Solutions Manual for C How to Program 9th Deitel

SOLUTIONS MANUAL SAMPLE PREVIEW

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Introduction to Computers and C

Objectives

In this chapter, you'll:

- Learn about exciting recent developments in computing.
- Learn computer hardware, software and Internet basics.
- Understand the data hierarchy from bits to databases.
- Understand the different types of programming languages.
- Understand the strengths of C and other leading programming languages.
- Be introduced to the C standard library of reusable functions that help you avoid "reinventing the wheel."
- Test-drive a C program that you compile with one or more of the popular C compilers we used to develop the book's hundreds of C code examples, exercises and projects (EEPs).
- Be introduced to big data and data science.
- Be introduced to artificial intelligence—a key intersection of computer science and data science.

Exercises

1.1 Categorize each of the following items as either hardware or software:
a) CPU.
Answer: Hardware.
b) C compiler.
Answer: Software.
c) ALU.
Answer: Hardware.
d) C preprocessor.
Answer: Software.
e) input unit.
Answer: Hardware.
f) an editor program.
Answer: Software.

1.2 *(Computer Organization)* Fill in the blanks in each of the following statements:
a) The logical unit that receives information from outside the computer for use by the computer is the _____.
Answer: input unit.
b) _____ is a logical unit that sends information which a computer has already processed to various devices for use outside the computer.
Answer: output unit.
c) _____ and _____ are a computer's logical units that retain information.
Answer: memory unit, secondary storage unit.
d) _____ is a computer's logical unit for performing calculations.
Answer: ALU.
e) _____ is a computer's logical unit for making logical decisions.
Answer: ALU.
f) _____ is a computer's logical unit for coordinating the other logical units' activities.
Answer: CPU.

1.3 Discuss the purpose of each of the following:
a) `stdin`
Answer: `stdin` (the standard input stream), which is normally the keyboard, but `stdin` can be connected to another stream.
b) `stdout`
Answer: Data is often output to `stdout` (the standard output stream), which is normally the computer screen, but `stdout` can be connected to another stream.
c) `stderr`
Answer: The standard error stream is referred to as `stderr`. The `stderr` stream (normally connected to the screen) is used for displaying error messages. It's common to route regular output data, i.e., stdout, to a device other than the

screen while keeping `stderr` assigned to the screen so that the user can be immediately informed of errors.

1.4 *(Gender Neutrality)* Write the steps of a manual procedure to process a text paragraph and replace gender-specific words with gender-neutral ones. Assuming you've been given a list of gender-specific words and their gender-neutral replacements (e.g., replace "wife" or "husband" with "spouse," replace "man" or "woman" with "person," replace "daughter" or "son" with "child," and so on), explain the procedure you'd use to read through a paragraph of text and manually perform these replacements. How might your procedure generate a strange term like "woperchild" and how might you modify your procedure to avoid this possibility? In Chapter 3, you'll learn that a more formal computing term for "procedure" is "algorithm," and that an algorithm specifies the *steps* to be performed and the *order* in which to perform them.

Answer: Search through the entire paragraph for a word such as "wife" and replace every occurrence with "spouse." Repeat this searching process for every gender specific word in the list. You could accidentally get a word like "woperchild" if you are not careful about how you perform replacements. For example, the word "man" can be part of a larger word, like "woman." So, replacing every occurrence of "man" can yield strange results. Consider the process of replacing "man" with "person" then replacing "son" with "child." If you encounter the word "woman," which contains the word "man," you'd replace "man" with "person" resulting in the word "woperson." In a subsequent pass you'd encounter "woperson" and replace "son" with "child" resulting in the "woperchild."

INSTRUCTOR NOTE: Exercises 1.5–1.17 are research and thought exercises for which we do not provide answers.

1.5 *(Self-Driving Cars)* Just a few years back, the notion of driverless cars on our streets would have seemed impossible (in fact, our spell-checking software doesn't recognize the word "driverless"). Many of the technologies you'll study in this book are making self-driving cars possible. They're already common in some areas.

a) If you hailed a taxi and a driverless taxi stopped for you, would you get into the back seat? Would you feel comfortable telling it where you want to go and trusting that it would get you there? What safety measures would you want in place? What would you do if the car headed off in the wrong direction?
b) What if two self-driving cars approached a one-lane bridge from opposite directions? What protocol should they go through to determine which car should proceed?
c) What if you're behind a car stopped at a red light, the light turns green, and the car doesn't move? You honk, and nothing happens. You get out of your car and notice that there's no driver. What would you do?
d) If a police officer pulls over a speeding self-driving car in which you're the only passenger, who—or what entity—should pay the ticket?

e) One serious concern with self-driving vehicles is that they could potentially be hacked. Someone could set the speed high (or low), which could be dangerous. What if they redirect you to a destination other than what you want?

1.6 ***(Research: Reproducibility)*** A crucial concept in data-science studies is reproducibility, which helps others (and you) reproduce your results. Research reproducibility and list the concepts used to create reproducible results in data-science studies.

