

PROGRAMMABLE LOGIC CONTROLS TEST QUESTIONS AND ANSWERS Reference

Programmable Logic Controls Test Questions and Answers

Understanding programmable logic controls (PLCs) is essential for anyone involved in industrial automation, control systems, or electrical engineering. Preparing for PLC certification exams or job assessments often involves reviewing common test questions and answers to solidify knowledge. In this article, we will explore a comprehensive set of PLC test questions and answers, organized by topic, to help learners prepare effectively for their exams and practical applications. Whether you're a student, technician, or engineer, this guide aims to enhance your understanding of PLC fundamentals, programming, troubleshooting, and more.

Fundamentals of Programmable Logic Controllers

What is a PLC?

- **Question:** Define a Programmable Logic Controller (PLC).
- **Answer:** A PLC is an industrial digital computer designed to control manufacturing processes, machinery, or factory assembly lines by monitoring inputs and controlling outputs based on programmed logic.

Key Components of a PLC

- **Question:** Name the main components of a PLC system.
- **Answer:** The main components include the Central Processing Unit (CPU), input modules, output modules, power supply, and programming device.

Types of PLCs

- **Question:** What are the different types of PLCs?
- **Answer:** The primary types include micro PLCs, compact PLCs, modular PLCs, and rack-mounted PLCs, each suitable for different scale and complexity of automation tasks.

PLC Programming Languages and Logic

Common PLC Programming Languages

- **Question:** What are the standard programming languages used in PLCs?

- **Answer:** The IEC 61131-3 standard defines five programming languages: Ladder Diagram (LD), Function Block Diagram (FBD), Structured Text (ST), Instruction List (IL), and Sequential Function Charts (SFC).

Understanding Ladder Logic

- **Question:** What is ladder logic, and why is it widely used in PLC programming?

- **Answer:** Ladder logic is a graphical programming language resembling electrical relay logic diagrams. It is popular because it is intuitive for electricians and engineers, making it easy to troubleshoot and visualize control processes.

Basic PLC Instructions

- **Question:** Name some common PLC instructions.

- **Answer:** Common instructions include Contact (XIC), Coil (OTE), Timer (TON, TOF), Counter (CTU, CTD), and Comparison instructions.

PLC Wiring and Input/Output Devices

Input Devices

- **Question:** What are common input devices used in PLC systems?

- **Answer:** Common input devices include push buttons, limit switches, proximity sensors, photoelectric sensors, and temperature sensors.

Output Devices

- **Question:** What devices are typically controlled by PLC outputs?

- **Answer:** The outputs control devices such as relays, motors, valves, alarms, and indicator lights.

Wiring Best Practices

- **Question:** What are some best practices for wiring PLC input/output modules?

- **Answer:** Use proper wire sizes, maintain clear labeling, ensure proper grounding, and follow manufacturer wiring diagrams to prevent faults and facilitate troubleshooting.

PLC Troubleshooting and Maintenance

Common PLC Faults

- **Question:** What are some common faults encountered in PLC systems?

- **Answer:** Common faults include input/output wiring issues, power supply failures, corrupted programs, CPU faults, and communication errors.

Troubleshooting Steps

- **Question:** What is a typical troubleshooting process for PLC faults?

- **Answer:** The process involves checking power supply, verifying wiring, monitoring input/output signals, reviewing program logic, and examining error codes or diagnostics provided by the PLC.

Maintenance Tips

- **Question:** How can preventive maintenance extend the life of a PLC system?

- **Answer:** Regular inspections, cleaning, updating firmware, backing up programs, and ensuring proper environmental conditions help prevent failures and ensure reliable operation.

PLC Communication Protocols

Common Protocols

- **Question:** What are some common communication protocols used with PLCs?

- **Answer:** Protocols include Ethernet/IP, Modbus, Profibus, Profinet, DeviceNet, and CANopen.

Importance of Communication Protocols

- **Question:** Why are communication protocols important in PLC systems?

- **Answer:** They enable seamless data exchange between PLCs, HMIs, SCADA systems, and other automation devices, ensuring coordinated control and data logging.

Advanced Topics and Applications

PLC Programming for Motion Control

- **Question:** How are PLCs used in motion control applications?
- **Answer:** PLCs can interface with servo drives and variable frequency drives (VFDs) to control motor speed, position, and acceleration for precise motion operations.

