Solutions for Homework1

Chapter 1 Problems

1. Name the four generations of electronic computers and their respective years of inclusion.

   1940 to 1950  First generation Computers use vacuum tubes
   1950 to 1964  Second generation Computers use transistors
   1964 to 1971  Third generation Computers use integrated circuits
   1971 to Present Fourth generation Computers use microprocessors

2. State the six elements of microcomputer system hardware and the purpose of each element. Give examples of each element.

   1) The Central Processing Unit (CPU) is the “brain” of the computer.
   2) A display device allows you to see information. A monitor is a display device.
   3) The CPU receives information from input devices. A keyboard is an input device.
   4) The CPU sends information to output devices. A common output device is a printer.
   5) Computers store information in memory. RAM and ROM are the two types of computer memory.
   6) Storage devices allow programs and data to be saved for easy retrieval at some other time. A hard disk drive is a storage device.

3. What are RAM and ROM? What are the differences between them?

   ROM and RAM are the two types of computer memory. ROM is read-only memory; this is permanent memory where the computer’s instruction set resides. No instructions can be added or written to ROM. Furthermore, ROM is not erased when the computer is shut down; instead, it is permanently retained, or hardwired, in the computer. Thus, ROM is also known as non-volatile memory. RAM, on the other hand, is used as temporary memory or workspace by the computer’s software programs. Unlike ROM, RAM is volatile memory that is erased when the computer is shut down.

4. Define the following terms:

   a) bit – a binary digit; a 0 or 1
   b) byte – a group of eight bits
   c) nibble – half of a byte; a group of four bits
   d) word – two bytes; a group of sixteen bits
   e) kilobyte (KB) – 1,024 (2^10) bytes
   f) megabyte (MB) – 1,048,576 (2^20) bytes
   g) gigabyte (GB) – 1,073,741,824 (2^30) bytes

5. What is the difference between a high-level language and a low-level language? Give examples of each.

   high-level language – a computer language that uses English-like phrases as instructions
   low-level language – a language in which there is a direct (usually one-to-one) correspondence between its instructions and the related machine language instructions
BASIC, C, Fortran, and Pascal are high-level languages. Assembly language is a low-level language.

6. What is the difference between a compiler and an interpreter? Give example languages for each.

A compiler is a computer program that translates high-level source code into machine language and creates an executable file. An interpreter is a computer language that translates and executes the source code instruction-by-instruction.

C, Fortran, and Pascal are compilers. BASIC and Java are examples of interpreters.

Chapter 1 Supplement Problems

1. Convert the following binary numbers to decimal by multiplying each bit by its respective decimal value and summing the results:

   a) \(0011_2 = 3\)
   b) \(0011\,0011_2 = 51\)
   c) \(1010\,1001_2 = 169\)
   d) \(0110\,1000_2 = 104\)
   e) \(1100\,1001\,0011_2 = 3219\)
   f) \(0111\,1100\,1001\,0011_2 = 31891\)

3. Convert the following decimal numbers to binary:

   a) \(13 = 1101_2\)
   b) \(42 = 0010\,1010_2\)
   c) \(125 = 0111\,1101_2\)
   d) \(255 = 1111\,1111_2\)
   e) \(300 = 0001\,0010\,1100_2\)

4. What decimal values can be represented using one bit? one nibble? one byte? one word?

   One bit can represent decimal values 0 or 1.
   One nibble can represent decimal values 0 through 15.
   One byte can represent decimal values 0 through 255.
   One word can represent decimal values 0 through 65535.
   In general, \(n\) bits can represent decimal values 0 through \(2^n - 1\).

5. Perform the following binary additions:

   a) \(0100\,1101_2 + 1010\,0011_2 = 1111\,0000_2\)
   b) \(0101\,1101_2 + 0000\,0011_2 = 0110\,0000_2\)
   c) \(1000\,1101_2 + 0011\,1111_2 = 1100\,1100_2\)
   d) \(1111\,1111_2 + 0000\,0001_2 = 0001\,0000\,0000_2\)
   e) \(1111\,1111_2 + 1111\,1111_2 = 0001\,1111\,1110_2\)