limited memory**
2. Mobile devices:
 - a. **Usually run just one application at a time**
3. Because mobile device can have limited connectivity:
 - b. **The user may be assessed user data charges for gaming.**

Essential details

- **Memory management** refers to optimizing the use of random access memory (RAM). These procedures include selectively storing data, monitoring it carefully, and freeing memory when the data is no longer needed.
- **Garbage collection** is a process for automatic recovery of heap memory. Blocks of memory that had been allocated but are no longer in use are freed, and blocks of memory still in use may be moved to consolidate the free memory into larger blocks.
- A **mobile device** is a handheld computing device with a touchscreen.
- A **PC (personal computer)** is a general-purpose single-user microcomputer designed to be operated by one person at a time.
- The **Windows Phone** is the operating system that replaced Windows Mobile®; used on the Windows Phone 7.

FAST TRACK HELP

- **Performance Considerations for Windows Phone 7**
create.msdn.com/downloads/?id=636
- **Designing Applications for Windows Phone 7, Chapter 2**
<http://msdn.microsoft.com/en-us/library/gg490770.aspx>
- **Windows Phone**
http://en.wikipedia.org/wiki/Windows_Phone#Games



OBJECTIVE 3

Understand Graphics

IN THIS CHAPTER

- 3.1 Understand rendering engines
- 3.2A Plan for game state
- 3.2B Plan for game state
- 3.3 Draw objects





OBJECTIVE

understand graphics 3.1

UNDERSTAND RENDERING ENGINES

SCENARIO: Kim has been transferred to the animation department at Adventure Works. Everyone on the entire team is required to know and use DirectX® in the production of the current project, Adventures in Space. DirectX is a powerful technology that is designed to make Microsoft Windows®-based computers an ideal platform for running and displaying applications rich in multimedia elements such as full-color graphics, video, 3-D animation, and rich audio.

- 1. Which of the following APIs in DirectX is used for creating 2-D graphics?**
 - a. DirectDraw
 - b. Direct2D
 - c. DirectWrite
- 2. Which of the following APIs in DirectX is used for creating high-quality text rendering?**
 - a. DirectText
 - b. DirectWrite
 - c. Direct3D
- 3. Which of the following APIs in DirectX is used for creating 3-D graphics?**
 - a. Direct3D
 - b. DirectX3D
 - c. DirectX Graphics

HINT 

An API is a set of rules and specifications that software programs can follow to communicate with each other.

Answers

1. Which of the following APIs in DirectX is used for creating 2-D graphics?
b. Direct2D. This has replaced DirectDraw, which was available in older versions.
2. Which of the following APIs in DirectX is used for creating high-quality text rendering?
b. DirectWrite
3. Which of the following APIs in DirectX is used for creating 3-D graphics?
a. Direct3D

Essential details

- **DirectX** is a collection of APIs from Microsoft® for handling tasks related to multimedia, especially programming games and high-performance multimedia applications, including 2-D and 3-D graphics.
- A **codec** is a device or software that is used to encode or decode (compress or decompress) a digital media file.
- An **application programming interface (API)** is a set of codes and rules used to communicate between two software programs.
- **Tearing** occurs when the VSync is disabled and the graphics card and monitor rates have different refresh rates. There appears to be a line separating two halves when this occurs.
- **VSync**, which stands for “vertical synchronization,” is used to synchronize the graphics card with the output on the monitor.

FAST TRACK HELP

- **Introduction to DirectX**
<http://channel9.msdn.com/coding4fun/articles/Beginning-Game-Development-Part-II-Introduction-to-DirectX>
- **DirectX Developer Center**
<http://msdn.microsoft.com/en-us/directx/default.aspx>
- **DirectX Samples**
[http://msdn.microsoft.com/en-us/library/dd368187\(v=VS.85\).aspx](http://msdn.microsoft.com/en-us/library/dd368187(v=VS.85).aspx)
- **QuickStart: A basic DirectX app**
[http://msdn.microsoft.com/en-us/library/br229585\(v=VS.85\).aspx](http://msdn.microsoft.com/en-us/library/br229585(v=VS.85).aspx)




OBJECTIVE

understand graphics 3.2A

PLAN FOR GAME STATE

SCENARIO: Wingtip Toys is launching a new promotional giveaway to its customers who order a minimum of \$50 in video games from their new online store. Customers will receive a free download of the Catapult Wars game if they meet this minimum requirement. However, you would like to make it more profitable for the company by offering different levels of the game. To be able to enhance Catapult Wars to the level you would like, there are a few concepts to review.

