CSE 8A Lecture 13

- Reading for next class: 8.4-8.5
- Today's topics:
  - Sounds!
- Finish PSA 6: Chromakey! DUE TUESDAY
- Interm exam 3 next Friday

CSE 8a Exam #3 Study Hints

1) Reading Quizzes (2/4-2/15)
   - Omit 2/6/13 #2
2) Peer Instruction questions
3) Includes: methods, loops, if, if else, Logical operators, mirroring, sound

   - Lecture7 (slide 14) through Lecture13 (slide 10)
4) Discussion section
5) End of chapter problems

   Ch 5: 5.1-5.8 Ch 6: 6.2,6.8-6.9,6.17-6.19 Ch 8: 8.6-8.15
6) Terms from above

Modified from the lab 5 quiz

```
for (int x = 0; x < getWidth(); x++)

  for (int y = 0; y < getHeight() / 2; y++)
  {
    Pixel p = getPixel(x, y);

    if(x > getWidth() / 2)
      if(p.getRed() == 255 && p.getBlue() == 0 && p.getGreen() == 0)
        p.setColor(Color.BLACK);
  }
```

A. This code changes any pure red pixels in the top-right quarter of the picture to black.

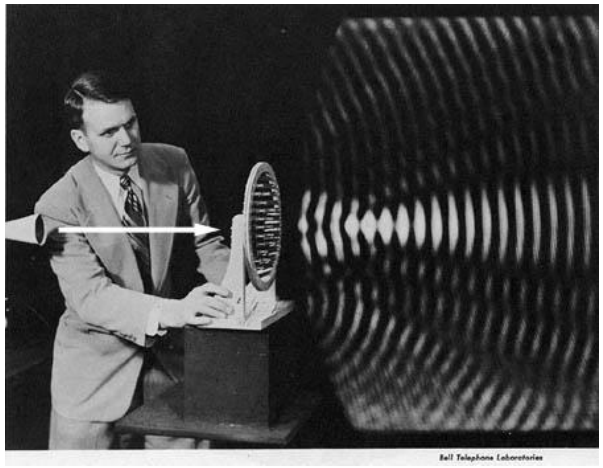
B. This code modifies the top-right quarter of the picture.

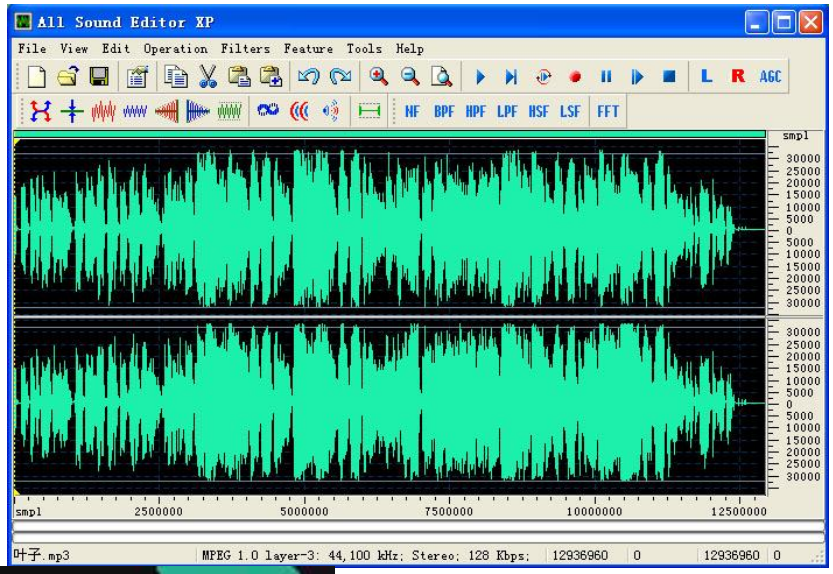
C. This code loops over pixels in the top half of the array and, if the x coordinate is greater than half the width,
checks if the red component is 255 and the blue is 0 and the green is 0,
and if so, sets the pixel to black.

What are we doing next?

- Chapters 8,9,10: Sound!
- Continue with computational basics from Picture work:
  - Iteration/looping, if statements, arrays
  - Emphasis on deeper understanding
  - Emphasis on Java terminology, features, mental "model" of how code is represented in the execution on the machine
- When working with Sound/SoundSample, compare and contrast to Picture/Pixel examples.

Chapter 8: Sound!





