

An Introduction to the Computer Age

Computers are changing our world. The invention of the internal combustion engine and the harnessing of electricity have had a profound effect on the way society operates. The widespread use of the computer is having a similar and perhaps even greater impact on our society.

In only decades, computers have shrunk from mammoth, room-filling machines that only the highly educated could operate to tiny devices held in the palm of the hand that the average person can use after a

small amount of training. Amazingly enough, as the size has decreased, the power has increased and prices have plummeted.

How does the computer age affect the Christian? What is the history behind the computer? What are the fundamental parts of a computer and how do they work together? What are the uses, advantages, and limitations of computers? Do I need a computer? This LightUnit and those following it will begin to answer some of these questions for you.



Section 1

Computer Background

Any study must be based on definitions about the subject. If definitions are not understood, there is little hope that much can be learned about the subject. The goal of the first section of this LightUnit is to provide a basis for the rest of the course by defining *computer* and many terms associated with computers. Since computers are a

very specialized field, new words have come into being, and many common words have acquired new definitions. Some of the words may already be familiar to you, but in the context of computers, they may take on a different meaning. Therefore, do not assume you know the definition even if the word is already familiar.

Section 1 Objectives

After you complete this section, you will be able to –

- define *computer*.
- explain what each part of the computer does.
- classify computers into broad categories.
- list advantages and limitations of a computer.

Lesson 1



What Is a Computer?

Terms to Know

data. A relatively unrelated collection of facts.

information. Data that has been organized to increase its usefulness.

What Is a Computer?

Simply stated, a computer is an electronic machine that can perform calculations and manipulate data with great speed and precision.

To the uninformed, a computer may have the appearance of a magic box. A computer operator can press a few keys on a keyboard, and pictures appear on the screen. Or an operator can type in his name, and the computer “remembers” it.

How is all this possible? How can a machine “know” anything? The next LightUnit will go into greater detail about how computers work, but for now, be content with the fact that a computer does not know anything. It is a hard, cold, nonliving object.

Classifying Computers

Computers are available in a wide variety of sizes and capabilities. Several decades ago, all computers were huge and, at their best, did much less than smaller computers of today. Here is a list of computers, ranging from the simplest to the most complex.

Microprocessor. A microprocessor is a very tiny computer, one that will fit on the tip of your finger! It is a tiny slice of silicon with many miniature circuits permanently wired onto it. A microprocessor may be designed to do only a very specific job, such as run a microwave oven. On the other

hand, it can be designed to control the complex operations inside a computer. Microprocessors are the building blocks for all classes of computers and therefore cost less than any of the following.

Microcomputer. The microcomputer will be the main emphasis of this course since it is the most common type of computer and you are more likely to have hands-on experience with it. The microcomputer has a microprocessor in it. Also included in it are devices for input, output, and storage. A microcomputer may be suitable for desktop, laptop, or hand-held use. A microcomputer is often called a PC, an abbreviation for *personal computer*.



What you see when you look for a microprocessor inside the computer. The microprocessor is actually behind these cooling fins.

Minicomputer. This type of computer is found in very large businesses or used in complex experiments and can handle much more information much faster than a microcomputer can; but it also costs ten to fifty times more than a microcomputer.

Minicomputers are sometimes used to allow several hundred microcomputers to work together in a linked arrangement called a network.

Mainframe. A mainframe computer is the “grandfather” of them all; the first computers were called mainframes. Today’s mainframes, however, are much more powerful, coordinating and controlling many hundreds of computer users at the same time as well as producing tremendous volumes of output. The cost? Several million dollars.

Supercomputer. A supercomputer is the most complex and fastest computer available today, and it may wear a price tag of many millions of dollars. Of course there are not many supercomputers around, but the companies who need them are usually working on complex scientific and engineering problems.

The distinctions between these types of computers are not clear-cut, and as computers continue to change, the differences decrease. For example, the mainframes of a few decades ago were much less capable than the notebook microcomputer of today.



From A to B: Humans can accomplish a goal in a variety of ways.

How Does a Computer Handle Data and Information?

A computer will do what it has been told to do. That does not necessarily mean it will do what you want it to do or what you mean for it to do. It knows only how to follow the instructions it has been programmed to follow, and it follows those instructions exactly the same way every time they are given.

Human beings are not that way. You may be instructed to clean your room, but you may do it a different way each week. One week you start at one corner and work your way through your room. The next week you start in a different corner and even push some things under the bed if you don’t want to deal with them at the moment! A computer, however, has no ability to do things in a different way; it must do a job exactly as it has been instructed. A computer would always start at the same place and clean everything the same way every time.