- 1. The content pipeline is designed to help the designer:**
 - a. Keep track of the game state.
 - b. Include art assets in a game easily and automatically.
 - c. Manage the Heads-up-display (HUD) for the game.
- 2. What is a Boolean variable?**
 - a. A variable that represents either true or false.
 - b. A variable used for decimals.
 - c. A variable used for saving game data.
- 3. What are the three states in gameplay?**
 - a. Load and Update, Initialize, Draw
 - b. Load, Update, and Draw
 - c. Load, Initialize, and Draw

HINT 

The content pipeline starts at build time and converts the original file format to data that XNA can decipher.

Answers

1. The content pipeline is designed to help the designer:
 - b. **Include art assets in your game easily and automatically.**
2. What is a Boolean variable?
 - a. **A variable that represents either true or false.**
3. What are the three states in gameplay?
 - b. **Load, Update, and Draw**

Essential details

- In the **Load** method, all images and other pertinent information are loaded into the game before gameplay begins.
- In the **Initialize** method, all variables are initialized.
- The **Draw** method is called 60 times per second and draws all content to the screen.
- A **Boolean variable** is a variable that is set to be either true or false.
- **Game state** consists of a description of an object at a given point in time in a game.
- **Gametime** is an XNA® class that has a snapshot of the game timing state expressed in values that can be used by variable-step (real time) or fixed-step (game time) games.
- The **XNA Content Pipeline** is a set of content importers and processors, integrated into the development environment, which provides an easy and flexible way to import, load, process and use three-dimensional (3-D) models, textures, images, sounds, and other assets in your game.

FAST TRACK HELP

- **Exercise 1: Basic XNA Framework Game with Game State Management**
http://msdn.microsoft.com/en-us/wp7trainingcourse_2dgamedevelopmentwithxnalab_topic2
- **Game State Management**
http://create.msdn.com/en-US/education/catalog/sample/game_state_management
- **XNA: Game Development - Loading Content Into Your Game (video)**
<http://channel9.msdn.com/Blogs/The-XNA-Show/XNA-Game-Development-Loading-Content-Into-Your-Game>



OBJECTIVE

understand graphics 3.2B

PLAN FOR GAME STATE

SCENARIO: Wingtip Toys is launching a new promotional giveaway to its customers who order a minimum of \$50 in video games from their new online store. Customers will receive a trial version of the spaceship game that you have been working on. To prepare this game for distribution, there are a few enhancements you need to add so that the user can move the spaceship across the screen. These are the specifications for moving the model:

1. Pressing left or right on the left thumbstick will move the model in the *X* or *Y* direction.
2. Pressing the right thumbstick will allow the user to zoom.
3. Pressing the DPad up or down will change the *x* and *y* rotation.
4. Pressing the A button will exit the program.

1. What code will change the value of the model rotation by using the left thumbstick?


- a. `modelRotation -= currentState.ThumbSticks.Left.X * 0.10f;`
- b. `ThumbSticks.Left.X = ThumbSticks.Left.X * 0.10f;`
- c. `modelRotation -= ThumbSticks.Left.X * 0.10f;`

2. What code will allow the user to zoom by pressing the right thumbstick?

- a. `zoom *= currentState.Triggers.Right;`
- b. `zoom += modelVelocityAdd.Triggers.Right`
- c. `zoom += state.ThumbSticks.Right.Y * 10;`

3. What line of code can be used to change the *X* rotation of the model by pressing the DPad up?

- a. `if (state.DPad.Up == ButtonState.Pressed)
 RotationX += 1.0f;`
- b. `if (currentState.DPad.Up == ButtonState.Pressed)
 RotationX += 1.0f;`
- c. `if (DPad.Up == ButtonState.Pressed)
 RotationX += 1.0f;`

HINT 

GameTime is an XNA class that takes a snapshot of the game timing state.

