

**Please provide a definition of the following terms in your own words in the space provided. Each definition is worth 5 points.**

The Hyper-Text Markup Language (HTML)

HTML is a simple and universal language used for formatting, embedding graphics, and hyper textual linking of documents. It is the means by which web documents are represented ("the language of the web"). It allows users to share and browse information using a widely accepted protocol.

analog data

The representation of information which can take on an infinitely-fine range of values. Examples of analog data are the phonograph, camera, television, tape player, radio, or thermostat.

digital data

This is a representation of information which can take on only a specific set of values, and whose values exist only at specific time instants. Examples of systems using digital data are the computer, the internet, a CD player, and digital clocks.

bit

The fundamental element of digital information systems. A single bit can represent 2 values, 1/0, true/false...

byte

A byte is a logical grouping of 8 bits.

Pixel

The basic unit of pictorial representation in digital systems. A picture element. It can be as small as 1 bit (black and white) or several bytes long in the case of color pictures.

The Universal Resource Locator (URL)

The URL is the universal addressing mechanism for the World Wide Web. It denotes 1. an information service, 2. the location of the hosting server within the Internet, 3. the location of that information within the host, and 4. the document type.

Protocol

An agreed upon sets of rules providing order to different systems and situations. There are different protocols for different purposes. There are protocols for data storage, data transmission, etc.

### Transducer

An input transducer is a device that converts a physical signal from a source to an electrical, electromagnetic, or mechanical signal that is more suitable for communicating. An output transducer is a device that converts a received signal back into a useful physical quantity.

### bit mapped graphics

An image representation technique utilizing regularly arranged spatially separated pixels

### vector graphics

An image representation technique utilizing mathematical descriptions of objects contained in the image. The computer is able to redraw the image for viewing.

### variable length coding

A coding technique wherein different numbers of bits are used to represent different characters based on their frequency of occurrence. Characters that appear more often have fewer bits in their code and characters not appearing as frequently have more bits in their code. The codes must be uniquely identifiable regardless of their length.

### Lossy coding of images

Lossy coding is a technique wherein an image is compressed with a loss of information but those quality is good enough to resemble the original and fool the human eye.

**For each of the following problems, show all your work and answer in the space provided.**

Present an example where you can clearly identify the components of message, data, and information. Explain in your own words what these terms mean and why each is needed to explain and understand information technology. (20 points)

You are a winemaker and have a monitoring system that tells you the sugar content of the grapes. You squeeze a grape to extract its juice and put the juice into a beaker with the monitoring device.

The monitoring device conveys a **message** that “the grape contains 14% sugar” using **data** that is displayed on a computer screen in the form of letters.

The **information** that you as the winemaker receive from the **data** of this **message** is that it is time to pick your grapes and start making wine.

Another example:

Let us say that an army officer radios a command to one of his field agents. The **data** in this case would be the radio waves that carry the message.

After the receiving radio alters this data into an audible sound, the field agent hears the message “Go to grandma’s house.” This is the **message**.

Due to prior training/briefing, the field agent knows that this means that he should return to home base. So the **information** would be that the agent needs to return to home base.

True/**False**? Variable length coding works best with evenly distributed occurrences of data. (5 points)

The answer is **FALSE**. Variable length coding only works with unevenly distributed occurrences of data.

Explain the difference between a Web client and a Web server. Which basic role does each play? (10 points)

A web server is a computer running a software application that services requests from, and provides web pages to, other computers on the internet.

A web client is an application that presents/creates the user interface. It is basically receiving and displaying what the web server is providing.

Assume that it is desired to represent financial amounts ranging in size from zero to 1 billion dollars, with a precision of one cent. How many decimal digits are needed to handle this requirement? How many binary digits are required?

Explain your answer. (10 points)

To determine the requirements to represent 0-\$1 billion in .01 increments: Since we want to represent our financial amounts to a one cent precision, the possible decimal digits = 1,000,000,000.00 =  $1.0 \times 10^{11}$  (or  $1.0 \times 10^{12}$  if you consider the leading 1) (I will accept either answer.)

Therefore set  $2^n$  greater than or equal to  $1.0 \times 10^{11}$  to find the binary digit required; where n will be 37 ( $2^{37} = 1.37 \times 10^{11}$ ) so 37-bit word is sufficient to represent the amounts ranging from 0 to \$1 billion in increments of 1 cent.

Assume that you are receiving a data stream representing 8x12 characters, and you have just received the following data:

0000000000001100000100100010000101000000110000001  
100000011000000101001010001001000001101000000001

what character does this data stream represent. (do your work in the space provided below) (15 points)

00000000  
00011000  
00100100  
01000010  
10000001  
10000001  
10000001  
10000001  
01001010  
00100100  
00011010  
00000001

this data stream represents the letter: Q

An image storage format uses 1 byte for each of the 3 primary colors per picture element. How many different colors may be represented in the displayed image? (10 points)

Each color is represented by 8 bits or  $2^8=256$  levels. Combining the 3 colors implies  $256*256*256 = 16,777,216$  colors.

The concept of variable length coding occurs very often in human experience. Explain two examples of such coding. (10 points)

Morse code, frequency of occurrence determines the number of dots and lines. Letters like r,s,t,l,n,e (wheel of fortune) appear more often in the English language, thus have short codes, letters like Z and Q have longer codes, more dots and lines.

Variable length coding is also seen in computed statistics, say I want to write a simple binary code of all the cars that pass on my block every minute. From statistics I can find an average, standard deviation, and frequency count. Thus my highest frequency will use the lowest number of bits and the lowest count will use the highest number of bits. But I do have to tell everyone what protocol I am using.

Explain why image compression merits a special discussion that is different than regular data compression. (10 points)

Regular data compression involves many different types of data. The vast majority of these data cannot tolerate any loss of resolution between sender and receiver. (examples are accounting data, your grades at the registrar's office, etc.) This means that only lossless compression techniques may be employed.

Image data can tolerate a great deal of loss in the original quality of the image and still be recognized by the receiver. We can specifically make use of this fact by using compression techniques that allow for some of loss of image quality, thereby achieving greater compression than would otherwise be available using lossless techniques.