Department of Computer Science, The University of Hong Kong

COMP2120 - Computer Organization
Assignment 1

Deadline: 2 Mar 2017, before 5:00pm
(Hardcopy submission via Assignment Box A2)

The Gray Code differs from the ordinary binary representation in that there is just a single bit change between the representations of any two adjacent integer numbers. This is useful for applications such as counters or analog-to-digital converters where a sequence of numbers is generated. Because only one bit changes at a time, there is never any ambiguity due to slight timing differences. The four bit binary to Gray Code mapping is shown in the table below.

Inputs				Outputs				Inputs				Outputs			
x_3	x_2	x_1	x_0	y_3	y_2	y_1	y_0	x_3	x_2	x_1	x_0	y_3	y_2	y_1	y_0
0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0
0	0	0	1	0	0	0	1	1	0	0	1	1	1	0	1
0	0	1	0	0	0	1	1	1	0	1	0	1	1	1	1
0	0	1	1	0	0	1	0	1	0	1	1	1	1	1	0
0	1	0	0	0	1	1	0	1	1	0	0	1	0	1	0
0	1	0	1	0	1	1	1	1	1	0	1	1	0	1	1
0	1	1	0	0	1	0	1	1	1	1	0	1	0	0	1
0	1	1	1	0	1	0	0	1	1	1	1	1	0	0	0

Table 1: Binary Code to Gray Code mapping.

A combinational circuit shown in Figure 1 is used to converts from Binary to Gray Code. The circuit has four inputs, which provide the four bit binary coded decimal representation $x_3\ x_2\ x_1\ x_0$ (0_{10} = 0000, … , 15_{10} = 1111). The four outputs $y_3\ y_2\ y_1\ y_0$ represents the four bit Gray code.

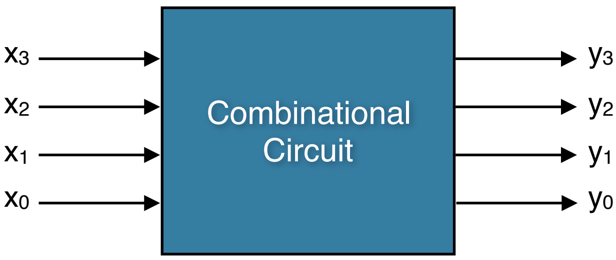

Figure 1: Combinational Circuit for Code Conversion.

a) With the help of K-Map, design and draw the logic circuit for Binary to Gray Code Converter using XOR gates only. (Hint: $A\overline{B} + \overline{A}B = A \oplus B$)

b) Repeat a), but this time the four inputs $x_3\ x_2\ x_1\ x_0$ represents Gray Code, and $y_3\ y_2\ y_1\ y_0$ represents the four bit Binary Code.

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