Answers

1. What code will change the position of the model rotation by using the left thumbstick?
 - a. `Position.X += state.ThumbSticks.Left.X * 10;`
2. What code will allow the user to zoom by pressing the right thumbstick?
 - c. `zoom += state.ThumbSticks.Right.Y * 10;`
3. What line of code can be used to change the X rotation of the model by pressing the DPad up?
 - a. `if (state.DPad.Up == ButtonState.Pressed)
 RotationX += 1.0f;`

Essential details

- The **XNA® content pipeline** is a set of content importers and processors, integrated into the development environment, provides an easy and flexible way to import, load, process, and use 3-D models, textures, images, and sounds.
- The **frame rate** is the speed at which an image is refreshed on the screen. This is measured in frames per second. A game is either fixed-step (the default) or variable-step.
- A **fixed-step game loop** calls the update method a certain number of times per second. Usually, the PC and Xbox® call the update 60 times per second, while the Windows Phone® calls the update 30 times per second.
- A **variable-step game loop** calls the *Update* and *Draw* methods in a continuous loop.

FAST TRACK HELP

- **Exercise 1: Basic XNA Framework Game with Game State Management**
http://msdn.microsoft.com/en-us/wp7trainingcourse_2dgamedevelopmentwithxnalab_topic2
- **XNA: Game Development—Loading Content Into Your Game (Video)**
<http://channel9.msdn.com/Blogs/The-XNA-Show/XNA-Game-Development-Loading-Content-Into-Your-Game>
- **Game State Management**
http://create.msdn.com/en-US/education/catalog/sample/game_state_management




OBJECTIVE

understand graphics 3.3

DRAW OBJECTS

SCENARIO: Trey Research is entering the education game market. They are planning a 3-D game in which the user flies a plane around the world to find the answers to geography problems. For example, the user might be asked to name the capital of a country and then have to navigate to the country to locate the city. Iliana Simbaeva has been offered the position of manager for this project and is eager to show her expertise with using 3-D graphics in XNA.

- 1. What variable should Iliana use to create 3-D graphics?**
 - a. Texture3D
 - b. Vector3D
 - c. model
- 2. How are 3-D graphics added to the screen?**
 - a. Drag them.
 - b. Use the *Draw()* method.
 - c. Use the *LoadContent()* method.
- 3. In which method is the code used to move the 3-D graphic placed?**
 - a. *Update()*
 - b. *LoadContent()*
 - c. *Draw()*

HINT 

3-D graphics are added the content to your solution by using the variable model.

Answers

1. What variable should Iliana use to create 3-D graphics?
c. **model**
2. How are 3-D graphics added to the screen?
c. Use the ***LoadContent()*** method.
3. In which method is the code used to move the 3-D graphic placed?
a. ***Update()***

Essential details

- XNA® provides a variety of methods for working with images, including ***Draw()***, ***LoadContent()***, ***SpriteBatch()***, and others.
- Images can be modified with the **Pixel/Fragment shader, Geometry shader, and Vertex shader**.
- **Parallax mapping** provides enhanced mapping techniques that are used to make images seem more real and have more depth.
- **Sprites** are 2-D bitmaps that are drawn directly to a render target without using the pipeline for transformations, lighting, or effects.
- **Image modifiers** include a Vertex shader, a Geometry shader, and a Pixel/Fragment shader, and parallax mapping.