Driving from your house to a friend’s house is another example. The actual drive is never exactly like the last time because you must deal with variable situations on the highway (other cars, traffic lights, animals, etc.) All these variations make each trip different even though you drive the same car over the same highways each time. Furthermore, you could choose to go a different route. However, a computer (if it could drive) would know only to travel the route it was instructed to take and would be unable to compensate for the variables along the way. It would try to run through any detours or obstacles that got in the way.

These examples show that human beings do not deal with **data and information** as computers do. Computers and humans both process data; but until the computer gets precise instructions on how to process that data, it cannot transform the data

Lesson 1

into anything useful or perform any useful function. You have to tell the computer every minute detail—there is no room for error. Otherwise, they will produce wrong answers.

So although a computer may seem to do amazing things in unexplainable ways, there is really nothing magical about it. It operates on the basis of carefully defined instructions given to it by a human being.



Define computer.

1. _____



Write supercomputer, mainframe, minicomputer, microcomputer, or microprocessor.

2. _____ Used to computerize appliances.
3. _____ Found on many desks in homes, schools, and businesses.
4. _____ Costs the most.
5. _____ Often called a PC.
6. _____ Used to solve complex scientific and engineering problems.
7. _____ The least expensive.
8. _____ The grandfather of all computers.
9. _____ The smallest.
10. _____ Smaller than a mainframe but larger than a microcomputer.



Number these in order of simplest to most complex.

11. _____ minicomputer _____ supercomputer _____ microcomputer
_____ mainframe _____ microprocessor



Write true or false.

12. _____ A computer can only follow instructions it has been given.
13. _____ A computer may vary how it follows a set of instructions each time it is given a job to perform.
14. _____ The instructions given to a computer must include every minute detail.
15. _____ A computer will always do what you want it to do.
16. _____ Data is a collection of relatively meaningless facts.
17. _____ Information is a meaningful collection of related facts.
18. _____ Computers and human beings handle data and information in the same way.

Lesson 2



Advantages and Limitations of Computers

Advantages of Computers

Precision. A major advantage of a computer is that it does its work the same way every time, making it very precise. A computer is very useful in situations that deal with data by rote. For example, 1,376 plus 3,892 equals 5,268 every time, and *explain* will always be spelled *e-x-p-l-a-i-n*. So if a computer is instructed how to do a job correctly, such as adding numbers or checking spelling, it will complete these jobs accurately every time. Therefore the computer can be given the same job 50 times or 50,000 times, and the results will be predictable and precise every time. That's more than can be said about a person. Just one person working the following addition problem three different times may yield three different answers. Try it yourself. What answer do you get?

$$\begin{array}{r} 42,769 \\ 176,898 \\ 72,982 \\ 986,519 \\ + 723,268 \\ \hline \end{array}$$

Speed. A computer is also very fast. How long did it take you to do the 27 calculations in that problem? ten seconds? twenty seconds? a minute? Those units of measure are almost meaningless to a computer. It can perform calculations so fast that, when people talk about the speed of a computer, they talk about how many millions or billions or even trillions of calculations it can do each second! Even if you managed to whiz through the above problem in thirteen and one-half seconds, that would have been only two calculations per second. To describe the speed of computers, the terms *millisecond*, *microsecond*, *nanosecond*, and *picosecond* have come into being.

$$1 \text{ millisecond} = 1 \times 10^{-3} \text{ seconds} \\ \text{or } .001 \text{ seconds}$$

$$1 \text{ microsecond} = 1 \times 10^{-6} \text{ seconds} \\ \text{or } .000001 \text{ seconds}$$

$$1 \text{ nanosecond} = 1 \times 10^{-9} \text{ seconds} \\ \text{or } .000000001 \text{ seconds}$$

$$1 \text{ picosecond} = 1 \times 10^{-12} \text{ seconds} \\ \text{or } .000000000001 \text{ seconds}$$

Another commonly used term to describe the speed of a computer is *megahertz* (mhz). It designates the number of cycles a microprocessor runs per second. One megahertz is 1,000,000 cycles per second.

Versatility. A third advantage of a computer is its versatility. Picture a large aircraft engine manufacturing firm and the hundreds of computers that are found throughout that one organization. Even if the computers look similar, they can be used for completely different purposes. Engineers use computers to design the parts for the engines; they can even test them "on the screen" to tell if certain components will be strong enough to hold up under stress.

In the manufacturing department, computers control the machines that cut the sheets of steel, and computers control the robots that do the actual welding and assembly of the components.

Production managers use computers to keep track of how many turbines, fuel injectors, compressors, rivets, etc., they have on hand and to decide the best time to order more.

Financial experts examine columns of numbers on their computer screens. These numbers help them decide the best time to borrow money and the best way to invest money.

Top executives, who do not want to bother with a lot of day-to-day details, are

Lesson 2

interested in the bottom line—how is the company doing today? Are we making money? This information is available at their computer terminals so that they will know how to make company decisions.

Accountants keep track of where factory money is coming from and how it is spent.

