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| **Total Marks:** | **04** |
| **Obtained Marks:** |  |

**Digital Image Processing**

**Assignment # 01**

**Submitted To: Mr. Fakhar**

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**Reg. Number: 2080210**

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**Question 1:** Describe the difference between uniform and non-uniform sampling. Provide examples of situations where each type might be used.

**Answer:**

1. **Uniform Sampling:**

When sampling is done consistently, samples are taken at regular intervals. This method is straightforward and simple to apply, but it presupposes that the signal lacks any rapid shifts or distinguishing features that might be lost during sampling.

* **Example:**

In digital audio recording, uniform sampling is widely employed because to the sound waves' smooth and predictable shifts. When recording audio at a predetermined rate, such as 44.1 kHz, we employ uniform sampling.

1. **Non-uniform Sampling:**  
   Non-uniform sampling entails taking samples at various intervals depending on the characteristics of the signal. This approach might be able to detect subtle or quick changes in a signal that uniform sampling might miss.

* **Example:**

The non-uniform sampling utilized in MRI imaging serves as one example of this. A clinician may sample an organ more extensively (non-uniformly) than other, less interesting regions of the image if they are especially interested in a specific area of the organ (such as a suspected malignancy).

**Question 2:** What is quantization in the context of digital image processing, and why is it necessary when representing digital images?

**Answer:**

In the context of digital image processing, quantization is the process of reducing an input from a big set to an output in a smaller set. A continuous signal or a huge number of potential values are translated into a finite range, to put it another way.

Since information on computers and other digital devices can only be represented by discrete numbers, quantization is required for digital images. A continuous signal, such as an analog image, must be converted into a digital image using a finite amount of bits. We may express the image's continuous brightness levels and colors using quantization and these few bits.

It is critical to remember that quantization, often known as quantization, may result in inaccuracies. These errors appear as discrepancies between a signal's true value and its quantization value. The quality of the digital representation will depend on the depth of quantization (the number of bits used); more bits are typically linked to higher quality (and larger file sizes), whereas fewer bits produce worse quality but smaller files.