FAST TRACK HELP

- **Displaying a 3D Model on the Screen:**
<http://msdn.microsoft.com/en-us/library/bb197293.aspx>
- **3D XNA Tutorials: Using 3D Models:**
<http://rbwhitaker.wikidot.com/using-3d-models>



OBJECTIVE 4

Understand Animation

IN THIS CHAPTER

- 4.1 Animate basic characters
- 4.2 Transform objects
- 4.3 Work with collisions





OBJECTIVE

understand animation 4.1

ANIMATE BASIC CHARACTERS

SCENARIO: Dean Halstead is a programmer who works for Tailspin Toys. Recently, the company has decided to enter the online game marketplace with some small educational applications for children.

Dean's new assignment is to create a game that includes a maze with an animated hamster. A math problem is shown, and the hamster (player) must navigate the maze to the piece of cheese that has the correct answer.

During the design phase, Dean came up with a few questions.

1. How should the mouse move?

- a. Because most young children can use the arrow keys, use these keys to direct the mouse.
- b. Have the hamster move forward when the space key is pressed, move left when the L key is pressed, and move right when the R key is pressed.
- c. Program the hamster to move randomly around the maze until it finds the right slice of cheese.

2. For this type of game, what type of lighting can Dean use to make it more interesting?

- a. Use directional light that comes from only one side.
- b. Lighting is not useful in this type of animation.
- c. Point light in the area directly around the mouse.

3. How can Dean make the hamster move faster with the use of a special keyboard command?

- a. Determine the time it takes to get across the screen at the normal 60 frames per second (FPS), and then add a speed factor that can be increased when the user presses a certain key.
- b. The hamster can have only one speed.
- c. Reduce the hamster's size to make it move faster.

HINT 

Animation can be a series of sprites shown in succession or movement caused by changing the x,y coordinates.

Answers

1. How should the mouse move?
 - a. **Because most young children can use the arrow keys, use these keys to direct the mouse.**
2. For this type of game, what type of lighting can Dean use to make it more interesting?
 - c. **Point light in the area directly around the mouse.** Point light can add a level of difficulty to the game for more advanced levels.
3. How can Dean make the hamster move faster with the use of a special keyboard command?
 - b. **Determine the time it takes to get across the screen at the normal 60 frames per second (FPS), and then add a speed factor that can be increased when the user presses a certain key.**

Essential details

- Every graphic (**sprite**) is placed on the screen using a bounding rectangle in a 2-D animation, and then a texture is applied to the shape.
- **Frames per second (FPS)** is the speed at which animation is displayed.
- A single sprite sheet can help minimize the number of images needed in an animation.
- The **projection matrix** defines the camera's field of view.
- XNA® uses **shader**-based rendering to convert vertex data into pixels.
- XNA uses a **texture** coordinate to map a coordinate on a texture to a vertex of a primitive.
- **Keyframes** combine a timer and interpolation to determine the location of objects.

FAST TRACK HELP

- **XNA Game Studio**
<http://msdn.microsoft.com/en-us/library/cc178930.aspx>
- **Animating a Sprite**
<http://msdn.microsoft.com/en-us/library/bb203866.aspx>
- **App Hub**
<http://create.msdn.com/en-US/>




OBJECTIVE

understand animation 4.2

TRANSFORM OBJECTS

SCENARIO: Bonnie Kearney is enrolled in a college class on video game design. The professor is reviewing the basic concepts of 2-D scaling and object rotation. The students have been assigned to create a game in which images appear randomly on the screen and slowly fade into the background while spinning. Users win points if they click the images before they disappear.

- 1. How can Bonnie make an image fade into the background?**
 - a. Change the opacity of the object until it becomes transparent.
 - b. Create multiple images of various sizes and cycle through the images.
 - c. Reduce the scale size of the image until it gets to zero.
- 2. What technique should Bonnie use for rotating the image?**
 - a. Create multiple images of various sizes and positions in rotation.
 - b. Change the rotation value in the *Draw()* method.
 - c. Identify the center point of the object and use with the rotation value in the *Draw()* method.
- 3. How can Bonnie detect if the user clicked a sprite before it disappeared?**
 - a. Create a *MouseState* object to capture the *Click* event. Check the (x,y) coordinates to see if it intersects any of the sprites.
 - b. Check every pixel on the screen because the sprites are rotating and fading at the same time.
 - c. Store an array of the locations of all sprites on the screen and compare it to the mouse click value.

