**Chapter 4 Data Formats**

1) Input from a device that represents a continuous range of data is known as

a) metadata.

**b) analog data.**

c) various data .

d) discrete data.

2) Information that describes or interprets the meaning of the data is known as

a) ASCII.

b) analog.

c) EBCDIC.

**d) metadata.**

3) Which of the following is NOT one of the common alphanumeric codes?

a) ASCII

b) Unicode

**c) Ordinal**

d) EBCDIC

4) When recording sound, the data that describes how long a time period each captured sound measurement represents is known as the

a) MIDI

b) WAVE

**c)** amplitude

d) **sampling rate**

5) The alphanumeric code that has codes for the characters of nearly every character-based alphabet of the world is

a) ASCII.

**b) Unicode.**

c) Ordinal.

d) EBCDIC.

6) Characters used to control the position of the output on the screen or paper, to cause some action to occur, such as ringing a bell or deleting a character, or to communicate status between the computer and an I/O device are called

a) glyphs.

b) symbols.

**c) control characters.**

d) command characters.

7) The order of the alphanumeric codes in the representation table, which will determine how data is sorted, is known as

a) metadata.

b) scan code.

c) control code.

**d) collating sequence.**

8) How many bytes are needed to store one ASCII character?

**a) 1**

b) 2

c) 3

d) 4

9) The presentation of an image as input or output, one pixel at a time, in order, is called

a) metadata.

b) sampling.

**c) a raster scan.**

d) collating sequence.

10) Image files that store each individual point within the image are

a) glyphs.

b) vector images.

c) object images.

**d) bitmap images.**

11) Images that are defined mathematically as geometrically definable shapes that can be easily moved around, scaled, and rotated without losing their shape and identity are known as

a) GIF images.

b) raster images.

**c) vector images.**

d) bitmap images.

12) An example of an image file that uses lossless compression is

a) TIFF.

**b) PNG.**

c) MP3.

d) JPEG.

13) Which image file format is best used for photographs of real-world objects?

a) GIF

b) PNG

c) MP3

**d) JPEG**

14) The nature of display technology makes it much more convenient and cost effective for regular printers and display screens to display and print all images as

a) palettes.

**b) bitmaps.**

c) equations.

d) pseudocode.

15) The color translation table, which translates the code for each pixel into actual color values, is known as

a) a theme.

b) a glyph.

**c) a palette.**

d) a color chart.

16) The individual elements that form a bitmap image are called

**a) pixels.**

b) palettes.

c) grid bits.

d) resolution.

17) Increasing or decreasing the number of pixels per inch changes the

a) codec.

b) amplitude.

**c) resolution.**

d) color depth.

18) Making the pixels smaller and increasing their number will result in a

a) corrupt file.

**b) clearer image.**

c) loss of quality.

d) smaller file size.

19) Which of the following is NOT an advantage of object images over bitmap images?

**a) Easy to create**

b) Manipulated easily

c) Resolution independent

d) Require far less storage space

20) In graphically based systems it is necessary to distinguish between characters and their object image-based representations, known as

a) PNGs.

b) TIFFs.

c) icons.

**d) glyphs.**

21) Video format is determined by an encoder/decoder algorithm known as a

**a) codec.**

b) modifier.

c) converter.

d) transformer.

22) Video that is transmitted through a network and displayed in real time is called

a) raster.

b) flowing.

**c) streaming.**

d) Post Script.

23) Original sound waves are analog in nature and must be converted to digital form for use in the computer. The circuit that performs this function is known as a(n)

a) analog inverter.

b) digital inverter.

**c) A-to-D converter.**

d) digital to analog converter.

24) Which of the following waveform metadata would NOT be necessary to process and reproduce the waveform?

**a) Genre**

b) Sampling rate

c) Maximum amplitude

d) Total number of samples

25) What is the format used to coordinate the sounds and signals between a computer and connected musical instruments, particularly keyboards?

a) MOD

b) VOC

c) WAV

**d) MIDI**

26) The bit rate of an MP3 file is usually measured in

a) bits per second.

**b) Kbits per second.**

c) Mbits per second.

d) Gbits per second.

