

Computing

Lesson 5: Sonic Playground

Data Representation

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Task 1 - Representation Size

The factors that determine the representation size of a piece of sound are its **sampling rate** (how many samples per second it comprises), its **sample size** (how many bits or bytes are used to represent the level of each sample), its **duration** (how many seconds the piece of sound lasts for) and the number of **channels**.

Representation size = **Sampling rate** × **Sample size** × **Duration** × **Channels**

total bits for a
piece of sound

samples
in a
second

bits in a
sample

seconds
of sound



Task 1 - Representation Size

Worked Example: What is the representation size, in megabytes, of 1 minute of stereo sound (2 sound channels) with a sampling rate of 48,000 Hz (48,000 samples per second) and a sample size of 24 bits?

$$\begin{aligned}\text{representation size} &= \text{sampling rate} \times \text{sample size} \times \text{duration} \\ &= 48,000 \text{ samples per second} \times 24 \text{ bits per sample} \times 60 \text{ seconds} \\ &= 1,152,000 \text{ bits for each second} \times 60 \text{ seconds}\end{aligned}$$



Task 1 - Representation Size

$$\begin{aligned} \text{representation size} &= \text{sampling rate} \times \text{sample size} \times \text{duration} \\ &= 144,000 \text{ bytes for each second} \times 60 \text{ seconds} \\ &= 8,640,000 \text{ bytes in total} \\ &= 8.6 \text{ megabytes (MB) in total} \end{aligned}$$

There are 2 channels, so this result should be doubled, and the final answer is **17.2MB**.



Task 1 - Representation Size

Part 1: Compute representation size.

Assume that you have a digital recording of a sound. The **duration** is 1 second, **sampling rate** is 8,000 samples per second and the **sample size** is 1 byte per sample.

Steps	Instructions
Use this information to compute the number of bytes required to represent this sound.	Write your answer here:
Convert this size to kilobytes .	Write your answer here:



Task 1 - Representation Size

Part 2: Compute representation size for **clarinet.wav** file.

Steps	Instructions
Open the sound file clarinet.wav.	Write your answer here:
The duration is 10 seconds. The sampling rate is 44,100 samples per second. The sample size is 16 bits per sample. It has two channels . Use this information to compute the number of bits required to represent this sound.	Write your answer here:



Task 1 - Representation Size

Part 2: Compute representation size for **clarinet.wav** file.

Steps	Instructions
Convert this size to bytes or kilobytes .	Write your answer here:
Right-click on the sound file clarinet.wav and view its Properties . What is the actual size of the file?	Write your answer here:
Is the size that you computed in the previous step identical (or even similar) to the actual size of the file?	Write your answer here:



Task 2- Sound Editing Challenges

Challenge 1:

Open the sound file **count.wav**, which contains a recording of the numbers from one to ten. Cut, copy, paste, and delete the individual words, in order to rearrange them into a **countdown**.

Challenge 2:

Open the sound file **scale.wav**, which contains the sound of eight successive musical notes: C, D, E, F, G, A, B, and then a last, higher C. Cut, copy, paste, and delete the individual notes, in order to rearrange them into a simple song.

For example, the notes C, C, G, G, A, A, G are the first few notes of *Twinkle, Twinkle, Little Star* (hear an example in *twinkle.wav*). If you'd like to go one step further, the next notes are F, F, E, E, D, D, C.



Task 2- Sound Editing Challenges

Challenge 3:

Open the sound file **audiovisual.wav**, where you can hear Maja talk about her preferences:

I like editing sounds a lot more than editing images.

Swap the words “sounds” and “images” in that recording, so that it sounds like Maja has changed her mind (hear an example in **audiovisual-new.wav**):

I like editing images a lot more than editing sounds.

Challenge 4:

Open the sound file count.wav and make each successive word have a **higher volume** and a **lower pitch**.



Task 2- Sound Editing Challenges

Challenge 5:

The table below contains a few words, grouped together in four different categories.

Common:	I, you, it, a, the, if, not, in, to, for, with, and
Verbs:	am, is, are, have, go, like, look, put
Nouns:	water, children, ice cream, sea, street, comet, butterfly, giant
Adjectives:	good, wonderful, delicious, warm, spectacular
Common:	I, you, it, a, the, if, not, in, to, for, with, and

Think of a sentence that you'd like to make with these words. It doesn't need to be too long; it doesn't even need to make complete sense! You can find recordings of these words in the sound file **words.wav**. Select and delete the words you that you **won't** need, and then copy, paste, and rearrange the rest to form your sentence.



Task 2- Explorer Task

Open any sound file.

Click on the **Zoom** tool or press the F4 key. Then click repeatedly on a part of the audio until you can see the individual samples. Click on the **Draw** tool or press the F3 key. Use the tool to modify individual samples.

Do you expect the changes in the audio to be perceptible? Listen to the audio again and check if your answer was correct. Try to explain the result.



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