Sounds

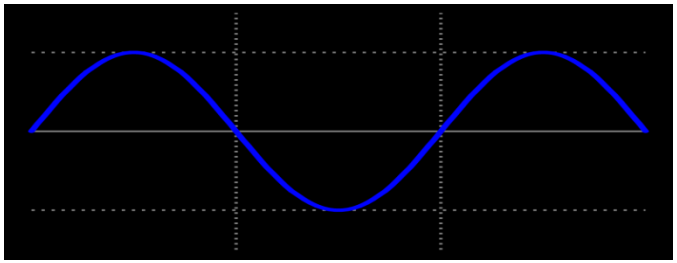
- Sound is a quasiperiodic pattern of waves of air pressure
  - Increase in air pressure is a **compression**
  - Decrease in air pressure is a **rarefaction**
- Strength of compression and rarefaction is the **amplitude** of the sound
- Number of compression/rarefaction cycles per second is the **frequency** of the sound

Digitizing Sounds

- To process sounds in a computer, sound must be digitized
- A microphone converts instantaneous sound pressure level into voltage
  (+ voltage for compression, - voltage for rarefaction)
- Then, amplitude of voltage can be converted to bits (digital integers) with an Analog-to-Digital converter (ADC)

Digital Sample Rate versus Sample Size

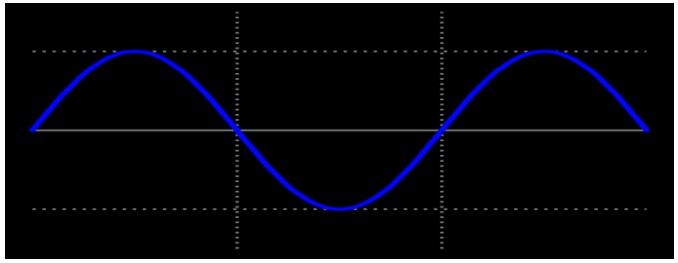
- Size determines max (and min) amplitude
  - CD audio: 16 bits per sample (per stereo channel)
  - Min: -32,768; Max: 32,767



- Rate is “how often we record an amplitude”
  - CD audio: 44,100 samples per second
  - A.k.a. 44.1 KHz sample rate

1) Solo: (30 sec)
2) Discuss/Group: (2 min)

If the following sound were modified to be louder it would



A) Have **lower frequency** and stronger compressions/rarefactions

B) Have **smaller amplitude** and stronger compressions/rarefactions

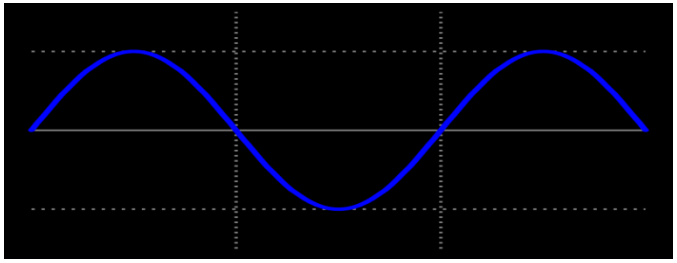
C) Have **higher frequency** and stronger compressions/rarefactions

D) Have **larger amplitude** and stronger compressions/rarefactions

E) None of the above

1) Solo: (30 sec)
2) Discuss/Group: (2 min)

If higher pitch?



1) Discuss: (2 min)

