

# Multimedia

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# The Course Outline

- **Course Title:** Preparation course for FE examination
- **Intended Participants:** University Students who are going to take ITPEC examinations
- **Course Duration:** 60 hours

# The Lecture Plan

# Lecture Plan: Morning Exam, Sec 3-Technological Elements, Chapter 2-Multimedia

Time	Learning Points/Keywords	Explanation Points	Method	Level
10 minutes	Multimedia technology	Web content, Hypermedia, Streaming, Authoring environment, PDF, PCM	Verbal Explanation	Medium
		MIDI, WAV (Waveform Audio Format), MP3, JPEG, GIF, PNG, BMP		
		TIFF, Exif (Exchangeable Image File Format), MPEG, QuickTime		
		AVI, ZIP, LZH, Compression ratio, Lossless compression, Lossy compression		
10 minutes	Multimedia application	CG, Simulator, Video game, AR (Augmented Reality)	Verbal Explanation	Medium
		VR (Virtual Reality), Video on demand		

## 2.1 Multimedia technology\*\*

- Understand the mechanism of characters, audio, and images in computers, and methods of integrating and handling them, and apply them to associated matters.
- Understand the purpose of information compression and decompression, as well as the typical characteristics, and apply them to associated matters.

## 2.1 Multimedia technology\*\*

- Web content, Hypermedia, Streaming, Authoring environment, PDF, PCM, MIDI, WAV (Waveform Audio Format), MP3, JPEG, GIF, PNG, BMP, TIFF, Exif (Exchangeable Image File Format), MPEG, QuickTime, AVI, ZIP, LZH, Compression ratio, Lossless compression, Lossy compression

## 2.2 Multimedia application\*\*

- Understand the characteristics of multimedia systems, and examples of multimedia applications.



## 2.2 Multimedia application\*\*

- CG, Simulator, Video game, AR (Augmented Reality), VR (Virtual Reality), Video on demand

# Analysis

# Analyzation

- Analyzed 7 questions
- Covered the most recent years
  - 2021 Q1 Exam
  - 2021 Q2 Exam
  - 2020 Q2 Exam

# Questions

# Question 1

Q1. (q3-8) Audio sampling is performed 11,000 times per second and each of the sampled values is recorded as 8-bit data. In this case, how many minutes of audio can be recorded in a flash memory with a capacity of  $512 \times 10^6$  bytes?

- a. 77
- b. 96
- c. 775
- d. 969

Q1. (q3-8) Audio sampling is performed 11,000 times per second and each of the sampled values is recorded as 8-bit data. In this case, how many minutes of audio can be recorded in a flash memory with a capacity of  $512 \times 10^6$  bytes?

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## Question 1: Answer Explanation

Sampling can be considered as “picking up samples.” Audio sampling is a technique of encoding analog data such as audio (that is, converting it into digital format), and fetching the size (amplitude) of a wave at a certain interval from the continuous analog waveform. Data is sampled 11,000 times per second, and each value is recorded in 8-bits. Based on the fact of “8 bits = 1 byte”, the amount of data sampled in a second is calculated as follows: 8 bits/time  $\times$  11,000 times/second

$$= 88,000 \text{ (bits/second)}$$

$$= 11,000 \text{ (bytes/second)}$$

$$= 11 \times 10^3 \text{ (bytes/second)}$$

Therefore, in a flash memory with a capacity of  $512 \times 10^6$  bytes, audio data of  $(512 \times 10^6 \text{ (bytes)}) \div (11 \times 10^3 \text{ (bytes/second)})$

$$= 512 \times 10^3 \div 11 \text{ (seconds)} = 46545.45 \text{ (seconds)},$$

that is,  $46545 \div 60 = 775.75$  (minutes) can be recorded.

Therefore, c) 775 (minutes) is the correct answer.



## Question 2

Q2. (q3-9) Which of the following is an international standard for the compression encoding of still image data?

- a. BMP
- b. GIF
- c. JPEG
- d. MPEG

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## Question 2: Answer Explanation: Slide I

- When image or audio data is handled in a multiple processing system, the data volume is very large. Therefore, data compression techniques are required. JPEG (Joint Photographic Experts Group) and GIF (Graphics Interchange Format) are the main compression methods for still image information. JPEG is an international standard defined by ISO/IEC.

Therefore, c) is the correct answer.

There are two types of JPEG compression methods: lossless compression and lossy compression. In the “lossless” method, when the compressed image data is restored to its original form, it can be fully restored, while in the “lossy” method, the compressed image data cannot be fully restored. Although the compressed image data cannot be fully restored, a human eye hardly feels the difference.

## Question 2: Answer Explanation: Slide II

- a) BMP (Bit MaP) is used as a standard graphic format used by Windows. Color and shape data is managed in units of bits. Screen is clear and sharp as data is not compressed, but file size becomes large.
- b) GIF (Graphics Interchange Format) is used as a compressed image format of the lossless compression method. LZW method is used for compression, and the more repeated parts of the same color or pattern, the higher the compression ratio. Therefore, it is more suitable for compressing illustrations. However, it is not yet standardized by international organizations such as ISO.
- d) MPEG (Moving Picture Experts Group) is used as an international standard of compression technology for moving images.

# Question 3

Q3. (q3-10) Which of the following is the appropriate characteristic of the compression technique for still image data?

