CAREER PATHS

Virginia Evans
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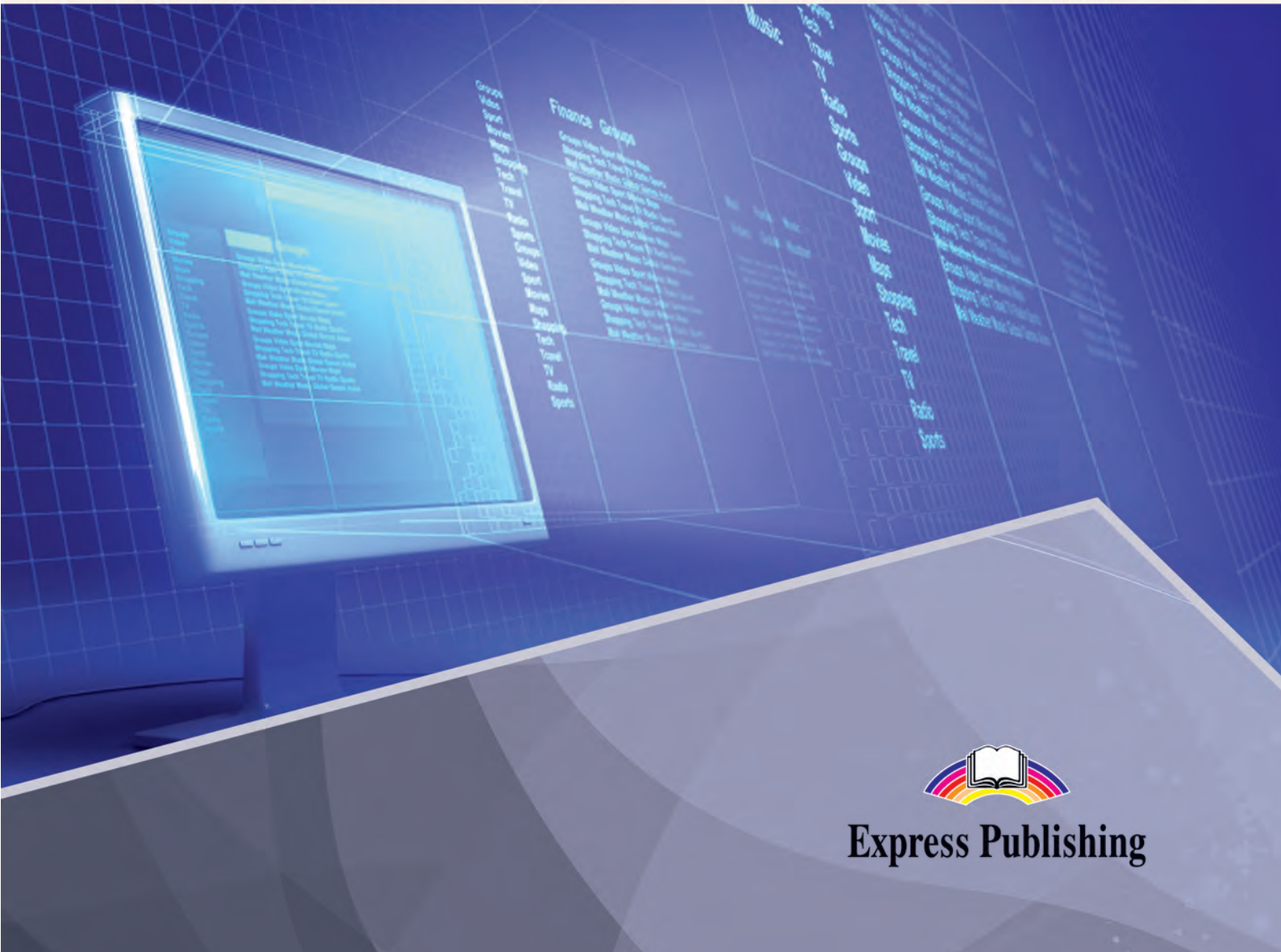
COMPUTER ENGINEERING



