uCertify

Course Outline

Computer Organization and Architecture

19 May 2024

1. Pre-Assessment
2. Exercises, Quizzes, Flashcards & Glossary

   Number of Questions
3. Expert Instructor-Led Training
4. ADA Compliant & JAWS Compatible Platform
5. State of the Art Educator Tools
6. Award Winning Learning Platform (LMS)
7. Chapter & Lessons

   Syllabus

   Chapter 1: Introduction

   Chapter 2: Basic Concepts and Computer Evolution

   Chapter 3: Performance Concepts

   Chapter 4: A Top-Level View of Computer Function and Interconnection

   Chapter 5: The Memory Hierarchy: Locality and Performance

   Chapter 6: Cache Memory

   Chapter 7: Internal Memory

   Chapter 8: External Memory

   Chapter 9: Input/Output

   Chapter 10: Operating System Support

   Chapter 11: Number Systems

   Chapter 12: Computer Arithmetic

   Chapter 13: Digital Logic

   Chapter 14: Instruction Sets: Characteristics and Functions

   Chapter 15: Instruction Sets: Addressing Modes and Formats

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   Chapter 19: Instruction-Level Parallelism and Superscalar Processors

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Chapter 24: Appendix B: Victim Cache Strategies

Chapter 25: Appendix C: Interleaved Memory

Chapter 26: Appendix D: The International Reference Alphabet

Chapter 27: Appendix E: Stacks

Chapter 28: Appendix F: Recursive Procedures

Chapter 29: Appendix G: Additional Instruction Pipeline Topics

Videos and How To

8. Practice Test

   Here's what you get

   Features

9. Performance Based labs

   Lab Tasks

   Here's what you get

10. Post-Assessment

1. Pre-Assessment

Pre-Assessment lets you identify the areas for improvement before you start your prep. It determines what students know about a topic before it is taught and identifies areas for improvement with question assessment before beginning the course.

2. Exercises

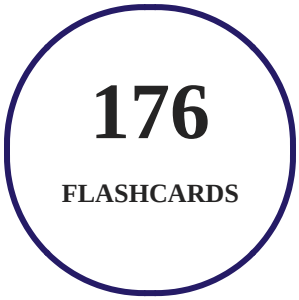
There is no limit to the number of times learners can attempt these. Exercises come with detailed remediation, which ensures that learners are confident on the topic before proceeding.

3. Quiz

Quizzes test your knowledge on the topics of the exam when you go through the course material. There is no limit to the number of times you can attempt it.

4. flashcards

Flashcards are effective memory-aiding tools that help you learn complex topics easily. The flashcard will help you in memorizing definitions, terminologies, key concepts, and more. There is no limit to the number of times learners can attempt these. Flashcards help master the key concepts.



5. Glossary of terms

uCertify provides detailed explanations of concepts relevant to the course through Glossary. It contains a list of frequently used terminologies along with its detailed explanation. Glossary defines the key terms.

6. Expert Instructor-Led Training

uCertify uses the content from the finest publishers and only the IT industry's finest instructors. They have a minimum of 15 years real-world experience and are subject matter experts in their fields. Unlike a live class, you can study at your own pace. This creates a personal learning experience and gives you all the benefit of hands-on training with the flexibility of doing it around your schedule 24/7.

7. ADA Compliant & JAWS Compatible Platform

uCertify course and labs are ADA (Americans with Disability Act) compliant. It is now more accessible to students with features such as:

- Change the font, size, and color of the content of the course
- Text-to-speech, reads the text into spoken words
- Interactive videos, how-tos videos come with transcripts and voice-over
- Interactive transcripts, each word is clickable. Students can clip a specific part of the video by clicking on a word or a portion of the text.

JAWS (Job Access with Speech) is a computer screen reader program for Microsoft Windows that reads the screen either with a text-to-speech output or by a Refreshable Braille display. Student can easily navigate uCertify course using JAWS shortcut keys.

8. State of the Art Educator Tools

uCertify knows the importance of instructors and provide tools to help them do their job effectively. Instructors are able to clone and customize course. Do ability grouping. Create sections. Design grade scale and grade formula. Create and schedule assessments. Educators can also move a student from self-paced to mentor-guided to instructor-led mode in three clicks.

9. Award Winning Learning Platform (LMS)

uCertify has developed an award winning, highly interactive yet simple to use platform. The SIIA CODiE Awards is the only peer-reviewed program to showcase business and education technology's finest products and services. Since 1986, thousands of products, services and solutions have been recognized for achieving excellence. uCertify has won CODiE awards consecutively for last 7 years:

- **2014**
    1. Best Postsecondary Learning Solution

- **2015**
    1. Best Education Solution
    2. Best Virtual Learning Solution
    3. Best Student Assessment Solution
    4. Best Postsecondary Learning Solution
    5. Best Career and Workforce Readiness Solution
    6. Best Instructional Solution in Other Curriculum Areas
    7. Best Corporate Learning/Workforce Development Solution

- **2016**
    1. Best Virtual Learning Solution
    2. Best Education Cloud-based Solution
    3. Best College and Career Readiness Solution
    4. Best Corporate / Workforce Learning Solution
    5. Best Postsecondary Learning Content Solution

