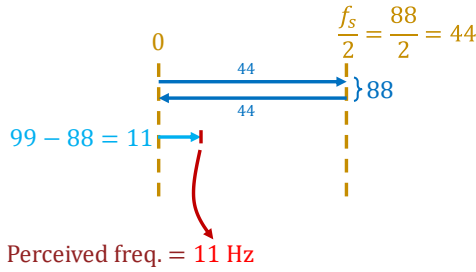# ECS 332: In-Class Exercise # 19 - Sol

Instructions

1. Separate into groups of no more than three students each. **The group cannot be the same as any of your former groups after the midterm.**
2. Write down all the steps that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.
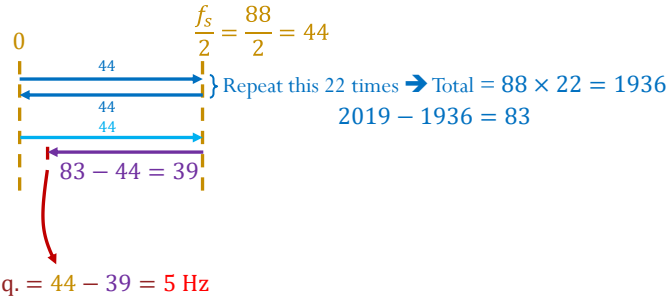3. **Do not panic.**

1. Suppose we input $\cos(2\pi(f_0)t)$ into `plotspect` with sampling rate $f_s = 88$ samples/sec.

   Find the **"perceived" frequency** (the freq. that `plotspect` sees) when

   a) $f_0 = 99$

$$\frac{f_s}{2} = \frac{88}{2} = 44$$

$$99 - 88 = 11$$

Perceived freq. = 11 Hz

   b) $f_0 = 2019$

$$\frac{f_s}{2} = \frac{88}{2} = 44$$

Repeat this 22 times ➔ Total = $88 \times 22 = 1936$

$$2019 - 1936 = 83$$

$$83 - 44 = 39$$

Perceived freq. = $44 - 39 = 5$ Hz

2. Suppose we input $e^{j(2\pi(f_0)t)}$ into `plotspect` with sampling rate $f_s = 88$ samples/sec.

   Find the **"perceived" frequency** (the freq. that `plotspect` sees) when

   a) $f_0 = 99$
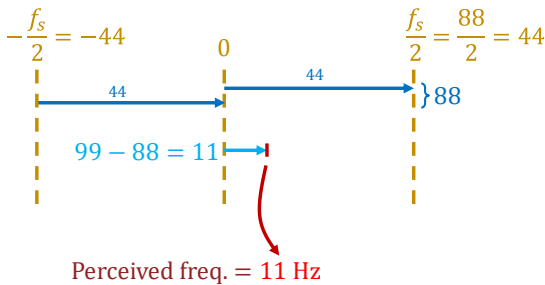
$$-\frac{f_s}{2} = -44 \qquad \frac{f_s}{2} = \frac{88}{2} = 44$$

$$99 - 88 = 11$$

Perceived freq. = 11 Hz

   b) $f_0 = 2019$

$$-\frac{f_s}{2} = -44 \qquad \frac{f_s}{2} = \frac{88}{2} = 44$$

Repeat this 22 times ➔ Total = $88 \times 22 = 1936$

$$2019 - 1936 = 83$$

$$83 - 44 = 39$$

Perceived freq. = $-44 + 39 = -5$ Hz