- a. The size of a file that is compressed with a lossless encoding method is smaller than that of a lossy encoding method.
- b. In a lossless encoding method, the compression ratio does not affect the quality of the image after decompression.
- c. In a lossy encoding method, the size of a decompressed image is smaller than that of the original image.
- d. In image compression based on a lossy encoding method, the compression ratio cannot be changed.

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## Question 3: Answer Explanation: Slide I

- There are two data compression methods: lossless encoding (lossless compression) and lossy encoding (lossy compression). In the lossless encoding method, data before compression and data after compression and decompression process completely matches. In this method, data after decompression completely returns to its original form. Therefore, image quality is constant irrespective of the compression ratio. Therefore, description of b) is appropriate.

On the other hand, in the lossy encoding method, data before compression and data after compression and decompression process does not match completely. Although the quality of data after decompression is reduced, a high compression ratio can be easily achieved. Deterioration in quality is made less noticeable by using audio-visual characteristics, and accordingly it is used for compressing general image and audio data. In JPEG, which is one of the typical

## Question 3: Answer Explanation: Slide II

still image compression methods, although the lossy encoding method is mainly used, the lossless encoding method is also included as a standard.

- a) The compression ratio is lower in the lossless encoding method in comparison with the lossy encoding method, and the file size becomes larger.
- c) In the lossy encoding method as well, the image size does not become smaller. In most cases, the size is kept the same while the resolution is reduced.
- d) In the lossy encoding method, it is usual that the compression ratio can be changed. However, there is a trade-off between quality and compression ratio.

# Question 4

Q4. (q3-11) Which of the following is the most appropriate explanation of VR (Virtual Reality)?

- a. VR improves the GUI by first displaying a coarse mosaic-like image and then gradually making it clear, instead of by displaying the image in sequence from the top.
- b. VR enables computer-simulated objects and space to be perceived like the real world by using computer graphics or such other technology.
- c. VR conducts computer based simulation in place of wind tunnel experiments used for the design of automobiles and aircrafts.
- d. VR synthesizes the separately taken video footages of scenery and persons in order to create a video that is different from reality

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## Question 4: Answer Explanation: Slide I

- Virtual Reality (VR) is also known as artificial reality. It refers to “information mediated by computers is used for having people experience and feel as though it is the real world.” In virtual reality, objects and space simulated with a computer are displayed by using computer graphics such that they create a perception of the real world. As described in b), a world created in computers by using technologies such as CG and sensor is presented as the real world. I/O devices, such as an HMD (Head Mounted Display) that provides a stereoscopic view so that objects appear stereoscopic and a data glove that conveys the sensation of touching the objects, are used. It is used in education, training, medical treatment, and design.

## Question 4: Answer Explanation: Slide II

- a) This describes “progressive JPEG” (Joint Photographic Experts Group) and “interlace GIF” (Graphics Interchange Format), which is one of the main image file format used on the Internet. When common GIF format image data is displayed, it gradually displays from the top to the bottom of the image while it is downloaded. However, in the interlace GIF, the entire screen first appears in mosaic form, and it gradually becomes clear as the download progresses. Interlace means to weave, and it originates from alternatively moving the scanning lines of display. Moreover, progressive JPEG is also a similar method of display, where even if the download is not complete, the view can get glimpses of the entire image.
- c) This describes simulation, which is one of the applications of virtual reality, but it is not appropriate as an explanation of virtual reality itself.

## Question 4: Answer Explanation: Slide III

- d) This refers to VFX (Visual Effects), and it indicates the technique of synthesizing a real recorded subject matter by using computers. SFX (Special Effects) is similar or synonymous to this, but it refers to synthesis technique that does not use computers, and in other words, it is “special photographing.” In some cases, no distinction is made between VFX and SFX.



# Question 5

Q5. (q3-12) When a shape is drawn in computer graphics, which of the following is a technique that is used to obscure the step-like jagged edges of the shape by placing different intermediate colors in the pixels near the edges?

- a. Anti-aliasing
- b. Clipping
- c. Shading
- d. Morphing

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## Question 5: Answer Explanation

- When a shape in computer graphics is drawn, technology used for making the step-like jagged appearance near edges less noticeable is anti-aliasing. An image is displayed by changing the color of pixels constituting the image. However, pixels can only display the color corresponding to the assigned numeric value, and therefore the number of colors that can be simultaneously displayed is only one at maximum. Therefore, a boundary of two colors has a step-like jagged appearance, and it is necessary to assign intermediate color to make it less noticeable. This process is called anti-aliasing. Therefore, a) is the correct answer.
- b) Clipping refers to specifying a portion of an image for restricting the processing range.
- c) Shading refers to assigning shade for giving a three-dimensional appearance.
- d) Morphing is creating an intermediate image from images before and after the change so that the image changes smoothly.

# Question 6

Q6. (2021 A FE AM-q24) Which of the following is an explanation of clipping in 3D graphics processing?

- a. It is a process that applies shading to the surface of an object for a more 3D appearance.
- b. It is a process that defines a window within the image display area, removes the area outside the window, and cuts out the section visible within the window.
- c. It is a process that is performed in the last phase of CG video production and visualizes object data so that it can be rendered on the screen.
- d. It is a process to hide the jaggies that occur near the edge of a shape because of the limited number of pixels on the screen.

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# Question 7



Q7. (2020 S FE AM-q25) Audio signals are recorded using 8-bit samples at a sampling rate of 11,000 times per second. When a flash memory of  $512 \times 10^6$  bytes is used, what is the maximum recording time of such data in minutes?

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# Any Questions?



IT Fundamentals (New FE Textbook Vol. 1)