6. Best Postsecondary LMS or Learning Platform
7. Best Learning Relationship Management Solution

- **2017**
  1. Best Overall Education Solution
  2. Best Student Assessment Solution
  3. Best Corporate/Workforce Learning Solution
  4. Best Higher Education LMS or Learning Platform

- **2018**
  1. Best Higher Education LMS or Learning Platform
  2. Best Instructional Solution in Other Curriculum Areas
  3. Best Learning Relationship Management Solution

- **2019**
  1. Best Virtual Learning Solution
  2. Best Content Authoring Development or Curation Solution
  3. Best Higher Education Learning Management Solution (LMS)

- **2020**
  1. Best College and Career Readiness Solution
  2. Best Cross-Curricular Solution
  3. Best Virtual Learning Solution

10. Chapter & Lessons

uCertify brings these textbooks to life. It is full of interactive activities that keeps the learner engaged. uCertify brings all available learning resources for a topic in one place so that the learner can efficiently learn without going to multiple places. Challenge questions are also embedded in the chapters so learners can attempt those while they are learning about that particular topic. This helps them grasp the concepts better because they can go over it again right away which improves learning.

Learners can do Flashcards, Exercises, Quizzes and Labs related to each chapter. At the end of every lesson, uCertify courses guide the learners on the path they should follow.

Syllabus

Chapter 1: Introduction

- What’s New in the Eleventh Edition
- Support of ACM/IEEE Computer Science and Computer Engineering Curricula
- Objectives
- Example Systems
- Plan of the Text

Chapter 2: Basic Concepts and Computer Evolution

- Organization and Architecture
- Structure and Function
- The IAS Computer
- Gates, Memory Cells, Chips, and Multichip Modules
- The Evolution of the Intel x86 Architecture
- Embedded Systems
- ARM Architecture

Chapter 3: Performance Concepts

- Designing for Performance
- Multicore, Mics, and GPGPUs
- Two Laws that Provide Insight: Amdahl's Law and Little’s Law
- Basic Measures of Computer Performance
- Calculating the Mean
- Benchmarks and Spec

Chapter 4: A Top-Level View of Computer Function and Interconnection

- Computer Components
- Computer Function
- Interconnection Structures
- Bus Interconnection
- Point-to-Point Interconnect
- PCI Express

Chapter 5: The Memory Hierarchy: Locality and Performance

- Principle of Locality
- Characteristics of Memory Systems

- The Memory Hierarchy
- Performance Modeling of a Multilevel Memory Hierarchy

Chapter 6: Cache Memory

- Cache Memory Principles
- Elements of Cache Design
- Implementing Cache Controllers
- Intel x86 Cache Organization
- The IBM z13 Cache Organization
- Cache Performance Models

Chapter 7: Internal Memory

- Semiconductor Main Memory
- Error Correction
- DDR DRAM
- eDRAM
- Flash Memory
- Newer Nonvolatile Solid-State Memory Technologies

Chapter 8: External Memory

- Magnetic Disk
- RAID
- Solid State Drives
- Optical Memory
- Magnetic Tape

Chapter 9: Input/Output

- External Devices
- I/O Modules
- Programmed I/O
- Interrupt-Driven I/O
- Direct Memory Access
- Direct Cache Access
- I/O Channels and Processors
- External Interconnection Standards
- IBM z13 I/O Structure

Chapter 10: Operating System Support

- Operating System Overview
- Scheduling
- Memory Management
- Intel x86 Memory Management
- ARM Memory Management

Chapter 11: Number Systems

- The Decimal System
- Positional Number Systems
- The Binary System
- Converting Between Binary and Decimal
- Hexadecimal Notation

Chapter 12: Computer Arithmetic

- The Arithmetic and Logic Unit
- Integer Representation
- Integer Arithmetic
- Floating-Point Representation

- Floating-Point Arithmetic

Chapter 13: Digital Logic

- Boolean Algebra
- Gates
- Combinational Circuits
- Sequential Circuits
- Programmable Logic Devices

Chapter 14: Instruction Sets: Characteristics and Functions

- Machine Instruction Characteristics
- Types of Operands
- Intel x86 and ARM Data Types
- Types of Operations
- Intel x86 and ARM Operation Types
- Appendix 13A Little-, Big-, and Bi-Endian

Chapter 15: Instruction Sets: Addressing Modes and Formats

- Addressing Modes

- x86 and ARM Addressing Modes
- Instruction Formats
- x86 and ARM Instruction Formats

Chapter 16: Assembly Language and Related Topics

- Assembly Language Concepts
- Motivation For Assembly Language Programming
- Assembly Language Elements
- EXAMPLES
- Types of assemblers
- Assemblers
- Loading and Linking

Chapter 17: Processor Structure and Function

- Processor Organization
- Register Organization
- Instruction Cycle
- Instruction Pipelining
- Processor Organization for Pipelining

