# DSP Homework 09

1. Write a summary of this week's video(s) and your further thoughts on the content.
2. This problem is about digital number representations.
   (a) In general a number is stored in computer as byte, short integer, integer, float, double, quadruple types, and can be classified as either fixed-point or floating-point numbers. Describe their exact meanings.
   (b) IEEE 754 is a standard commonly used for computer number representations. Describe its definition for double type floating point numbers. Analyze its error when representing numbers. Then propose and analyze a better way of representation.
3. The following digital image uses $M = 24$ bits to quantize pixel colors. Use Lloyd-Max quantization algorithm to do *optimal* quantization for $M$ in the range of [2, 10] and explore what you can discover, especially regarding quantization error and visual effect.

4. Assume the random variable $x \in [0, 1]$ with probability density function (pdf) $p(x)$. We want to choose $Q$ with $M$ quantization points to minimize

$$J = \int_0^1 (Q(x) - x)^2 p(x) dx \tag{1}$$

   In the special case of uniform distribution ($p(x) = 1$), derive the optimal quantization strategy.