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CAREER PATHS

COMPUTER ENGINEERING

Book 1

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Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	The Computer Engineer	Webpage	computer engineer, computer science, design, develop, evaluate, hardware, investigate, mathematical analysis, software, test	Describing goals
2	Types of Computers	Webpage	computer, computer cluster, desktop, embedded computer, laptop, notebook, PC, server, tablet, workstation	Expressing a preference
3	I/O Devices 1	Textbook chapter	active matrix, bitmap, component, CRT, display, flat-panel, frame buffer, HD, LCD, monitor, pixel, screen	Expressing satisfaction
4	I/O Devices 2	Product description	button, click, electromechanical mouse, GUI, keyboard, LED, optical mouse, peripheral, pointer, QWERTY, scroll, scroll wheel	Making a prediction
5	Storage Devices	Article	capacity, CD, DVD, flash drive, flash memory, floppy disk, hard drive, magnetic tape, storage, Zip drive	Listing features
6	Inside the Computer	Troubleshooting guide	bay, case, CD/DVD drive, cover, fan, heat sink, motherboard, processor, port, power supply	Giving instructions
7	Networks	Webpage	antenna, broadband, CAT-5 cable, Internet, LAN, modem, network, router, signal, wireless, WLAN	Making a recommendation
8	Operating Systems	Advice column	Apple®, customize, Linux®, Microsoft®, open source, operating system, OS X®, software compatibility, Windows®	Politely disagreeing
9	Basic Math	Chart	add, divide by, equals, hundred, less, minus, multiply by, over, plus, subtract, times	Making a realization
10	Analyzing Quantities	Textbook chapter	convert, decimal numbers, denominator, fraction, numerator, -out-of, percent, percentage, point, reduce	Giving a reminder
11	Measurements	Conversion chart	Celsius, centimeter, convert, degree, Fahrenheit, gram, Imperial, inch, kilogram, Metric, ounce, pound	Expressing confusion
12	Energy	Textbook chapter	chemical energy, conservation of energy, energy, friction, heat energy, kinetic energy, potential energy, release, transfer, work	Realizing an error
13	Electricity 1	Course description	alternating current, charge, conduct, direct current, electricity, electrons, negative, polarity, positive	Confirming information
14	Electricity 2	Guide	ampere, conductor, current, electrical energy, electrical power, ohm, resistance, volt, voltage, watt	Describing a problem
15	Education	Webpage	bachelor's degree, calculus, computer architecture, electrical engineering, foundation, hardware design, mathematics, physics, programming, signal processing	Describing progress

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COMPUTER ENGINEERING

Book 2

Virginia Evans
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Express Publishing

Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Traits of a Computer Engineer	Job listing	critical thinking, curious, dedicated, detail-oriented, efficient, focus on, innovative, logical, mastery, pay close attention, talented, thorough	Describing skills and traits
2	The Scientific Method	Webpage	conclusion, control group, evaluation, experiment, experimental group, hypothesis, independent variable, observation, problem, prototype, result, scientific method, testable	Confirming information
3	Accounting	Textbook chapter	closed system, consumption, extensive quantity, final, generation, initial, input, intensive quantity, open system, output, system, universal accounting equation	Expressing confusion
4	SI and IEC Units	Email	binary, byte, exponential, factor, IEC, kibi-, kilo-, mebi-, mega-, prefix, SI unit, tebi-, tera-	Emphasizing a point
5	Describing Change	Magazine article	correspond, decline, decrease, double, expand, fluctuate, increase, Moore's law, obsolescence, rise, stabilize, steady, trend	Expressing interest
6	Describing Performance	Guide	availability, bandwidth, bit/s, compact, compression ratio, data compression, data decompression, data transmission, rate, resource, response time, terminal	Asking for a recommendation
7	Concepts in Physics	Course description	conservation, constant, electromagnetism, equilibrium, gravity, law, magnetism, momentum, motion, thermodynamics, vibration, wave	Correcting oneself
8	Theory of Computation	Textbook chapter	abstract, automata theory, computability theory, computational complexity theory, efficiently, machine, process, solvable, space complexity, theory of computation, time complexity, Turing machine	Asking for help
9	Control Systems	Class handout	control system, derivative, error, integral, ladder logic, linear control, logic control, negative feedback, on/off control, oscillation, PID control, process variable, proportional control, set point	Offering help
10	Solid-state Electronics	Webpage	charge carrier, confined, crystalline, electromechanical, electron hole, gas-discharge tube, moving part, semiconductor, solid, solid-state, vacuum	Realizing an error
11	Design Processes	Employee manual	assemble, constraint, construct, criteria, detailed design, estimate, feasibility, identify, narrow down, preliminary design, sketch, study, verify	Clarifying information
12	Algorithms	Textbook chapter	algorithm, automated, calculation, decidable, decision problem, determine, effective method, elegance, finite, function, goodness, sequence, step-by-step	Asking for an opinion
13	Memory	Journal article	cache memory, DIMM, DRAM, memory, nonvolatile memory, primary memory, secondary memory, SIMM, SRAM, volatile memory	Agreeing with an opinion
14	Chips	Webpage	bond, chip, defect, die, discard, insulator, integrated circuit, on/off switch, pattern, silicon, transistor, ULSI, VLSI, wafer	Reporting on progress
15	Internet Security	Email	anti- virus, audit log, authenticate, deny, encrypt, firewall, log in, password, permit, security, software, SSL connection, virus	Making a recommendation

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CAREER PATHS

COMPUTER ENGINEERING

Book 3

Virginia Evans
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Scope and Sequence

Unit	Topic	Reading context	Vocabulary	Function
1	Computer Languages 1	Textbook chapter	assembler, assembly language, binary digit, C, compiler, human-readable programming language, Java, machine language, programmer, systems software, translate	Expressing confusion
2	Computer Languages 2	Textbook chapter	address, basic block, bit, concept, conditional branch, data, data transfer instruction, instruction, instruction set, register, stored-program, word	Giving a reminder
3	Arithmetic for Computers 1	Textbook chapter	base 2, base 10, leading 0, leading 1, least significant bit, most significant bit, number base, sign bit, signed number, subscript, two's complement, unsigned number	Asking for clarification
4	Arithmetic for Computers 2	Textbook chapter	addition, bit-wise shift, borrow, carry-out, division, exception, ignore, interrupt, multiplication, operand, overflow, recognize, result, subtraction, value	Making a realization
5	Arithmetic for Computers 3	Webpage	accurate, approximation, double precision, exponent, floating point, guard digits, infinite, integer, normalized, round, scientific notation, significand, single precision, sticky bit, ulp, underflow	Confirming information
6	Assessing Performance 1	Report	clock cycle, clock rate, CPI, CPU time, execution time, metric, performance, system CPU time, throughput, user CPU time, wall-clock time	Describing mixed results
7	Assessing Performance 2	Webpage	Amdahl's law, application, arithmetic mean, benchmark, diminishing returns, MIPS, reproducibility, SPEC CPU benchmark, SPEC ratio, weighted arithmetic mean, weighting factor, workload	Checking for understanding
8	Datapaths and Control	Textbook chapter	adder, ALU, arithmetic-logical, branch, control, data selector, datapath, destination, implementation, instruction class, memory-reference, multiplexer, PC, source	Explaining a process
9	Pipelining 1	Journal article	branch hazard, branch prediction, control hazard, concurrently, data hazard, forwarding, hazard, latency, load-use data hazard, pipeline stall, pipelining, stage, structural hazard, untaken branch	Describing possibility
10	Pipelining 2	Textbook chapter	branch delay slot, branch history table, branch prediction buffer, branch target buffer, bubble, correlating predictor, dynamic branch prediction, flush instructions, NOP, tournament branch predictor	Asking for an explanation
11	Memory Hierarchy 1	Message board	access time, block, hit, hit rate, hit time, memory hierarchy, miss penalty, miss rate, principle of locality, reference, spatial locality, temporal locality	Making comparisons
12	Memory Hierarchy 2	Encyclopedia entry	access, cache, cache miss, consistent, direct-mapped cache, fully associative cache, handle, parallel, queue, set-associative cache, split cache, tag, valid bit, write-back, write buffer, write-through	Asking for help
13	Virtual Memory	Textbook chapter	address space, address translation, LRU replacement scheme, page, page fault, page table, protection, physical address, reference bit, segmentation, share, swap space, TLB, virtual address, virtual memory	Explaining terms
14	Disk Storage	Journal article	controller time, cylinder, disk controller, hot swapping, magnetic disk, mirroring, protection group, rotational latency, RAID, seek, seek time, sector, standby spare, striping, track	Disagreeing with an opinion
15	Buses	Online encyclopedia entry	asynchronous, backplane bus, bus, bus transaction, FireWire, handshaking protocol, parallel bus, processor-memory bus, read transaction, SCSI, serial bus, split transaction protocol, synchronous, USB, write transaction	Clarifying information