- The x86 Processor Family
- The ARM Processor

Chapter 18: Reduced Instruction Set Computers

- Instruction Execution Characteristics
- The Use of a Large Register File
- Compiler-Based Register Optimization
- Reduced Instruction Set Architecture
- RISC Pipelining
- RISC-V Instructions
- MIPS R4000
- SPARC
- Processor Organization For Pipelining
- CISC, RISC, And Contemporary Systems

Chapter 19: Instruction-Level Parallelism and Superscalar Processors

- Overview
- Design Issues

- Intel Core Microarchitecture
- ARM Cortex-A8
- ARM Cortex-A53
- ARM Cortex-M3

Chapter 20: Control Unit Operation and Microprogrammed Control

- Micro-Operations
- Control of the Processor
- Hardwired Implementation
- Microprogrammed Control

Chapter 21: Parallel Processing

- Multiple Processor Organizations
- Symmetric Multiprocessors
- Cache Coherence and the MESI Protocol
- Multithreading and Chip Multiprocessors
- Clusters
- Nonuniform Memory Access

Chapter 22: Multicore Computers

- Hardware Performance Issues
- Software Performance Issues
- Multicore Organization
- Heterogeneous Multicore Organization
- INTEL Core i7 Memory Hierarchies
- The ARM Cortex-A53 and Intel Core i7 Memory Hierarchies
- INTEL Core i7-5960X
- INTEL Core i7 6700
- ARM Cortex-A15 MPCore
- IBM z13 Mainframe

Chapter 23: Appendix A: System Buses

- A.1 Bus Structure
- A.2 Multiple-Bus Hierarchies
- A.3 Elements of Bus Design

Chapter 24: Appendix B: Victim Cache Strategies

- B.1 Victim Cache
- B.2 Selective Victim Cache

Chapter 25: Appendix C: Interleaved Memory

Chapter 26: Appendix D: The International Reference Alphabet

Chapter 27: Appendix E: Stacks

- E.1 Stacks
- E.2 Stack Implementation
- E.3 Expression Evaluation

Chapter 28: Appendix F: Recursive Procedures

- F.1 Recursion
- F.2 Activation Tree Representation
- F.3 Stack Implementation
- F.4 Recursion and Iteration

Chapter 29: Appendix G: Additional Instruction Pipeline Topics

- G.1 Pipeline Reservation Tables
- G.2 Reorder Buffers

- G.3 Tomasulo’s Algorithm
- G.4 Scoreboarding

11. Practice Test

Here's what you get

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PRE-ASSESSMENTS QUESTIONS	POST-ASSESSMENTS QUESTIONS

Features

Each question comes with detailed remediation explaining not only why an answer option is correct but also why it is incorrect.

Unlimited Practice

Each test can be taken unlimited number of times until the learner feels they are prepared. Learner can review the test and read detailed remediation. Detailed test history is also available.

Each test set comes with learn, test and review modes. In learn mode, learners will attempt a question and will get immediate feedback and complete remediation as they move on to the next question. In test mode, learners can take a timed test simulating the actual exam conditions. In review mode, learners can read through one item at a time without attempting it.

12. Performance Based Labs

uCertify's performance-based labs are simulators that provides virtual environment. Labs deliver hands on experience with minimal risk and thus replace expensive physical labs. uCertify Labs are cloud-based, device-enabled and can be easily integrated with an LMS. Features of uCertify labs:

- Provide hands-on experience in a safe, online environment
- Labs simulate real world, hardware, software & CLI environment
- Flexible and inexpensive alternative to physical Labs
- Comes with well-organized component library for every task
- Highly interactive - learn by doing
- Explanations and remediation available
- Videos on how to perform

Lab Tasks

- Installing a CPU Fan on a Motherboard
- Installing Motherboard Components
- Installing a Motherboard, Processor, and Processor Fan
- Installing an Expansion Card on a Motherboard
- Calculating the Mean
- Installing Input and Output Devices
- Identifying a PCI Bus Slot
- Determining the Characteristics of Memory Devices in a Memory Architecture
- Determining L3 Cache Sizes for The Processors
- Determining Semiconductor Memory Types and Their Erasure Processes
- Installing DDR5 RAM on a Motherboard
- Connecting the Motherboard to the Internal Hard Disk
- Installing an NIC on a Motherboard of a CPU
- Connecting a New Workstation to the Internet
- Connecting a USB Printer
- Configuring a Wireless Client

- Converting Fraction Decimal Number into Equivalent Binary Number
- Converting Decimal Number into Two's Complement Binary Number
- Identifying Types of Logic Gates
- Drag the x86 data type to its description.
- Identify the Addressing Mode
- Using Greatest Common Divisor
- Installing an i7 Processor on a Motherboard
- Determining Characteristics of Processors
- Understanding the Intel Core Microarchitecture
- Understanding The Functioning of Microprogrammed Control Unit
- Determing the Types of Parallel Processor Systems
- Installing Memory Modules on a Motherboard
- Identifying Chip Organizations
- Identifying Levels of Cache
- Determining ARM ACE Cache Line States

Here's what you get

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PERFORMANCE BASED LAB

13. Post-Assessment

After completion of the uCertify course Post-Assessments are given to students and often used in conjunction with a Pre-Assessment to measure their achievement and the effectiveness of the exam.