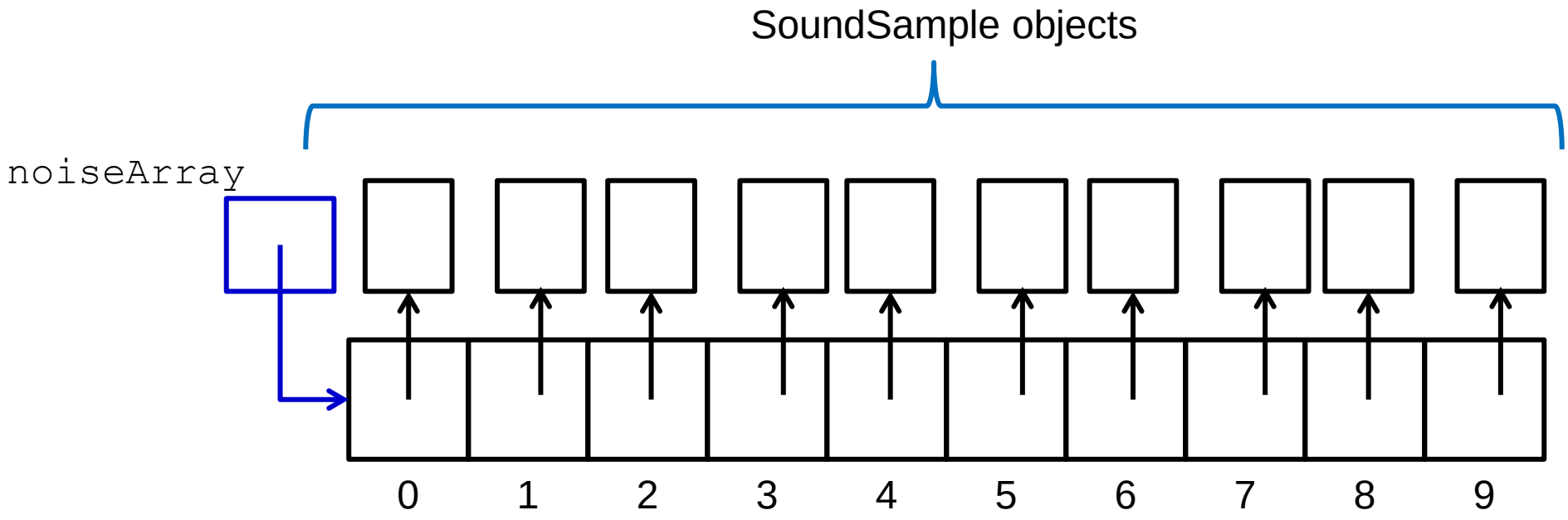
Making bad music: What's wrong with these decisions?

- I decided, I don't like the sampling rate and sample size provided by the book authors. Comment on my decision to use…

Sampling Rate	Sample Size	Explanation
5,000Hz	4 bits	
100,000Hz	32 bits	

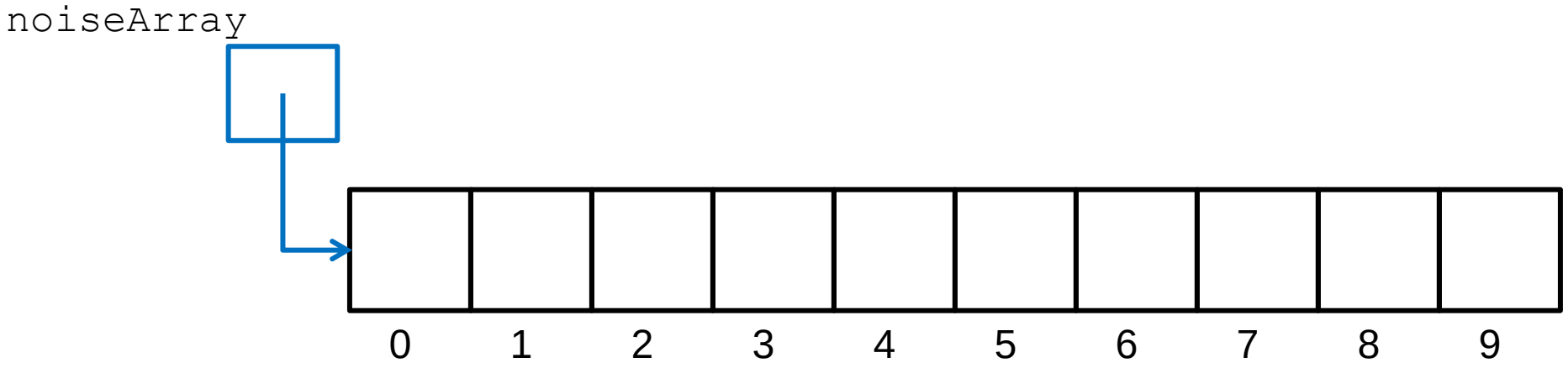
Our Representation of Sound

```
String fileName = FileChooser.pickAFile();
Sound  noise    = new Sound(fileName);
SoundSample[] noiseArray = noise.getSamples();
noiseArray[3].setValue(0);

int foo = noiseArray[2].getValue();
```