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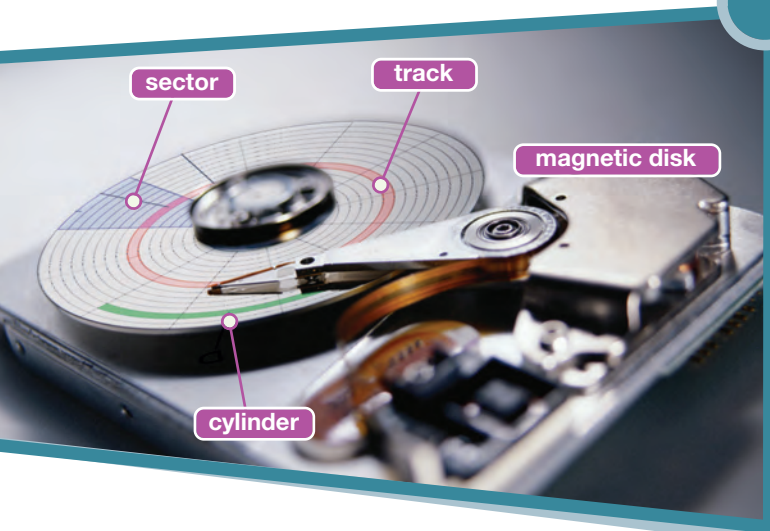
14 Disk Storage

Get ready!

1 Before you read the passage, talk about these questions.

1 How do magnetic disks organize data?
2 What kind of redundancy schemes are there for magnetic disks?



Excerpts from:

Magnetic Disk Storage and RAID Configurations

*by **Dr. Gerald Hart, Ph.D***
*Article from the **International Journal of Computer Hardware and Engineering***

Despite advancement in SSDs, **magnetic disks** are still the standard for secondary memory. With fast **seek times** and low **rotational latency**, disk storage is highly efficient.

One of the advantages of magnetic disk storage is its data organization. The disk is divided into **tracks**, and tracks are divided into **sectors**. Some older machines also reference **cylinders**. A **seek** positions the read/write head over the correct track or cylinder. Most magnetic disks have a dedicated **disk controller** to improve performance. Magnetic disks will remain useful as long as **controller time** remains low.

Redundancy schemes for magnetic disks are called **RAIDs** (redundant arrays of inexpensive disks). RAID configurations are largely responsible for the practicality of magnetic disks. RAID 1, known as **mirroring**, is the most expensive RAID configuration. Mirroring requires a check disk for every active data disk. Other RAID configurations arrange data disks into **protection groups** to minimize hardware requirements. **Striping**, though referred to as RAID 0, has no actual redundancy.

No matter how efficient the RAID configuration, disks will fail and need replacement. While RAIDs usually prevent system failures, **hot swapping** is a risky process. In order to avoid shutting down the system, some machines use **standby spares**. The standby spares remain inactive until a primary disk fails.

