# Understanding the Lesson Objectives

The material we want you to learn during this course is defined in these objectives, broken out by major course block and lesson. In fact, all our testable material comes directly from at least one of them. We recommend you use this document as a continuous note-taker and find these steps helpful.

1. Fill in the objectives with notes as you read them before the lesson
2. Update your original notes after the lesson with additional details, context, and understanding
3. Review your notes regularly to reinforce the concepts

Each objective starts with 1 of 10 words from Bloom’s Taxonomy of Learning. Depending on the word, we have different expectations for the objective. To better aid your studies, we’ve defined each below:

1. Define – Knowledge, Level 1
2. Know the concept
3. Summarize – Comprehension, Level 2
4. Know the concept
5. Provide general details about its application
6. Explain – Comprehension, Level 2
7. Know the concept
8. Provide in-depth details about its application
9. Distinguish – Comprehension, Level 2
10. Know the differences between multiple concepts
11. Use – Application, Level 3
12. Apply the concept
13. Calculate – Application, Level 3
14. Apply the concept
15. Convert – Application, Level 3
16. Apply the concept
17. Create – Application, Level 3
18. Apply the concept
19. Analyze – Analysis, Level 4
20. Make informed observations and decisions using the concepts
21. Combine – Synthesis, Level 5
22. Combine multiple concepts into a solution

# Algorithmic Reasoning

**Lesson 1: Course Introduction**

**Lesson 2: Introduction to Algorithmic Reasoning & Problem Solving**

* 1. Define an algorithm
  2. Explain how algorithmic reasoning is broadly applicable
  3. Analyze narrative problem definitions for component tasks

**Lesson 3: Sequential Logic (Input-Process-Output)**

* 1. Use the basic features of zyBooks
  2. Use basic syntax and semantics related to Python
  3. Explain how sequential flow accomplishes one task after another
  4. Use input and output to retrieve data from the user and display data in the console
  5. Use assignment statements with expressions
  6. Use predefined functions for calculations
  7. Define variables and data types

**Lesson 4: Conditional Logic (Selection)**

* 1. Explain how conditional flow makes decisions based on Boolean expressions
  2. Create Boolean expressions using relational and logical operators
  3. Create complex conditional structures using nested and cascading structures

**Lesson 5: Graphics in RAPTOR**

* 1. Use pythonGraph window functions to create, clear, set titles for, and close graphical windows
  2. Use pythonGraph drawing functions to create graphical images
  3. Use pythonGraph *functions* to control graphical programs

**Lesson 6: Iterative Logic I (Loops)**

* 1. Explain how iterative control flow structures are used to repeatedly perform sets of operations
  2. Create counted loops for performing a set of operations a given number of times
  3. Create logical loops for repeating a set of operations until some condition becomes true

**Lesson 7: Iterative Logic II (Loops)**

* 1. Iterative Logic II Objective 1.17
  2. Iterative Logic II Objective 1.18

**Lesson 8: RAPTOR Assessment 1 (Lessons 2 – 7)**

**Lesson 9: Requirements Analysis**

* 1. Analyze narrative specifications for requirement contradictions and omissions
  2. Create decision tables to analyze complex specifications

**Lesson 10: Subcharts, Functional Decomposition & Logic Design / Project Day #1**

* 1. Create and call functions to manage program complexity and avoid redundancy
  2. Use functional decomposition to breakdown complex tasks into a series of manageable sub-tasks
  3. Create English-language logic designs for problem definitions
  4. Combine sequential, conditional, and iterative control flows, arrays, functional decomposition, logic design, and requirements analysis to solve non-trivial algorithmic reasoning problems, including those producing interactive graphical animations

**Lesson 11: Procedures & Parameter Passing | Intro Animation**

* 1. Summarize the advantages and disadvantages of using functions
  2. Distinguish between pass by value and pass by reference.
  3. Create functions to perform well-defined tasks that effectively utilize local variables.
  4. Explain the method of creating animations with static images with basic erase, move, and draw tasks.