Safety and Interlocks in PLC Systems

- **Question:** How are safety features incorporated into PLC-controlled systems?
- **Answer:** Safety PLCs, emergency stop circuits, safety interlocks, and redundant safety relays are integrated to ensure operator safety and prevent hazardous conditions.

Programming for Data Logging and Monitoring

- **Question:** How do PLCs facilitate data logging and system monitoring?
- **Answer:** PLCs can be configured to record process parameters, generate alarms, and communicate with SCADA systems for real-time monitoring and historical data analysis.

Conclusion

Preparing for PLC certification or improving your proficiency in automation systems requires a solid understanding of both theoretical concepts and practical skills. Reviewing commonly asked **programmable logic controls test questions and answers** provides a strong foundation for success. Focus on mastering PLC components, programming languages, wiring practices, troubleshooting methods, communication protocols, and advanced applications to become a competent automation professional. Remember, hands-on experience combined with theoretical knowledge is key to excelling in the field of programmable logic controls.

Whether you're studying for an exam or working on industrial automation projects, continuous learning and practice will help you stay updated with the latest PLC technologies and best practices. Use this guide as a starting point, and supplement it with practical exercises, laboratory work, and real-world troubleshooting to build confidence and expertise in programmable logic controls.

Programmable Logic Controls Test Questions and Answers: A Comprehensive Guide for Learners and Professionals

In the rapidly evolving world of automation and industrial control systems, programmable logic controls (PLCs) test questions and answers serve as essential tools for students, technicians, engineers, and professionals seeking to validate their understanding and skills. Whether you're preparing for certification exams, brushing up on system fundamentals, or troubleshooting real-world applications, mastering PLC concepts through well-structured test questions is crucial. This guide delves into common PLC test questions, their answers, and the reasoning behind them, helping you build confidence and competence in this vital area of control engineering.

Understanding the Significance of PLC Test Questions and Answers

Before we explore specific questions, it's essential to recognize why PLC test questions and answers are so important:

- **Assessment of knowledge:** They help gauge your understanding of PLC principles, programming languages, and application scenarios.
- **Preparation for certification:** Many industry certifications require passing specific tests; practicing with questions enhances your chances of success.
- **Troubleshooting skills:** Real-world PLC issues often mirror exam questions, so practicing helps develop critical troubleshooting abilities.
- **Foundation for advanced learning:** Mastery of basic concepts through testing enables progression into complex automation topics.

Core Topics Covered in PLC Test Questions

PLC test questions typically span several key areas. To prepare effectively, focus on understanding these fundamental topics:

- **PLC Hardware Components**
 - Central Processing Unit (CPU)
 - Input and output modules
 - Power supply units
 - Communication interfaces
- **Programming Languages & Logic**

- Ladder Logic (LAD)
- Function Block Diagram (FBD)
- Structured Text (ST)
- Sequential Function Charts (SFC)

- Basic PLC Operations

- Scan cycle process
- Input processing
- Logic execution
- Output updates

- Programming Concepts

- Timers and counters
- Data types and memory
- Variables and tags
- Programming best practices

- Troubleshooting and Maintenance

- Diagnosing faults
- Reading diagnostic LEDs and messages
- Safety procedures

Sample PLC Test Questions and Answers

Below, we analyze some typical questions you might encounter, along with detailed explanations to deepen your understanding.

Question 1: What is the primary function of a PLC in industrial automation?

- A. To replace human operators entirely
- B. To automate control processes by executing programmed logic

C. To provide power to industrial machinery

D. To store inventory data

Correct Answer: B. To automate control processes by executing programmed logic

Explanation:

A PLC (Programmable Logic Controller) is designed to automate control processes by executing user-defined logic. It continuously monitors inputs, processes logic based on its program, and updates outputs accordingly. Unlike options A, C, or D, its core purpose is to facilitate automation in industrial settings.

Question 2: Which programming language is most commonly used for ladder logic programming in PLCs?

A. Structured Text

B. Ladder Diagram

C. Function Block Diagram

D. Sequential Function Chart

Correct Answer: B. Ladder Diagram

Explanation:

Ladder Diagram (LD) is the most widely used programming language for PLCs, especially in industrial environments. It visually resembles relay logic schematics, making it accessible for electricians and control engineers. While other languages like Structured Text and Function Block Diagram are also supported, Ladder Logic remains the standard.

