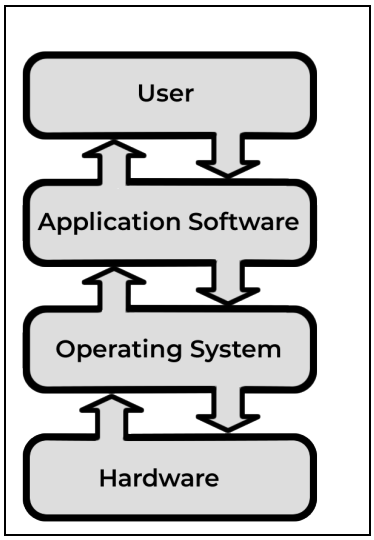
Foreword

Why study this book? To understand the importance of this type of book, one needs to look at the topics in the book and their relevance to students studying a computing discipline in the 21st century. The relevance and importance of the topics are crucial in understanding the foundations for information technology, computer science, and the other computing disciplines. Why are the topics included in this book important to you?

If you were building a house, you would not start by putting walls up without first preparing a foundation. A foundation serves to keep the house stable and precise. When a foundation is unstable, the whole house becomes unstable. OK, so how does this concept relate to computing? The concepts in this book are the foundation for computing disciplines.



Hierarchy of computing interactions
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The diagram shows the hierarchy of the interaction between a computing user, application software, operating systems, and hardware.

Notice that hardware is at the bottom of the hierarchy. It is our computing foundation. Hardware interacts with software, both operating systems and application software and all of these interact with users. Each one of these levels has many components. To get to each higher level we need to understand the levels below it. To build and use an operating system correctly, we need to understand all components that make up computing hardware and how they interface with the operating systems. To understand the use and need for application software, we should know the basis of operating systems so we can write software application code to work efficiently and

accurately with the operating system and hardware. The application software must support the needs of the users.

Most computing disciplines concentrate on the "soft" side of computing – primarily operating systems and computer applications. Computer engineers are more concerned with computer hardware – in other words, their discipline teaches how to design and build the hardware components. However, this does not mean that computing majors don't need to know anything about hardware and how it interfaces with the operating system and application software. IT, CS, and other computing disciplines need to know what components make up the hardware of a computer system, but not how to design and manufacture the actual hardware.

Many computer programmers believe they don't really need to understand operating systems or hardware because they are just working with computer programs. A computer programmer who uses, writes, and updates application software needs the knowledge of how operating systems work, and how all the hardware components interface with the operating system. This knowledge is crucial in writing complete, efficient, and usable software applications. However, most programmers feel very removed from the operating systems and hardware. As shown in the hierarchy diagram, the interfacing of hardware, operating systems, application software and users is both "up" and "down". Computing professionals need to be able to move both up and down and not just vertically in the hierarchy. Our primary study in information technology and computer science is the operating system and application software, but many information technology and computer science students go into networking where they work with the physical network and the software that controls it. They also go into cloud and web programming where they interface with physical and virtual networks. Computer security is a huge area of study in computing that needs to have a good understanding of hardware and software and how to protect both.

This book is dedicated to helping students in the computing disciplines understand the basics of computing hardware and how it interfaces with the operating system and application software, and the users. It provides some

fundamental information on how information is represented in computer systems and surveys some areas you will study more deeply in later classes.

Dr. Bob Brown has been teaching hardware and software concepts for many years to undergraduate students majoring in computing disciplines. He also worked for 30 years in industry in information technology dealing with hardware, software, and operating systems. His professional work experience has given him a unique knowledge of these areas and he brings this knowledge to this textbook. Learning this important set of foundational concepts will give you a solid foundation for your computing career.

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