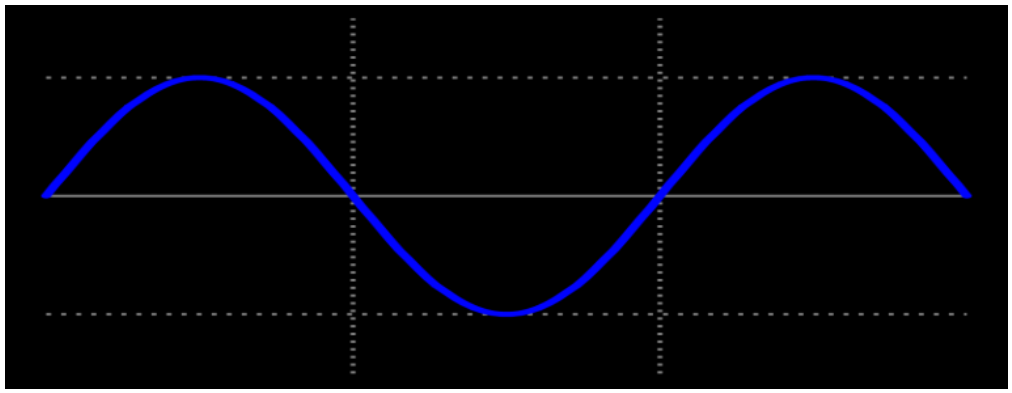
Our Representation of Sound (Shorthand)

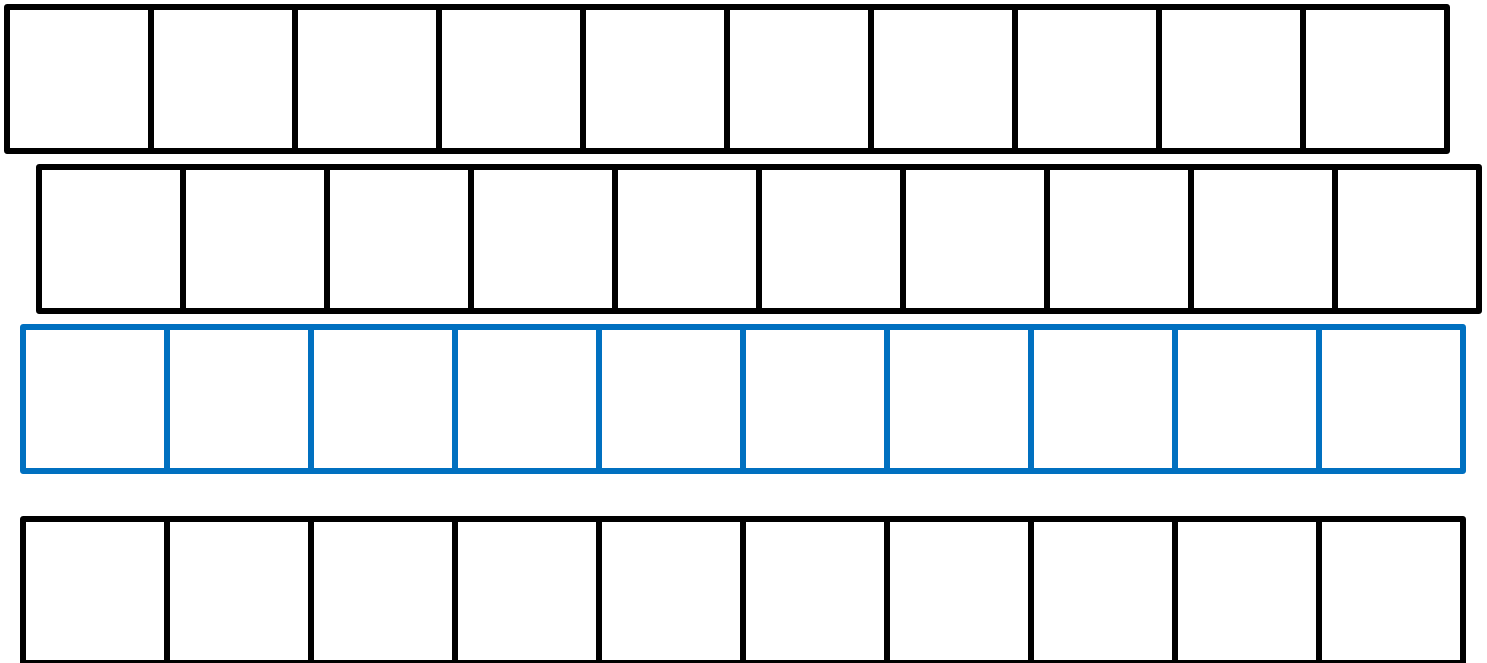
```
String fileName = FileChooser.pickAFile();
Sound  noise    = new Sound(fileName);
SoundSample[] noiseArray = noise.getSamples();
noiseArray[3].setValue(0);

int foo = noiseArray[2].getValue();
```



