DSP VLSI Systems
Homework (IX)

Processing Elements Design

Deadline: 16 Nov.

1. Find the simplest implementation of a serial/parallel multiplier with fixed coefficient when the coefficient is
   (a) $(0.011001)_{2C}$
   (b) $(0.111011)_{2C}$
   (c) $(1.011001)_{2C}$

2. Conversion between RGB and YCbCr digital color video image formats can be performed by the following transformations:

$$R = Y + 350Cr/256 - 175/256$$
$$G = Y - 86Cb/256 - 178Cr/256 + 132/256$$
$$B = Y + 444Cb/256 - 222/256$$

   and

$$Y = (77R + 150G + 29B)/256$$
$$Cb = (-44R - 87G + 131B)/256 + 128$$
$$Cr = (131R - 110G - 21B)/256 + 128$$

   The color components are quantized to 8 bits. Derive an implementation based on
   (a) Bit-serial multipliers
   (b) Distributed arithmetic
   (c) Compare the two implementations.

3. Describe how to use CORDIC to efficiently compute the distance of a point (x, y) to the origin.