Personnel managers can study their employees' records easily by using a computer; they simply let the computer "look" through hundreds or thousands of records and place them on the screen one by one or as a group.

Secretaries throughout the organization type memos, reports, and documents on their computers and send messages to one another through the wires.

And, finally, on payday, the employees are handed checks that were calculated, recorded, and printed by computers.

All this versatility is evident in one organization. That is multiplied many times over when you consider all the different types of organizations there are and how computers are found in almost all of them.

Limitations of Computers

Computers cannot think. Computers cannot do everything. Their biggest problem is that they cannot think. They may appear to think, but that is not the case! If computers are told the wrong process by which to arrive at a certain result, they will do it the wrong way every time and arrive at the wrong result every time. They don't know any better. And they won't care, either, even if that wrong result costs the company \$2,000,000,000 or ends a person's life. Computers have no feelings.

Computers cannot learn. A related limitation is that computers must be told every step, down to the smallest detail. They cannot use information they "learn" in one area and apply it to another area as human beings can. For example, you learn geographical, social, and historical facts about a country, and those facts help you understand the reasons for current events in that country. Or you do your trigonometry homework and can then figure out whether there



An accountant uses a computer to keep track of business records.

is room to safely fell the tree in your front yard without climbing to the top of the tree and throwing a tape measure to the ground. When a computer program is written for a specific purpose, the computer cannot use that program to figure out how to solve another problem; instead, another program must be written for that specific purpose.



Photo: Mark Peterstein

An author writes a book with a laptop computer in the comfort of her tropical surroundings.



An artist designs a cover for the book using several software programs.

Computers cannot evaluate some things. A third limitation is that a computer cannot evaluate or calculate certain things. A computer could show a teacher that a particular student's grades have dropped drastically during the last six-weeks period. But the computer would be unable to show why the grades dropped. Was it because the student became angry with the teacher? Was it because the student experienced a death in his family? Was it because the student has been losing sleep? The computer would not know, but an experienced teacher would be able to think through possible causes.

Thus, a computer is not the solution for every problem. A computer program has not yet been written to work in every situation, and today's computers are unable to solve some problems.

In areas involving speed and precision, they can usually surpass the human brain, but when it comes to matters of reasoning and common sense, the finest and fastest computer is still no match for the tiny, three-pound "computer" housed inside your skull.



After printing, the book is stored in the stockroom. A computer keeps track of inventory and sales.



The three-pound computer inside your skull far outshines the best man-made computer.

Lesson 2



Number these in order of smallest to largest.

1. _____ nanosecond _____ picosecond
_____ millisecond _____ microsecond



List three advantages of a computer.

2. _____
3. _____
4. _____



List three limitations of a computer.

5. _____
6. _____
7. _____



Complete these activities.

8. Look up Psalm 139:14. Copy it here. Memorize it. Do you think David was thinking about the wonders of the human brain when he penned that verse?

9. In what ways does the human brain outshine the best and fastest man-made computer?

LOOKING BACK . . .



Number these in order, smallest to largest. Can you do it without looking back at Lesson 1?

10. _____ microprocessor _____ mainframe _____ minicomputer
_____ microcomputer _____ supercomputer



Match.

- | | |
|-------------------------|--|
| 11. ____ microcomputer | a. most complex and the fastest computer |
| 12. ____ supercomputer | b. the “grandfather” of all computers |
| 13. ____ mainframe | c. used to create a network of microcomputers |
| 14. ____ microprocessor | d. often called a PC; most common type of computer |
| 15. ____ minicomputer | e. very tiny, the building block for all other computers |

Lesson 3



Parts of a Computer



Terms to Know

central processing unit (CPU). The part of a computer that controls the movement of data and performs calculations.

hard copy. A printed reproduction of computer data or graphic displays.

hardware. All physical components of the computer system that are not software. This includes the CPU, the monitor, the keyboard, the printer, a tape backup, a mouse, and a modem.

Not all computers are the same. In fact, computers come in many different sizes, but all computers need the same basic components to carry out their work. In the next few pages, you will be learning about the **hardware** computers use. Not all computers have all the components mentioned, indicating that not all computers have the same capabilities.

The Computer

The CPU. The computer is the box that houses all the computer’s internal components. It is often referred to as the CPU (**central processing unit**), although the CPU is really the main microprocessor

inside the computer. Some computers sit flat on the desktop; others sit in an upright position and are known as towers.

A computer receives input (data), processes that input, and produces output (information). A computer is also able to store data and information. Think of it like this: Suppose you are doing a geometry assignment about proofs. By reading the problem, your eyes become the “input device.” Then your mind does the processing. Finally, your hand becomes the “output device” as you write the answer on paper or some other storage medium. Your mouth can also be an output device if you tell the answer to a friend or the teacher.