1) Solo: (60 sec)
2) Discuss:/Group(2 min)

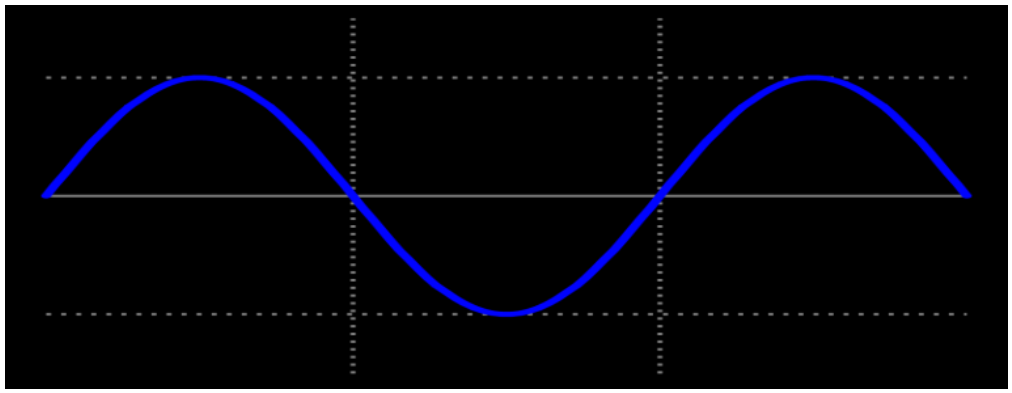
How would we fill in this `SampleSound[]`

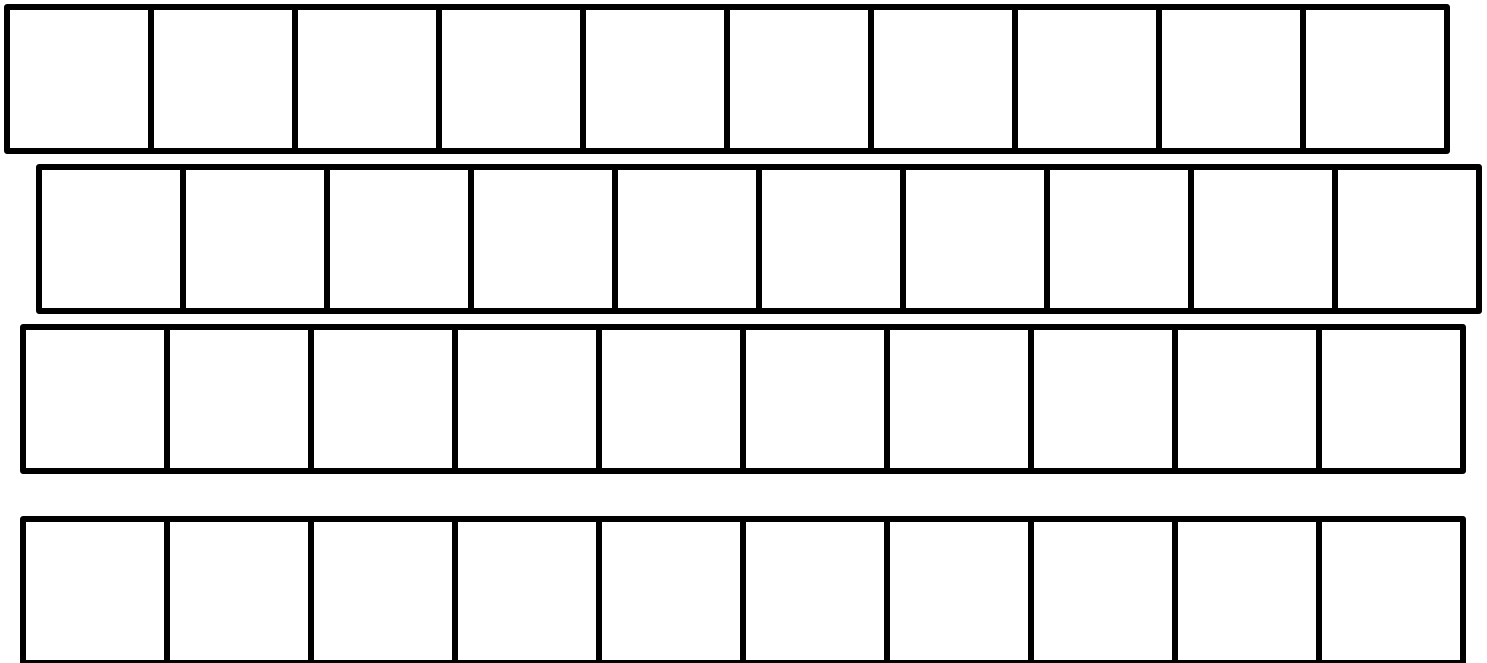




1) Solo: (60 sec)
2) Discuss/Group(2 min)