Question 3: In a PLC scan cycle, which process occurs first?

A. Output updating

B. Input processing

C. Program execution

D. Communication with external devices

Correct Answer: B. Input processing

Explanation:

The typical PLC scan cycle begins with reading all inputs, then executing the control program based on those inputs, and finally updating outputs. This sequence ensures that the program always acts on the latest input data, maintaining system integrity.

Question 4: Which of the following is an example of a timer function in PLC programming?

A. To count the number of parts produced

B. To delay actions for a specified period

C. To compare two values

D. To reset a system

Correct Answer: B. To delay actions for a specified period

Explanation:

Timers in PLCs are used to introduce delays or measure durations. For instance, a timer can delay turning on a motor or wait for a process to stabilize before proceeding. Counters, on the other hand, count occurrences, which is different from timers.

Question 5: What does a "fault LED" typically indicate on a PLC?

A. The program is running smoothly

B. There is an error or fault in the system

C. The PLC is in sleep mode

D. The system has completed its cycle

Correct Answer: B. There is an error or fault in the system

Explanation:

A fault LED on a PLC indicates a fault or error condition, such as hardware failure, communication issues, or program errors. Recognizing fault indicators quickly helps in effective troubleshooting.

Advanced Topics and Sample Questions

Beyond basic concepts, advanced PLC topics include network communication, safety programming, and integrating PLCs with other systems. Here are some sample questions for advanced learners:

Question 6: Which communication protocol is most commonly used for industrial PLC networks?

- A. HTTP
- B. Modbus
- C. FTP
- D. SMTP

Correct Answer: B. Modbus

Explanation:

Modbus is a widely adopted communication protocol in industrial automation, enabling PLCs, sensors, and other devices to communicate over serial lines or Ethernet. Protocols like HTTP and FTP are more common in IT networks, while SMTP is used for email.

Question 7: In safety PLC programming, what is a key feature that distinguishes it from standard PLCs?

- A. Use of high-level programming languages
- B. Implementation of redundant circuits and fail-safe logic
- C. Faster scan times
- D. Ability to connect to the internet

Correct Answer: B. Implementation of redundant circuits and fail-safe logic

Explanation:

Safety PLCs are designed for critical applications where safety is paramount. They incorporate redundant hardware, fail-safe logic, and special programming to ensure safe shutdowns and fault detection, distinguishing them from standard PLCs.

Tips for Preparing for PLC Tests

- Understand core concepts thoroughly: Focus on hardware, programming languages, and cycle operations.
- Practice with real PLC hardware or simulation software: Hands-on experience solidifies theoretical knowledge.
- Solve a variety of questions: Cover both basic and advanced topics to build comprehensive understanding.
- Review troubleshooting scenarios: Many tests include diagnosing faults?practice reading diagnostic messages.
- Stay updated: New protocols and safety standards may be included in modern PLC systems.

Conclusion

Mastering programmable logic controls test questions and answers is instrumental in advancing your career in automation and control engineering. By understanding the fundamental topics, practicing real-world scenarios, and staying informed about industry standards, you can confidently approach exams and practical applications alike. Remember, consistent study and practical application are key to transforming theoretical knowledge into effective control solutions.

Whether you're just starting out or looking to sharpen your skills, this guide provides a solid foundation. Keep practicing, stay curious, and leverage these questions and answers to propel your mastery of PLC systems forward!

Question What are the primary functions of Programmable Logic Controllers (PLCs)?
PLCs are used to automate industrial processes by monitoring inputs, processing logic based on programming, and controlling outputs to machinery or systems, ensuring reliable and efficient operation. Which programming languages are commonly used for PLC programming? The most common PLC programming languages are Ladder Logic, Function Block Diagram (FBD), Structured Text (ST), Instruction List (IL), and Sequential Function Charts (SFC), as specified by IEC 61131-3 standard. How do you troubleshoot a PLC that is not responding to input signals? Troubleshooting involves checking power supply, verifying input wiring, inspecting sensor connections, testing input modules, reviewing program logic for faults, and using diagnostic tools or status indicators to identify issues. What is the significance of scan time in PLC operation? Scan time is the duration it takes for a PLC to complete one cycle of reading inputs, executing the program, and updating outputs. Shorter scan times improve responsiveness and control accuracy in real-time systems. Explain the

