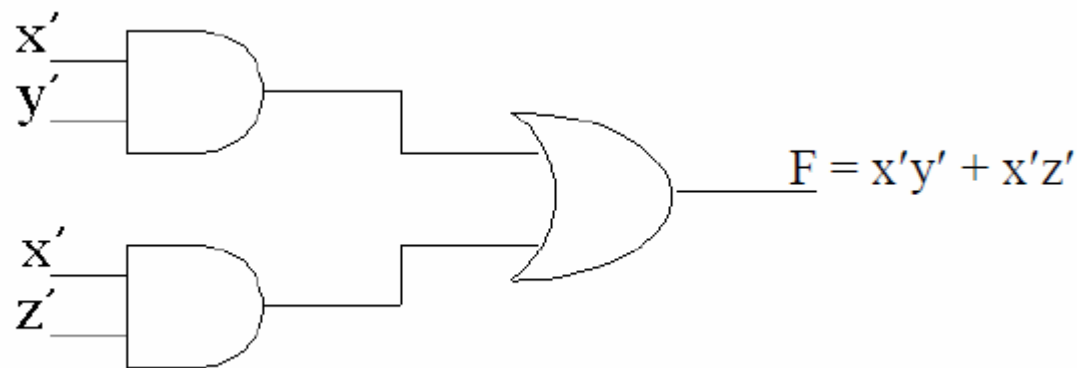# Numerical on K-maps Half and Full Adder

Q1: Design a combinational circuit with three inputs and one output. The output is 1 when the binary value of the inputs is less than 3. The output is 0 otherwise.
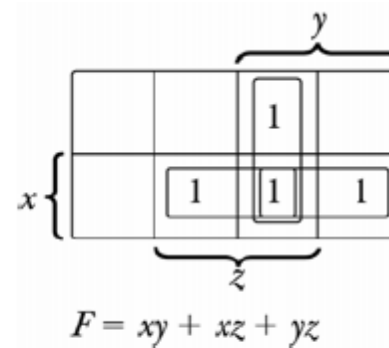
x	y	z	F
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

x\yz	00	01	11	10
0	1	1		1
1				

$$F = x'y' + x'z'$$

Q2: A majority function is generated in a combinational circuit when the output is equal to 1 if the input variables have more 1's than 0's. The output is 0 otherwise. Design a three-input majority function.

x y z	F
0 0 0	0
0 0 1	0
0 1 0	0
0 1 1	1
1 0 0	0
1 0 1	1
1 1 0	1
1 1 1	1

$$F = xy + xz + yz$$

Q3: Design a combinational circuit with three inputs x, y, z and three outputs A, B, C. When the binary input is 0, 1, 2 , or 3, the binary output is one greater than the input. When the binary input is 4, 5 , 6, or 7, the binary output is one less than the input.

x	y	z	A	B	C
0	0	0	0	0	1
0	0	1	0	1	0
0	1	0	0	1	1
0	1	1	1	0	0
1	0	0	0	1	1
1	0	1	1	0	0
1	1	0	1	0	1
1	1	1	1	1	0

y →

x\yz	00	01	11	10
0			1	
1		1	1	1

x ↕

$A = xy + xz + yz$

y →

x\yz	00	01	11	10
0		1		1
1	1			1

x ↕

$B = x \oplus y \oplus z$ $C = z'$

$B = x \oplus y \oplus z$

Full-Adder

$A = xy + xz + yz$

$C = z'$