# ECE 2300
# Digital Logic Design

## Homework 5

Choi Tim Antony Yung

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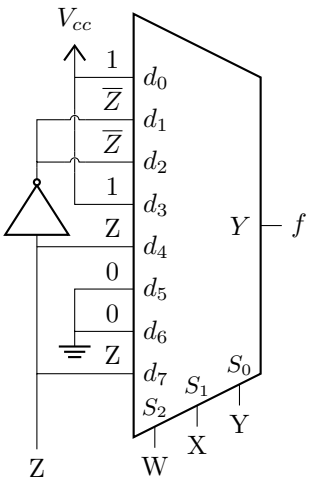
# 1 Using an 8:1 mux, create a circuit to generate

$$f(ABCD) = \overline{W} \cdot \overline{Z} + \overline{X} \cdot \overline{Y} \cdot Z + X \cdot Y \cdot Z$$

| W | X | Y | Z | $f$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 1 |

| W | X | Y | Z | $f$ |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 1 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 |



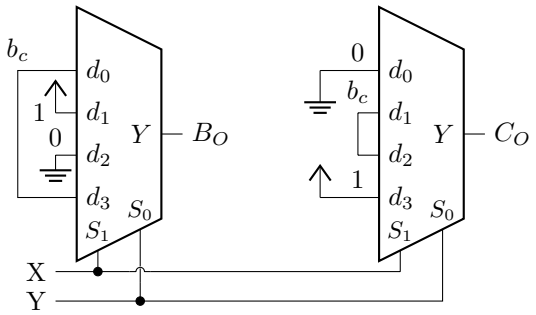
**2 Using two 4:1 muxes, generate the $B_O$ (Borrow-Out) and $C_O$ (Carry-Out) outputs for a 1-bit full subtractor and 1-bit full adder respectively where X is the minuend, Y is the subtrahend or Y and Y are the addends and bc is the borrow-in or carry-in.**

$$B_O = \overline{X} \cdot b_c + \overline{X} \cdot Y + Y \cdot b_c$$

$$C_O = X \cdot Y + X \cdot b_c + Y \cdot b_c$$

| X | Y | $b_c$ | $B_O$ | $C_O$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 1 | 1 |

| X | Y | $b_c$ | $B_O$ | $C_O$ |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |



**3 Using an 8:1 mux, create a circuit to generate the segment $g$ outputs for a 7-segment display where $g = \overline{B} \cdot \overline{D} + C \cdot \overline{D}$.**

| A | B | C | D | $g$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 |

| A | B | C | D | $g$ |
|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 0 |