27) What is the primary contributor to the small MP3 file size?

a) Lossless compression

**b) Psychoacoustic lossy compression**

c) Compression, using an algorithm called LZW

d) Compression, similar to that used in .WAV files

28) The .WAV format is a general-purpose format used primarily to store and reproduce

a) text.

**b) sound.**

c) movies.

d) pictures.

29) Lossless data compression must be used for all of these EXCEPT

a) text files.

b) program files.

**c) multimedia files.**

d) numerical data files.

30) ZIP files use

a) lossy algorithms only.

**b) lossless algorithms only.**

c) mix of both lossless and lossy algorithms.

d) depends on the nature of the data being compressed.

31) Most page description languages also provide the capability to extend the language to include new data formats and new objects using language stubs called

a) clients.

**b) plug-ins.**

c) web-apps.

d) applications.

32) A language that describes the layout of objects on a displayed or printed page is called

a) MIDI.

b) a palette.

c) EBCDIC.

**d) a page description language.**

33) Which of the following is NOT an example of a page description language?

a) PDF

**b) PCX**

c) HTML

d) PostScript

34) Two-valued variables or constants with values of true or false are called

a) float.

b) binary.

**c) Boolean.**

d) symbols.

35) Numbers with a fractional portion are called

**a) real.**

c) integers.

b) Boolean.

d) enumerated.

**Discussion Questions**

1) What is the major difference between how JPEG and GIF image files are compressed?

**Sol: GIF uses a lossless compression algorithm (LZW); JPEG is a lossy compression algorithm.**

2) Why is "metadata" important?

**Sol: Metadata contains information about the waveform or graphic image required to process and reproduce the waveform or graphic image. Without metadata, applications would not understand how to process and reproduce the original content.**

3) Why is it critical that *standard* data representations exist?

**Sol: From the text: "These data representations must be recognized by a wide variety of hardware and software so that they can be used by users working within different computer environments.”**

4) What data type would likely be used for a phone number and why?

**Sol: Text (string of characters). Phone numbers are not commonly manipulated mathematically, so there is no reason to store phone numbers in numeric form. Also, phone numbers are more commonly used in text-based queries, which are more easily handled by text-based manipulation.**

5) What shortcomings of ASCII led to the development of Unicode?

**Sol: ASCII is 7-bit, and extended ASCII is 8-bit giving a total representation space of 127 and 256 symbols respectively. This is a severe limitation for representing other languages besides English. Alternatively, ASCII cannot encode enough symbols to represent languages that use other than the basic Latin alphabet.**

6) What would printing ASCII text on an EBCDIC terminal do, and why?

**Sol: from the text: "if we use an ASCII terminal for the input, the output will also be in ASCII form unless some translation took place within the computer. In other words, printing ASCII characters on an EBCDIC terminal would produce garbage."**

7) When sorting an array of words, which comes first: "Apple" or "alligator"? How can you fix it for natural sort?

**Sol: Uppercase "A" has a collating sequence of 65(dec) and lowercase "a" has a collating sequence of 97(dec). Sorting the words "Apple" and "alligator" would result in "Apple" coming before "alligator." This is fixed by converting the words to all uppercase (or lowercase) before sorting.**

8) What is the general concept behind psychoacoustic compression?
**Sol: From the text: "Psychoacoustic compression is based on the assumption that there are sounds that a listener cannot hear or will not notice, which can then be eliminated. As an example, a soft sound in the background is not usually noticeable against a loud foreground sound. The level of compression depends on the tolerable level of sound quality, but also on the nature of the audio being compressed."**

9) If we record a song that is one minute long using 16-bit sound samples, sampled at 44.1KHz in mono channel, without any metadata or compression, how large would the file be? (Express your answer in Megabytes)

**Sol:**

**Note:**

**K=1,000 in speed calculations.**

**M = 1,048,576 for capacity calculations.**

**Solution is (samples)(sampling rate)(number of channels)(60sec/min)**

 **= (16-bit samples)(44.1K/sec)(1 for mono)(60sec/min)**

**= 42,336Kbits/min**

**= 42,336,000bits/min (1byte/8bits)(M/1,048,576)**

**= 5MB**

10) If true color requires 3 bytes per pixel, how much storage space is required for a minute's worth of output for a video camera producing full screen 1024 × 768 pixel true-color images at a frame rate of thirty frames per second? Explain any assumptions you make about your calculations.