Reading

2 Read the journal article. Then, mark the following statements as true (T) or false (F).

1 What is the main idea of the article?
- **A** changes in disk storage methods over the years
- **B** the advantages of magnetic disk storage methods
- **C** challenges of using magnetic disk storage for secondary memory
- **D** ways to prevent disk storage failures

2 Which is NOT true of RAID configuration?
- **A** It is an efficient alternative to striping.
- **B** It sometimes requires hot swapping.
- **C** It uses standby spares to replace failed disks.
- **D** Its disks can be organized into protection groups.

3 Why is mirroring so expensive?
- **A** It requires the organization of additional protection groups.
- **B** It makes hot swapping necessary when disks fail.
- **C** It requires a duplicate disk for every data disk.
- **D** It is usually combined with the use of standby spares.

Vocabulary

3 Match the words (1-7) with the definitions (A-G).

1 __ seek
2 __ track
3 __ cylinder
4 __ striping
5 __ mirroring
6 __ magnetic disk
7 __ rotational latency

- **A** all tracks that are underneath the read/write head
- **B** a type of nonvolatile memory that records data to rotating platters
- **C** the time required to move the correct sector under the read/write head
- **D** the process of distributing sequential blocks to separate disks
- **E** a single concentric circle on the surface of a disk
- **F** the process of recording identical data to two disks
- **G** the act of moving the read/write heads over the right track

4 **Read the sentence pairs. Choose which word or phrase best fits each blank.**

1 **sector / seek time**

A As disk technology advances, _____ decreases.

B Most magnetic disks can find the requested _____ quickly.

2 **RAID / disk controller**

A _____ is a method for increasing performance and reliability.

B A _____ handles instructions and operations for the disk.

3 **protection group / controller time**

A The engineers arranged redundancy with three disks to a _____ .

B A high _____ can slow down the processor considerably.

4 **hot swapping / standby spare**

A A _____ remains inactive until a data disk fails.

B _____ places high demands on the system during replacement.

5 **Listen and read the journal article again. What is the advantage of using standby spares?**

Listening

6 **Listen to a conversation between two computer engineers. Mark the following statements as true (T) or false (F).**

1 __ The engineers are deciding on a RAID scheme.

2 __ The woman would prefer to use mirroring.

3 __ The project will use standby spares instead of hot swapping.

7 **Listen again and complete the conversation.**

Engineer 1: Yeah, that's right. We know we'll be using **1** _____ _____ . But we need to decide on the level of redundancy.

Engineer 2: Right. So we have to decide what **2** _____ scheme to use?

Engineer 1: Yes. What are your thoughts?

Engineer 2: Well, I think we should use **3** _____ . It's the most reliable.

Engineer 1: **4** _____ _____ . I don't think we can justify the cost of mirroring.

Engineer 2: But isn't it in budget? I **5** _____ _____ the budget proposal just a few minutes ago.

Engineer 1: You're forgetting about the **6** _____ _____ . Part of that budget is needed for spare disks.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then, switch roles.**

USE LANGUAGE SUCH AS:

We need to decide ...

I disagree ...

You're forgetting ...

Student A: You are an engineer. Talk to Student B about:

- disk storage for a new project
- what redundancy scheme to use
- why another scheme is not practical

Student B: You are an engineer. Talk to Student A about disk storage for a new project.

Writing

9 **Use the reading passage and conversation from Task 8 to write a report to a senior engineer. Include: the status of the new project, what disk configuration you plan to use, and why you chose that configuration.**

15 Education

Get ready!

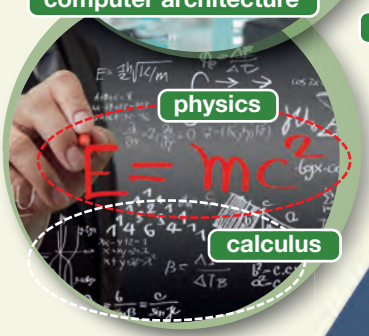
1 Before you read the passage, talk about these questions.

