**Direct Digital Synthesis (DDS)** is a technique to create periodic waveforms with very precise frequency control using a system with a fixed clock frequency. The periodic function is stored in a look-up table, like the one below, which represents one cycle of a sine wave.

int8 sin[64] = {128,141,153,165,177,189,200,210,219,227,235,241,246,250,253,255,

 255,254,252,248,244,238,231,223,214,205,194,183,171,159,147,134,

 122,109, 97, 85, 73, 62, 51, 42, 33, 25, 18, 12, 8, 4, 2, 1,

 1, 3, 6, 10, 15, 21, 29, 37, 46, 56, 67, 79, 91,103,115,128};



You are:

1) Given a lookup table with 2^N values corresponding to one wavelength of a function

2) Given a sampling rate or a play back rate of f updates/second

3) Given a phase increment x, which every 1/f is added to the index of the LUT

f updates x values 1 cycle f\*x

--------- \* --------- \* --------- = --- hz

1 second update 2^N values 2^N

**Questions:**

Assuming an update rate of 48kHz, a LUT with 1024 entries, and a phase increment

of x, expressed as a 10.6 fixed point number. Answer the following questions.

* **What is the maximum frequency we could generate?**
* **What is the minimum frequency we can generate?**
* **What is the smallest change in frequency we can make with the phase increment?**
* **What phase increment generates a frequency of 440hz?**
* **How did I arrive at the format of the phase increment?**