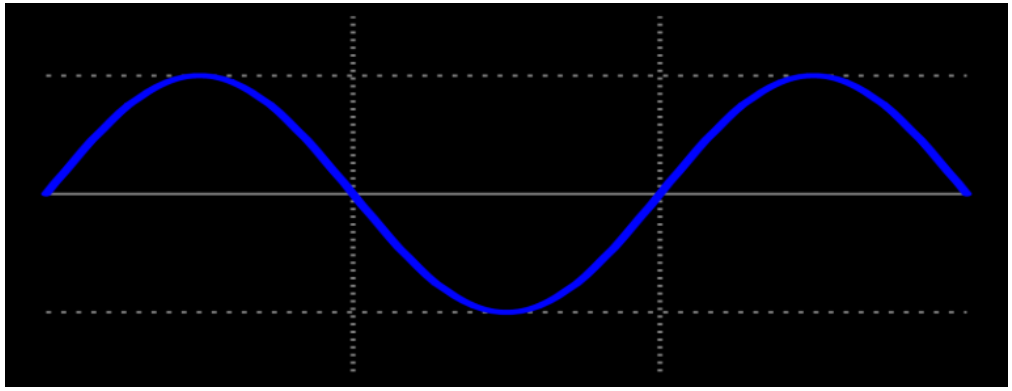
How would we fill in this `SampleSound[]`





1) Solo: (60 sec)
2) DiscussGroup: (2 min)

According to Nyquist's Theorem what is the minimum sampling rate?



A. 1.5 Hz

B. 3 Hz

C. 6 Hz

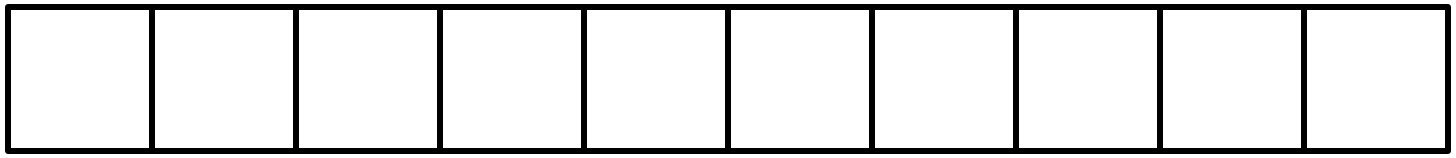
D. 10,000 Hz

E. 20,000 Hz

1) Solo: 45 sec)
2) Discuss/Group(2 min)

Write code which makes the following changes

- Here's a `Sound`



```
String fileName = FileChooser.pickAFile();
Sound  noise    = new Sound(fileName);
SoundSample[] noiseArray = noise.getSamples();
<<<  PICK SOME CODE  >>>
```

```
for (SoundSample sample: noiseArray)
{
  int foo = sample.getValue();
  sample.setValue(foo/2);
}
```

```
int i = 0;
while (i < noiseArray.length)
{
  SoundSample sample =
      noiseArray[i];
  int foo = sample.getValue();
  sample.setValue(foo/2);
}
```

```
for (int i = noiseArray.length/2; i < noiseArray.length)
{
  SoundSample sample = noiseArray[i];
  int foo = sample.getValue();
  sample.setValue(foo/2);
}
```

What does that code do

A. Makes a **lower pitched** sound during **first half** of play

B. Makes a **quieter sound** during **first half** of play

C. Makes a **lower pitched** sound during **second half** of play

D. Makes a **quieter sound** during **second half** of play

E. For each SoundSample element in **second half** of array
it gets the Value and stores that into an int and
then sets the Value with something that is half that

For you to practice

- Write code that reduces the volume of every other SoundSample.
  - What does that really sound like?

Summary of Concepts

- Digital representations of sounds
- Manipulating sounds using loops

TODO

- Reading for next class: 8.4-8.5
  - Read more about Sounds.
- Finish PSA6