concept of ladder logic in PLC programming. Ladder logic is a visual programming language that mimics relay logic diagrams, using rungs and symbols to represent control circuits, making it intuitive for electrical technicians to develop and troubleshoot PLC programs. What are common safety considerations when testing or working with PLC systems? Safety considerations include disconnecting power before wiring, verifying correct grounding, using protective equipment, following lockout/tagout procedures, and ensuring that the system is in safe states before performing tests. How can you ensure the reliability of a PLC-controlled system during testing? Reliability can be ensured by thorough testing of individual components, validating program logic with simulations, implementing redundancy where necessary, maintaining proper documentation, and conducting regular system diagnostics and maintenance.

Related keywords: PLC test questions, PLC answers, programmable logic controller quiz, PLC troubleshooting, PLC programming exam, PLC fundamentals, industrial automation quiz, PLC training questions, PLC logic diagrams, PLC certification questions

logic a very short introduction very short introd

logic a very short introduction very short introd

Logic is the foundational discipline that underpins critical thinking, reasoning, and decision-making across various fields. It provides the tools to analyze arguments, distinguish valid from invalid reasoning, and develop sound conclusions. Whether in philosophy, mathematics, computer science, or everyday problem-solving, understanding logic is essential for clarity and rationality. In this brief introduction, we will explore what logic is, its significance, and its core components, setting a solid groundwork for further exploration.

What is Logic?

Definition of Logic

Logic is the systematic study of the principles of valid reasoning and argumentation. It involves understanding the structure of arguments and evaluating their validity based on established rules.

Historical Background

- Ancient Origins: Logic traces back to ancient civilizations, notably the Greeks with Aristotle, who formalized early principles of deductive reasoning.

- **Development Over Centuries:** From medieval scholasticism to modern symbolic logic, the field has evolved considerably.
- **Contemporary Relevance:** Today, logic is integral to computer science, artificial intelligence, linguistics, and philosophy.

Why is Logic Important?

Applications of Logic

- **Critical Thinking:** Enhances the ability to analyze arguments and identify fallacies.
- **Mathematics:** Provides the foundation for proof systems and formal theories.
- **Computer Science:** Underpins programming languages, algorithms, and machine reasoning.
- **Everyday Decision-Making:** Assists in making rational choices based on sound reasoning.

Benefits of Studying Logic

- Improves clarity in communication.
- Fosters analytical skills.
- Enables understanding complex concepts systematically.
- Supports the development of automated reasoning systems.

Core Components of Logic

Propositions

Propositions are statements that can be either true or false. They are the basic building blocks of logical reasoning.

Logical Connectives

Logical connectives are operators that combine propositions to form complex expressions:

- **And ($\wedge$):** Both propositions are true.
- **Or ($\vee$):** At least one proposition is true.
- **Not ($\neg$):** Negation of a proposition.
- **Implication ($\Rightarrow$):** If one proposition is true, then another is true.
- **Bi-conditional ($\Leftrightarrow$):** Both propositions are equivalent.

Arguments and Validity

An argument consists of premises leading to a conclusion. Validity depends on the logical structure:

- The premises should support the conclusion logically.
- Invalid arguments may have true premises and a false conclusion.

Logical Systems

Different logical systems exist to analyze various types of reasoning:

- **Propositional Logic:** Focuses on propositions and connectives.
- **Predicate Logic:** Incorporates quantifiers and predicates for more detailed reasoning.
- **Modal Logic:** Deals with necessity and possibility.

Types of Logic

Deductive Logic

Deductive logic involves reasoning from general principles to specific conclusions. If the premises are true, the conclusion must be true.

Inductive Logic

Inductive reasoning draws generalizations from specific observations, though conclusions may be probabilistic.

Formal Logic

Formal logic uses symbolic notation and strict rules to analyze the structure of arguments.

Informal Logic

Focuses on everyday reasoning, argumentation, and fallacy detection without symbolic notation.

Basic Logical Fallacies

Common Fallacies to Recognize

- Straw Man: Misrepresenting an argument to make it easier to attack.
- Ad Hominem: Attacking the person instead of the argument.
- False Dilemma: Presenting only two options when others exist.
- Appeal to Authority: Relying solely on authority rather than evidence.
- Slippery Slope: Suggesting a relatively small step leads to a significant consequence without proof.