1.7 ***(Research: Artificial General Intelligence)*** One of the most ambitious goals in the field of AI is to achieve *artificial general intelligence*—the point at which machine intelligence would equal human intelligence. Research this intriguing topic. When is this forecast to happen? What are some key ethical issues this raises? Human intelligence seems to be stable over long periods. Powerful computers with artificial general intelligence could conceivably (and quickly) evolve intelligence far beyond that of humans. Research and discuss the issues this raises.

1.8 ***(Research: Intelligent Assistants)*** Many companies now offer computerized intelligent assistants, such as IBM Watson, Amazon Alexa, Apple Siri, Google Assistant and Microsoft Cortana. Research these and others and list uses that can improve people's lives. Research privacy and ethics issues for intelligent assistants. Locate amusing intelligent-assistant anecdotes.

1.9 ***(Research: AI in Health Care)*** Research the rapidly growing field of AI big-data applications in health care. For example, suppose a diagnostic medical application had access to every x-ray that's ever been taken and the associated diagnoses—that's surely big data. "Deep Learning" computer-vision applications can work with this "labeled" data to learn to diagnose medical problems. Research deep learning in diagnostic medicine and describe some of its most significant accomplishments. What are some ethical issues of having machines instead of human doctors performing medical diagnoses? Would you trust a machine-generated diagnosis? Would you ask for a second opinion?

1.10 ***(Research: Privacy and Data Integrity Legislation)*** In the Preface, we mentioned HIPAA (Health Insurance Portability and Accountability Act) and the California Consumer Privacy Act (CCPA) in the United States and GDPR (General Data Protection Regulation) for the European Union. Laws like these are becoming more common and stricter. Investigate each of these laws and their effects on your privacy.

1.11 ***(Research: Personally Identifiable Information)*** Protecting users personally identifiable information (PII) is an important aspect of privacy. Research and comment on this issue.

1.12 ***(Research: Big Data, AI and the Cloud—How Companies Use These Technologies)*** For a major organization of your choice, research how they may be using each of the following technologies: AI, big data, the cloud, mobile, natural-language processing, speech recognition, speech synthesis, database, machine learning, deep learning, reinforcement learning, Hadoop, Spark, Internet of Things (IoT) and web services.

1.13 ***(Research: Raspberry Pi and the Internet of Things)*** It's now possible to have a computer at the heart of just about any device and to connect those devices to the Internet. This has led to the Internet of Things (IoT), which interconnects billions of devices. The Raspberry Pi is an economical computer often at the heart of IoT devices. Research the Raspberry Pi and some of the many IoT applications in which it's used.

1.14 ***(Research: The Ethics of Deep Fakes)*** Artificial-intelligence technologies make it possible to create *deep fakes*—realistic fake videos of people that capture their appearance, voice, body motions and facial expressions. You can have them say and do whatever you specify. Research the ethics of deep fakes. What would happen if you turned on your TV and saw a deep-fake video of a prominent government official or newscaster reporting that a nuclear attack was about to happen? Research Orson Welles and his "War of the Worlds" radio broadcast of 1938, which created mass panic.

1.15 ***(Research: Blockchain—A World of Opportunity)*** Cryptocurrencies like Bitcoin and Ethereum are based on a technology called blockchain that has seen explosive growth over the last few years. Research blockchain's origin, applications and how it came to be used as the basis for cryptocurrencies. Research other major applications of blockchain. Over the next many years, there will be extraordinary opportunities for software developers who thoroughly understand blockchain applications development.

1.16 ***(Research: Secure C and the CERT Division of Carnegie Mellon University's Software Engineering Institute)*** Experience has shown that it's challenging to build industrial-strength systems that stand up to attacks. Such attacks can be instantaneous and global in scope. Many of the world's largest companies, government agencies, and military organizations have had their systems compromised. Such vulnerabilities often come from simple programming issues. Building security into software from the start of its development can significantly reduce vulnerabilities. Carnegie Mellon University's Software Engineering Institute (SEI) created CERT (`https://www.sei.cmu.edu/about/divisions/cert/index.cfm`) to analyze and respond promptly to attacks. CERT publishes and promotes secure coding standards to help C programmers and others implement industrial-strength systems that avoid the programming practices that leave systems vulnerable to attacks. The CERT standards evolve as new security issues arise. The SEI CERT C Coding Standard is concerned with "hardening" computer systems and applications to resist attacks. Research CERT and discuss their accomplishments and current challenges. To help you focus on secure C coding practices, Chapters 2–12 and 14 contain Secure C Coding sections that present some key issues and techniques and provide links and references so that you can continue learning.

1.17 ***(Research: IBM Watson)*** IBM is partnering with tens of thousands of companies—including our publisher, Pearson Education—across a wide range of industries. Research some of IBM Watson's key accomplishments and the kinds of challenges IBM and its partners are addressing.