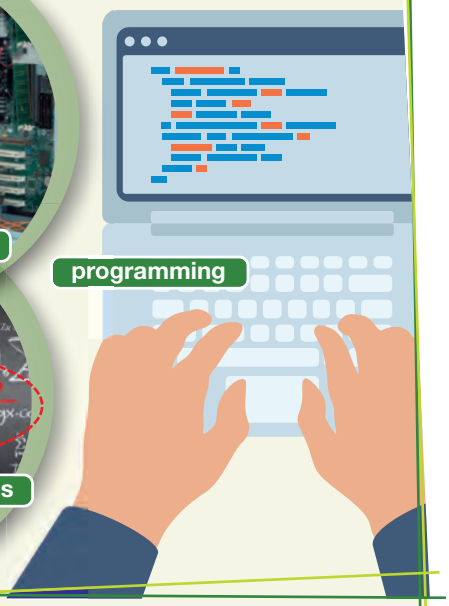
1 What classes do students usually take as part of a computer engineering degree?

2 What are some common prerequisites for computer engineering programs?

Central University – Bachelor's of Science in Computer Engineering

www.central-university.edu/programs/degrees/ computerengineering.html





Central University offers a **bachelor's degree** in computer engineering. The program covers circuitry and other aspects of **electrical engineering**. It also includes a comprehensive education in computer science. Students will gain an advanced understanding of computer hardware and software.

The first semester includes courses in **computer architecture**. These teach the basic physical structure of computers. Then, students move on to **programming**. This is where they will learn how to create software. Later courses include **signal processing** and **hardware design**.

Program applicants must have a strong background in **mathematics** and science. Before officially entering the program, students must take several **foundation** courses. These include introductory courses in **physics** and **calculus**.

Reading

2 Read the webpage. Then, mark the following statements as true (T) or false (F).

1 __ Students study mathematics before they are admitted to the program.

2 __ The first semester includes a course in signal processing.

3 __ Students are required to take calculus courses during the first year of the program.

Vocabulary

3 Match the words (1-6) with the definitions (A-F).

1 __ foundation
2 __ mathematics
3 __ bachelor's degree
4 __ signal processing
5 __ electrical engineering
6 __ computer architecture

A a certificate that is earned after four years of study

B a class that students take to prepare for a degree program

C the process of creating computers from hardware components

D a general field of study concerned with numbers and shapes

E a branch of engineering that focuses on the uses of electricity

F a branch of engineering that studies communication between electrical components and devices

4 **Read the sentence pairs. Choose which word or phrase best fits each blank.**

1 **calculus / physics**

A The lecture on _____ explains how gravity works.

B The student used _____ to find the slope of the curve.

2 **programming / hardware design**

A The student's skill at _____ helped her rewrite the software.

B The man created a new processor in his _____ class.

5 **Listen and read the webpage again. What courses must students take before applying to the computer engineering program?**

Listening

6 **Listen to a conversation between an academic advisor and a student. Choose the correct answers.**

1 What is the conversation mostly about?

A the woman's grades in the previous semester's courses

B the woman's application to enter the computer engineering program

C the woman's progress towards a bachelor's degree

D the woman's concerns about completing her engineering courses

2 Which of the following courses did the woman already take?

A programming **C** hardware design

B electrical engineering **D** signal processing

7 **Listen again and complete the conversation.**

Advisor: So, Lisa. You wanted to discuss **1** _____ _____ towards your degree?

Student: Yes. I'd also like to plan my next **2** _____ _____ _____.

Advisor: Let's see. You're about **3** _____ _____ the bachelor's degree program.

Student: That sounds about right. I just finished classes in programming and **4** _____ _____.

Advisor: Good. It looks like your ready for advanced **5** _____ _____.

Student: What does that include?

Advisor: Well, I'd recommend enrolling in **6** _____ _____ and hardware design.

Student: Okay. I'll sign up for both next semester.

Speaking

8 **With a partner, act out the roles below based on Task 7. Then, switch roles.**

USE LANGUAGE SUCH AS:

You're about halfway ...

I just finished ...

I thought I'd ...

Student A: You are an academic advisor. Talk to Student B about:

- his or her progress towards a degree
- the classes the student has already taken
- the classes the student still needs to take

Student B: You are a student. Talk to Student A about your progress towards a degree.