HINT 

It is important to set the correct position for the origin of your image if you are using rotation or movement.

Answers

1. How can Bonnie make an image fade into the background?
 - c. **Reduce the scale size of the image until it gets to zero.** The speed must be tested to ensure that the user has time to click it.
2. What technique should Bonnie use for rotating the image?
 - c. **Identify the center point of the object and use with the rotation value in the *Draw()* method.**
3. How can Bonnie detect whether the user clicked on a sprite before it disappeared?
 - a. **Create a *MouseState* object to capture the *Click* event. Check the *(x,y)* coordinates to see if it intersects any of the sprites.**

Essential details

- **Rotating** an object will turn the object on one or more axes. By moving the points in 3-D space, the object will spin.
- **Scaling** an object will make the object larger or smaller. This is done by moving the points in the object closer together or farther apart, to scale down or scale up.
- **Frames per second (FPS)** is a value that represents the number of frames drawn each second of the animation.
- **Forming** is the process of putting together texture elements to create a background or terrain using primitives.
- **Deforming** occurs when something happens, such as an explosion, that causes the animation to break apart the texture. The image becomes distorted.

FAST TRACK HELP

- **Animating a Sprite** <http://msdn.microsoft.com/en-us/library/bb203866.aspx>
- **App Hub** <http://create.msdn.com/en-US/>
- **Riemer's 2D & 3D XNA®** <http://www.riemers.net/>



OBJECTIVE

understand animation 4.3

WORK WITH COLLISIONS

SCENARIO: Bonnie Kearney is enjoying her video game design class. In the current unit, the professor is teaching animation collisions. Her next XNA® game design assignment requires that she monitor closely any collisions in the game world. The game is an animated bicycle race in which the user has to avoid the other bicycles and obstacles on the track.

- 1. Considering the odd shape of the dirt bike with a rider, what is the best way to detect a collision with another rider?**
 - a. Use a pixel-by-pixel comparison.
 - b. Use a bounding rectangle and look for any intersection of the two rectangles.
 - c. Use the (x,y) coordinates of each image and look for any matches.
- 2. What is the best way to detect a collision with an obstacle on the track?**
 - a. Use a pixel-by-pixel comparison.
 - b. Use a bounding rectangle and look for any intersection of the two rectangles.
 - c. Use the (x,y) coordinates of each image and look for any matches.
- 3. When is the best time to use a pixel-by-pixel comparison?**
 - a. When the objects are similar in size.
 - b. After a collision of bounding rectangles has been detected.
 - c. Constantly, throughout the animation.

HINT 

When testing for collisions, it is sometimes necessary to sacrifice accuracy for improved performance.

Answers

1. Considering the odd shape of the dirt bike with a rider, what is the best way to detect collision with another rider?
 - a. **Use a pixel-by-pixel comparison.** The program should first look for an intersection of the bounding rectangle, but due to the irregular shape, the program needs to do a more detailed comparison.
2. What is the best way to detect collision with an obstacle on the track?
 - b. **Use a bounding rectangle and look for an intersection of the two rectangles.**
3. When is the best time to use a pixel-by-pixel comparison?
 - b. **After a collision of bounding rectangles has been detected.** The pixel-by-pixel comparison is very resource-intensive.

Essential details

- When a detailed comparison is needed, use the bounding rectangle to identify the collision and follow up with a **pixel-by-pixel comparison**.
- **Pixel collision** involves comparing pixel-by-pixel to see if any of the pixels contain color (part of one object is touching another).
- Think about what should happen when a collision occurs? Do the colliding images link? Do they bounce away in opposite directions? Do they change size or speed?
- A solid understanding of the **fundamentals of physics** is necessary to make a realistic animation.
- **A sprite** is a small bitmap image often used in animated games and sometimes used as a synonym for icon.

FAST TRACK HELP

- **XNA Game Studio**
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