**Lesson 12: Animation II**

* 1. Create smooth graphical animations using pythonGraph functions

**Lesson 13: Graphics II – Mouse / Keyboard Interactions**

* 1. Distinguish between blocking and non-blocking built-in function calls
  2. Use pythonGraph calls to get and respond to input from the mouse and keyboard

**Lesson 14: Arrays and Intro to Parallel Arrays**

* 1. Define the concept of an array as a set of indexed variables that share a common name
  2. Use arrays to store and manipulate string information
  3. Create counted loops to manipulate data within an array, to include, but not be limited to, inputting values, calculating totals and averages, determining minimums and maximums, conditionally counting, and selectively outputting results

**Lesson 15: Parallel Arrays II**

* 1. Calculate values and positions of values within parallel arrays
  2. Use parallel arrays to store and manipulate heterogeneous information about multiple objects

**Lesson 16: Debugging in RAPTOR**

* 1. Use the debugging tools to identify and locate bugs in Python programs.
  2. Use code instrumentation (output calls) to identify and locate bugs in Python programs.
  3. Use single-stepping capabilities in the integrated development environment (IDE) to locate program bugs.
  4. Use breakpoints in your IDE to locate program bugs.

**Lesson 17: Summary / Catchup & Review**

**Lesson 18: RAPTOR Assessment 2 (Lessons 9 – 15)**

# Computer System Capabilities

**Lesson 19: Project Day #2**

**Lesson 20: What’s Inside a Computer and Why?**

* 1. Define what a computer is
  2. Explain the functions and interactions between the components of the Von Neumann computer architecture
  3. Describe the function of each major computer hardware component: motherboard, CPU, memory boards, display card, power supply
  4. Apply Moore's Law to computer performance analysis
  5. Explain how and why the memory hierarchy uses a layered approach to balance access speed, storage capacity, and cost
  6. Describe the primary functions of an operating system

**Lesson 21: Binary Numbers & Binary Data Encoding**

* 1. Convert between binary and decimal numbers
  2. Calculate how many values can be represented with b bits
  3. Calculate how many bits are needed to represent a given number of unique values
  4. Convert between bits, bytes, kilobytes, megabytes, and gigabytes
  5. Define how characters are encoded in ASCII and UNICODE
  6. Define how a bitmap image is stored
  7. Calculate the size of a bitmap image given its dimensions and color-depth (bits / pixel)
  8. Calculate the size of a video given its dimensions, color-depth, duration, and frame-rate

**Lesson 22: Data Compression and Transmission**

* 1. Analyze situations for the most appropriate compression, lossy or lossless
  2. Distinguish between latency and bandwidth
  3. Calculate the time to transmit a file given file size and bandwidth
  4. Calculate the compression ratio given uncompressed and compressed file sizes
  5. Calculate the size of files given a compression ratio

**Lesson 23: Spreadsheets**

* 1. Use spreadsheets to specify formulas, format cells, address cells (relative & absolute), auto-fill cells, utilize functions, and conditionally calculate/format cells
  2. Use spreadsheet capabilities to visualize information

**Lesson 24: Databases & Database Applications**

* 1. Define the basic structures of a database: tables, fields/attributes, rows/records, relations, queries, and keys
  2. Explain how database design can prevent data redundancy and anomalies
  3. Explain the strengths and weaknesses of spreadsheets and databases and how they can be used to complement each other

**Lesson 25: Big Data & Data Analytics**

* 1. Summarize the concept of cloud computing
  2. Explain the data science process
  3. Explain data analytics and how it supports decision making
  4. Summarize the concept of big data and its potential impacts

**Lesson 26: The Network Protocol Model**

* 1. Define the role of each layer in the five-layer network protocol model
  2. Distinguish common protocols for each layer in the network protocol model
  3. Explain internet protocol (IP) addressing and routing
  4. Summarize the concept of logical ports

**Lesson 27: Network Routing & Wireless Networking**

* 1. Define the functions of gateways, bridges, routers, switches, and hubs
  2. Summarize the domain name system (DNS)
  3. Summarize the dynamic host configuration protocol (DHCP)
  4. Summarize network address translation (NAT)
  5. Explain the security and IP reuse benefits of NAT
  6. Summarize the differences between IPv4 and IPv6 addresses
  7. Explain the security and privacy challenges inherent in wireless networking
  8. Summarize wireless security technologies

