

## HW4-1

1. (20%) Design a combinational circuit with three inputs,  $x$  (MSB),  $y$ , and  $z$  (LSB), and three outputs,  $A$  (MSB),  $B$ , and  $C$  (LSB). When the binary input is 0, 2 or 3, the binary output is three greater than the input ( $xyz=000$  (0)  $\Rightarrow ABC=011$  (3),  $xyz=010$  (2)  $\Rightarrow ABC=101$  (5)). When the binary input is 1, 4, 5, 6, or 7, the binary output is one less than the input ( $xyz=110$  (6)  $\Rightarrow ABC=101$  (5),  $xyz=100$  (4)  $\Rightarrow ABC=011$  (3)).
  - (a) Derive the truth table. (5%)
  - (b) Derive the simplified Boolean expressions for  $A$ ,  $B$ , and  $C$  using maps. (10%)
  - (c) Draw the related logic diagram. (5%)
2. (10%) Design an excess-3-to-binary decoder using the unused combinations of the code as don't-care conditions.
3. (10%) Design a 3-bit absolute value calculator. Assume the input is 2's complement numbers. ( $Z = |z|$ ).
4. (10%) Which of the following circuits are combinational? Each box in the figure is itself a combinational circuit.