Learning and Applying Logic

Steps to Improve Logical Thinking

- Study basic logical principles and vocabulary.
- Practice analyzing arguments in daily life and media.
- Learn to identify logical fallacies.
- Engage with puzzles, riddles, and formal logic exercises.
- Explore formal logic systems and proof techniques.

Tools and Resources

- Logic textbooks and online courses.
- Proof software and logic calculators.
- Philosophical and mathematical forums.
- Critical thinking workshops.

Conclusion

Logic is an essential intellectual tool that sharpens reasoning, enhances communication, and supports decision-making across all areas of life. Its study ranges from understanding simple propositions to complex formal systems, and its applications are vast—from computer programming to philosophy. Gaining a solid grasp of logic not only improves analytical skills but also fosters a rational approach to understanding the world. Whether you are a student, a professional, or a curious mind, delving into the basics of logic provides a valuable foundation for lifelong learning and effective reasoning.

If you'd like, I can expand on specific sections or include additional topics related to logic, such as symbolic notation, logical puzzles, or advanced logical theories.

Logic: A Foundational Pillar of Reasoning and Inquiry

Introduction

Logic, the systematic study of reasoning, has been a cornerstone of philosophy, mathematics, computer science, and cognitive science for centuries. Its primary purpose is to distinguish valid from invalid arguments, providing the framework for rigorous thinking and decision-making. As we navigate a world increasingly influenced by complex data, algorithms, and automated reasoning, understanding the fundamentals and evolution of logic becomes more crucial than ever. This article aims to explore the historical development, core principles, modern advancements, and ongoing debates within the field of logic, offering a comprehensive overview suitable for review and scholarly analysis.

The Historical Evolution of Logic

Ancient Foundations

The origins of logic trace back to ancient civilizations, with early formalizations emerging in Greece. Aristotle (384-322 BCE) is often regarded as the father of Western formal logic. His work *Organon* laid the groundwork for deductive reasoning, emphasizing syllogistic logic—a system of reasoning where conclusions are derived from two premises. Aristotle's logical system was primarily qualitative, focusing on categorical propositions and their relationships.

Meanwhile, in India, the Nyaya school developed sophisticated logical theories around the same period, emphasizing inference and debate. Simultaneously, Chinese philosophers like Mozi and later Confucian scholars addressed logical reasoning in ethical and political contexts.

Medieval and Early Modern Developments

During the Islamic Golden Age, scholars such as Al-Farabi and Avicenna expanded upon Aristotle's logic, integrating it with their philosophical systems. The medieval period in Europe saw the rise of scholastic logic, exemplified by figures like Thomas Aquinas, who used logical analysis to reconcile faith and reason.

The 17th and 18th centuries ushered in the scientific revolution, where logic began to intertwine with empirical science. The development of propositional and predicate logic laid the foundation for modern formal systems.

Modern and Contemporary Logic

In the late 19th century, George Boole formalized Boolean algebra, which became instrumental in the development of digital computers. Concurrently, Gottlob Frege introduced predicate logic, enabling more expressive formal languages.

The 20th century saw the emergence of mathematical logic as a rigorous discipline, with key figures such as Bertrand Russell, Kurt Gödel, and Alan Turing. Gödel's incompleteness theorems revealed fundamental limitations in formal systems, profoundly impacting philosophy and mathematics.

Today, logic continues to evolve with subfields like modal logic, non-classical logics (fuzzy, intuitionistic), and computational logic, reflecting the diverse applications and ongoing research frontiers.

Core Principles and Types of Logic

Deductive vs. Inductive Logic

Understanding the distinction between deductive and inductive reasoning is essential:

- Deductive Logic: Conclusions necessarily follow from premises. Validity is absolute; if premises are true, the conclusion must be true. Example: All humans are mortal; Socrates is human; therefore, Socrates is mortal.

- Inductive Logic: Conclusions are probable, based on patterns or evidence. They are not guaranteed but supported by likelihood. Example: The sun has risen every day; therefore, it will rise again tomorrow.

Formal vs. Informal Logic

- Formal Logic: Uses symbolic systems, mathematical notation, and rigorous rules to analyze validity. It includes propositional logic, predicate logic, modal logic, etc.

- Informal Logic: Focuses on natural language arguments, fallacies, and reasoning in everyday contexts. It is vital for critical thinking and assessing persuasive arguments.