**Lesson 28: Graded Review 1 (Lessons 14 – 24)**

# Cyber Operations

**Lesson 29: Information Security**

* 1. Define information security
  2. Define the concept of risk in terms of threats and vulnerabilities
  3. Explain the principles of information security: confidentiality, integrity, and availability
  4. Define the types of threats to information security
  5. Explain which control measures best mitigate different threats to information security

**Lesson 30: Project Day #3**

**Lesson 31: Cryptography**

* 1. Explain the role of cryptography in information security
  2. Define symmetric encryption
  3. Summarize the transposition, substitution, shift, Vigenère, and one-time pad ciphers
  4. Explain the key management weakness of symmetric encryption
  5. Define asymmetric encryption
  6. Summarize how checksums and hashes are used to ensure information integrity
  7. Summarize the use of public key infrastructures to provide encryption and authentication
  8. Summarize how certificates and certificate authorities are used to verify authenticity

**Lesson 32: The Cyber-Attack Methodology | Reconnaissance & Scanning**

* 1. Distinguish between the objectives of a cyber-attack
  2. Summarize recent cyber-crime trends
  3. Define the phases of the cyber-attack methodology
  4. Summarize how the cyber-attack methodology is used by the Air Force to improve network defenses
  5. Explain how reconnaissance is commonly conducted
  6. Explain the privacy and security concerns of having information publicly available
  7. Explain the role of social engineering in the cyber-attack methodology and how its techniques, including phishing, can subvert network defenses
  8. Explain the role of network mapping and vulnerability identification in the cyber-attack methodology

**Lesson 33: Gaining Access, Maintaining Access, & Covering Tracks**

* 1. Explain how gaining access uses the results of the reconnaissance and scanning phases
  2. Summarize common techniques for covering tracks
  3. Explain the role of password cracking in the cyber-attack methodology
  4. Define exhaustive, dictionary, and rainbow table password attacks
  5. Define the components of strong passwords
  6. Calculate the time and effort required for different types of password attacks
  7. Summarize common techniques for maintaining access

**Lesson 34: Malware, & Web Exploits**

* 1. Define the types of malware and their role in the cyber-attack methodology
  2. Summarize web security risks and precautions
  3. Explain the vulnerabilities prevented through input validation, such as SQL injection and cross-site scripting (XSS)

**Lesson 35: Industrial Control Systems & Stuxnet Case Study**

* 1. Summarize the vulnerabilities inherent in industrial control systems (ICS) and the possible outcomes of attacks against ICS
  2. Explain how offensive cyber operations can achieve effects in support of operations in the physical and cyberspace domains

**Lesson 36: Digital and Network Forensics**

* 1. Define Locard's Exchange Principle
  2. Summarize the role of digital forensics in cyber-crime and intelligence
  3. Distinguish between the roles and authorities provided in US Code Title 10, Title 18, and Title 50
  4. Summarize the ethical and legal complications of computer-based activities
  5. Define the types of information kept in various sections of a computer: file system, email system, web browsing history, cookies, and system registry
  6. Summarize the types of forensic information available on a network
  7. Describe the concept and benefits of virtual machines

**Lesson 37: Graded Review 2 (Lessons 26 – 35)**

**Lesson 38: Personal & Network Defense and Security**

* 1. Summarize the concept of “the asymmetry of defense”
  2. Summarize the concept of “defense in depth”
  3. Define basic network defenses: firewalls, proxy servers, intrusion detection systems (IDS), intrusion prevention system (IPS), and access controls
  4. Distinguish between firewall whitelisting and blacklisting network traffic
  5. Summarize how proxy servers cache and filter network traffic
  6. Distinguish between signature-based and statistical anomaly-based intrusion detection
  7. Summarize personal security practices to avoid social engineering attacks
  8. Summarize personal security practices to protect your personal information

**Lesson 39: Cyber Capstone**

* 1. Explain how offensive and defensive cyber operations can be employed in conflict
  2. Analyze the unique implications of cyber operations in conflict, including, but not limited to, attribution, effect assessment, escalation management, and intelligence

**Lesson 40: Review and Post Assessment**