**Sol:**

**Bytes in one frame = (1024 x 768 pixels)(3 bytes/pixel) = 2,359,296 bytes/frame**

**Bytes in one minute = (2,359,296 bytes/frame)(30frames/sec)(60sec/min)**

**= 4,246,732,800 bytes/min**

**Convert to MB = (4,246,732,800 bytes)(M/1,048,576)**

**=4,050MB in one minute.**

**Assume M = 1,048,576 for capacity calculations.**

11) Describe the trade-offs between audio quality versus transmission rate or file size for MP3 digital audio data format.

**Sol: Higher bitrates are directly related to file size and audio quality. A high bitrate means improved representation of the audio, but larger file sizes. That in turn, means longer transmission times. From the text "the options chosen are made by the creator of the file during the encoding process, based on the trade-off between tolerable audio quality versus transmission rate or file size."**

12) What is the main assumption regarding lossy compression?

**Sol: from the text: "Lossy algorithms operate on the assumption that some data can be sacrificed without significant effect, based on the application and on known properties of human perception."**

13) Describe the advantages and disadvantages of data compression.

**Sol: Files are compressed for reducing their file size but it takes computing power to perform the compression and reverse the compression for use. Smaller files have the advantage of reduced storage and can be transmitted over a network faster. Lossless compression is the only option for files that must maintain their integrity.**

14) A loan application takes as input loan amount, credit scores, salary history, tax history and other relevant data and produces a single result: either the customer is credit worthy or not. What data type is the variable "result"?

**Sol: Boolean. There are only two possible values. The input data types will vary as integer, float, text or some other data type.**

15) What two factors determine how the binary numbers stored in a computer are interpreted? That is—what determines whether 01000001 is seen as the character "A" or the integer 65?

**Sol: From the text: "The interpretation of these [binary numbers stored in the computer] depends upon two factors: The actual operations that the computer processor is capable of performing" and "The data types that are supported by the programming language used to create the application program." Alternative answer: The context in which the value is used.**

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| Problem | Answer | Section in text / comments |
| 1 | b | Section 4.1 General Considerations |
| 2 | d | Section 4.1 General Considerations |
| 3 | c | Section 4.1 General Considerations |
| 4 | d | Section 4.1 General Considerations |
| 5 | b | Section 4.2 Alphanumeric Character Data |
| 6 | c | Section 4.2 Alphanumeric Character Data |
| 7 | d | Section 4.2 Alphanumeric Character Data |
| 8 | a | Section 4.2 Alphanumeric Character Data |
| 9 | c | Section 4.3 Visual Data |
| 10 | d | Section 4.3 Visual Data |
| 11 | c | Section 4.3 Visual Data |
| 12 | b | Section 4.3 Visual Data |
| 13 | d | Section 4.3 Visual Data |
| 14 | b | Section 4.3 Visual Data |
| 15 | c | Section 4.3 Visual Data |
| 16 | a | Section 4.3 Visual Data |
| 17 | c | Section 4.3 Visual Data |
| 18 | b | Section 4.3 Visual Data |
| 19 | a | Section 4.3 Visual Data |
| 20 | d | Section 4.3 Visual Data |
| 21 | a | Section 4.3 Visual Data |
| 22 | c | Section 4.3 Visual Data |
| 23 | c | Section 4.4 Audio Data |
| 24 | a | Section 4.4 Audio Data |
| 25 | d | Section 4.4 Audio Data |
| 26 | b | Section 4.4 Audio Data |
| 27 | b | Section 4.4 Audio Data |
| 28 | b | Section 4.4 Audio Data |
| 29 | c | Section 4.5 Data Compression |
| 30 | b | Section 4.5 Data Compression |
| 31 | b | Section 4.6 Page Description Languages |
| 32 | d | Section 4.6 Page Description Languages |
| 33 | b | Section 4.6 Page Description Languages |
| 34 | b | Section 4.7 Internal Computer Data Format |
| 35 | a | Section 4.7 Internal Computer Data Format |