Writing

9 **Use the conversation from Task 8 to fill out the degree progress report.**

Mid-Year Progress Report

Advisor: _____

Student: _____

Before entering the program, the student completed _____

_____

After entering the program, the student completed _____

_____

Next, the student should _____

_____

_____

Glossary

abstract [ADJ-U8] If something is **abstract**, it exists in the form of a thought, but not as a real object or event.

algorithm [N-COUNT-U12] An **algorithm** is a set of precise rules describing the process for performing calculations.

anti-virus software [N-UNCOUNT-U15] **Anti-virus software** is a type of security software that removes malware, or prevents its installation.

assemble [V-T-U11] To **assemble** something is to put its parts together.

audit log [N-COUNT-U15] An **audit log** is a record of all user interactions with a protected system.

authenticate [V-T-U15] To **authenticate** something is to prove that it is correct or legitimate.

automata theory [N-UNCOUNT-U8] **Automata theory** is the study of abstract machines and the problems they are theoretically able to solve.

automated [ADJ-U12] If an action is **automated**, it is done by a machine.

availability [N-UNCOUNT-U6] **Availability** is the proportion of time that a computer system is functional and able to complete a task.

bandwidth [N-COUNT-U6] A **bandwidth** is a measurement of a computer network's ability to transmit information.

binary [ADJ-U4] If something is **binary**, it uses a number system based on two.

bit/s [N-COUNT-U6] A **bit/s**, or bit per second, is a unit that measures the rate of data transmission.

bond [V-T-U14] To **bond** two or more objects is to cause them to adhere to each other.

byte [N-COUNT-U4] A **byte** is a very small unit of computer data.

cache memory [N-UNCOUNT-U13] **Cache memory** is small, fast memory that stores recent or frequently-used data for fast access.

calculation [N-COUNT-U12] A **calculation** is the process of analyzing a mathematical problem and determining its solution.

charge carrier [N-COUNT-U10] A **charge carrier** is a free subatomic particle that carries an electrical charge.

chip [N-COUNT-U14] A **chip**, also called an integrated circuit, is an electronic circuit consisting of a large number of small devices mounted on one solid piece of semiconductor material.

closed system [N-COUNT-U3] A **closed system** is a system that does not gain or lose mass.

compact [ADJ-U6] If something is **compact**, it occupies a very small amount of space and its parts are usually closely joined or compressed.

compression ratio [N-COUNT-U6] A **compression ratio** is the difference between a file's actual size and its size while compressed.

computability theory [N-UNCOUNT-U8] **Computability theory** is the study of abstract machines and the computational problems they can solve.

computational complexity theory [N-UNCOUNT-U8] **Computational complexity theory** is the study of the resources computers need to solve problems.

conclusion [N-COUNT-U2] A **conclusion** is a decision or determination that is made after an experiment.

