

Pop Quiz 1 [10 mins]

Name:

Student ID:

1. An audio signal makes 250 cycles in its span (or has a frequency of 250Hz). How many samples do you need, at a minimum, to sample it correctly? [1]

500 samples (Nyquist sampling criterion)

2. If the number of bits is reduced, the quantization error **increases** .[1]
3. Draw a 3x3 kernel that will take an image as input and output as image which has a quarter dimmed ghost to its bottom right. Make sure that the total energy is preserved. [3]

This is not a simple question and hence the greater points. Note the if you want a ghost you would need at least one pixel in between the original and ghost. Otherwise there is no difference between ghosting and splatting. Without energy preservation, this will be given by the kernel [1,0,0; 0,0,0; 0, 0, ¼]. In this way, the top left is the original, the center pixel is the gap and the bottom right is the ¼ dimmed ghost. However, this kernel does not preserve energy since the total weight is 5/4 and not 1. Therefore, divide every entry of the kernel by 5/4 to get the energy preserved kernel. It is [4/5, 0, 0; 0, 0, 0; 0, 0, 1/5].

4. A geometric mesh has 20 vertices, 32 edges and 12 faces.

- What the euler characteristics, e , of this mesh? [2]

$$e = V - E + F = 20 - 32 + 12 = 0$$

- What is the genus of this object? [1]

$$e = 2 - 2g$$

Therefore, for $e=0$, $g=1$.

- Topologically this object is equivalent to which of the following? [1]
- Sphere

- **Torus (i.e. Donut)**
- Double Torus (i.e. Eight shaped double donut)

5. A sphere is a which of the following? **[1]**

- Manifold**
- Manifold with boundaries
- Non-manifold