Major Types of Logical Systems

- Propositional Logic

Deals with simple declarative sentences connected by logical connectives (and, or, not, implies).

- Predicate Logic

Extends propositional logic by including quantifiers (for all, there exists) and predicates, allowing more detailed statements about objects.

- Modal Logic

Incorporates notions of necessity and possibility, useful in philosophy and computer science.

- Non-Classical Logics

- Fuzzy Logic: Handles degrees of truth, useful in AI and control systems.
- Intuitionistic Logic: Rejects some classical principles, relevant in constructive mathematics.
- Relevance Logic: Emphasizes the relevance of premises to conclusions.

Modern Applications of Logic

Logic in Computer Science

The influence of logic on computer science is profound. Formal logic underpins:

- Programming Languages: Formal semantics define how programs behave.
- Automated Theorem Proving: Algorithms verify the correctness of software and hardware.
- Artificial Intelligence: Knowledge representation, reasoning engines, and expert systems rely heavily on logical frameworks.
- Cryptography: Logical rigor ensures security protocols.

Logic in Philosophy and Cognitive Science

Philosophers utilize logic to analyze arguments, clarify concepts, and investigate metaphysical and epistemological questions. Cognitive scientists study how humans process logical reasoning,

shedding light on rationality and biases.

Logic in Mathematics and Formal Sciences

Mathematicians leverage logic to formalize proofs, develop new theories, and explore foundational issues such as set theory and the nature of mathematical truth.

Current Debates and Future Directions

Limits of Formal Systems

Gödel's incompleteness theorems demonstrate that no sufficiently powerful and consistent formal system can prove all truths within its language. This raises questions about the completeness of logical frameworks and whether human reasoning can transcend formal limitations.

Artificial Intelligence and Logic

As AI systems grow more complex, the adequacy of classical logic for modeling real-world reasoning is debated. Alternative logics and probabilistic reasoning are being explored to address uncertainty and ambiguity.

Non-Classical Logics and Their Adoption

The expansion of non-classical logics reflects recognition that classical logic may not suffice for all applications. Their integration into practical systems remains an active area of research.

Philosophical Challenges

Questions about the nature of logical truth, the relationship between logic and language, and the possibility of alternative logical systems continue to stimulate philosophical inquiry.

Conclusion: The Enduring Relevance of Logic

Logic remains an indispensable discipline, bridging abstract reasoning and practical application. Its evolution from ancient syllogisms to modern computational systems illustrates its adaptability and foundational significance. As technology advances and interdisciplinary research expands, logic continues to shape our understanding of reasoning, truth, and the nature of knowledge itself. Future developments promise to deepen our grasp of rationality, challenge existing paradigms, and open new horizons for innovation and inquiry.

In essence, logic is not merely a tool for philosophers or mathematicians but a universal language of

reasoning that underpins our pursuit of understanding in every domain of human thought.

QuestionAnswer What is the main purpose of 'Logic: A Very Short Introduction'? The book aims to provide a concise overview of logic, its principles, and its importance in philosophy and everyday reasoning. Who is the author of 'Logic: A Very Short Introduction'? The book is written by Graham Priest, a renowned philosopher and logician. What topics are covered in this short introduction to logic? It covers fundamental concepts like propositional and predicate logic, logical reasoning, fallacies, and the significance of logic in philosophy. Is 'Logic: A Very Short Introduction' suitable for beginners? Yes, it is designed to be accessible for newcomers to logic, providing clear explanations without requiring prior knowledge. How does this book differ from more comprehensive logic textbooks? It offers a brief, high-level overview ideal for quick understanding, whereas detailed textbooks delve deeper into technical aspects. Can this book help improve critical thinking skills? Absolutely, by understanding logical principles, readers can enhance their reasoning and decision-making abilities. Is knowledge of formal logic necessary to understand this book? No, the book introduces formal logic concepts in a straightforward way suitable for beginners. Where can I find 'Logic: A Very Short Introduction'? It is available in bookstores, online retailers, and can often be accessed through libraries or digital platforms.

Related keywords: logic, introduction, philosophy, reasoning, critical thinking, argumentation, formal systems, propositional logic, deductive reasoning, logic fundamentals

Read the full article online: [Logic a very short introduction very short introd](#)