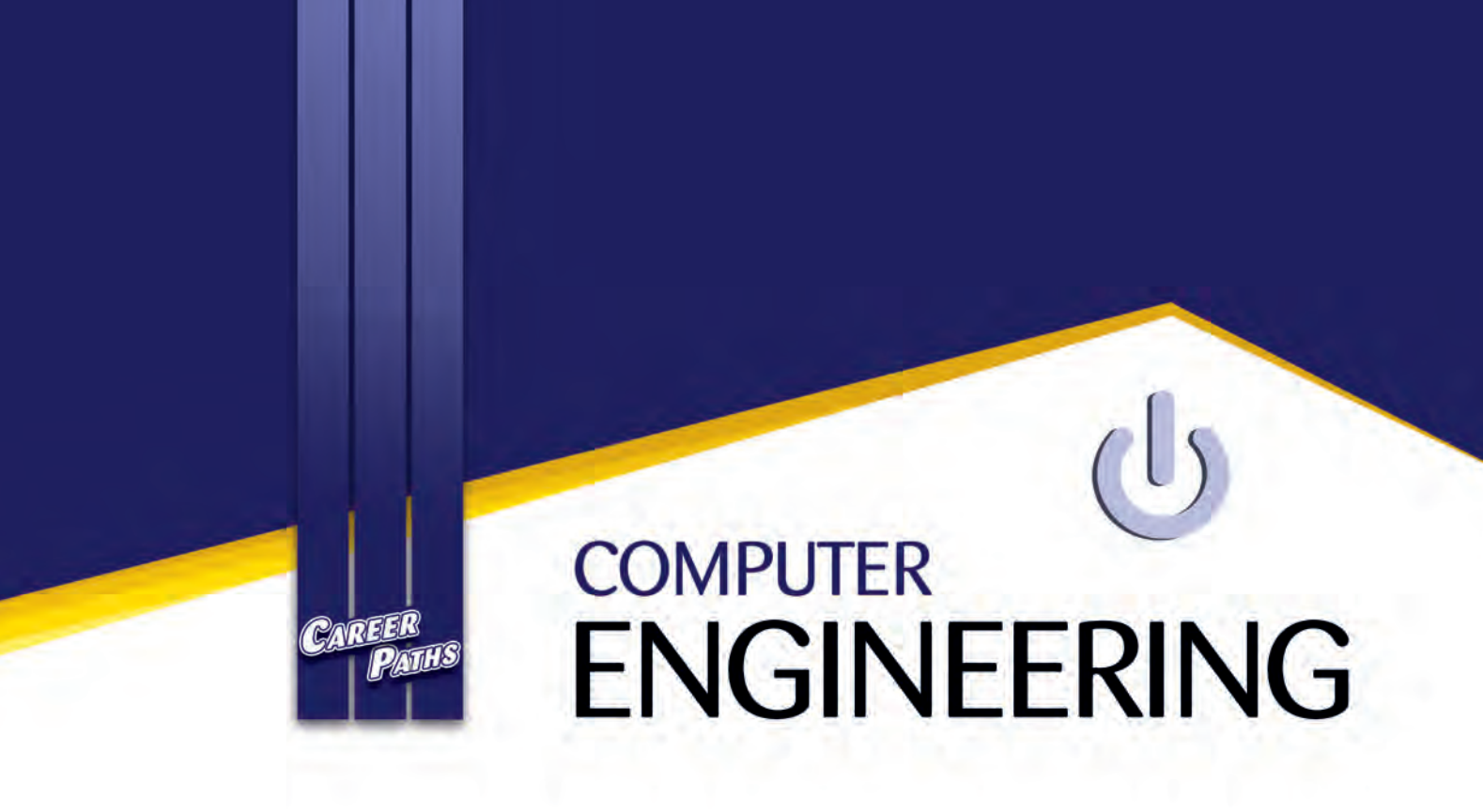
confined [ADJ-U10] If an object is **confined**, its movement is restricted to a certain area.

conservation [N-UNCOUNT-U7] **Conservation** is a principle that prevents the total value of a quantity in a system from changing.

constant [N-COUNT-U7] A **constant** is a number that never changes.

constraint [N-COUNT-U11] A **constraint** is a restricting condition.

construct [V-T-U11] To **construct** something is to build it.



Career Paths: Computer Engineering is a new educational resource for computer engineering professionals who want to improve their English communication in a work environment. Incorporating career-specific vocabulary and contexts, each unit offers step-by-step instruction that immerses students in the four key language components: reading, listening, speaking, and writing. ***Career Paths: Computer Engineering*** addresses topics including working with numbers, computer accessories, computer hardware, writing software, and operating systems.

The series is organized into three levels of difficulty and offers a minimum of 400 vocabulary terms and phrases. Every unit includes a test of reading comprehension, vocabulary, and listening skills, and leads students through written and oral production.

Included Features:

- A variety of realistic reading passages
- Career-specific dialogues
- 45 reading and listening comprehension checks
- Over 400 vocabulary terms and phrases
- Guided speaking and writing exercises
- Complete glossary of terms and phrases

The **Teacher's Guide** contains detailed lesson plans, a full answer key and audio scripts.

The **audio CDs** contain all recorded material.

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