- **Problem 1:** Half Adder:
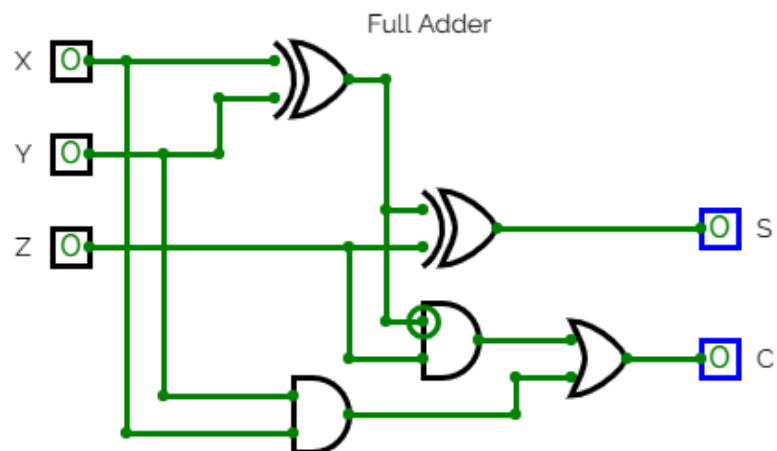 $S = X \oplus Y$
  $C = XY$
  Circuit:
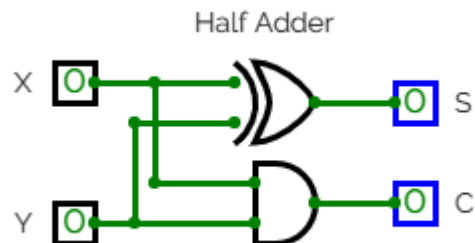
- **Problem 2:** Full Adder:
  $S = X \oplus Y \oplus Z$
  $C = XY + YZ + XZ$
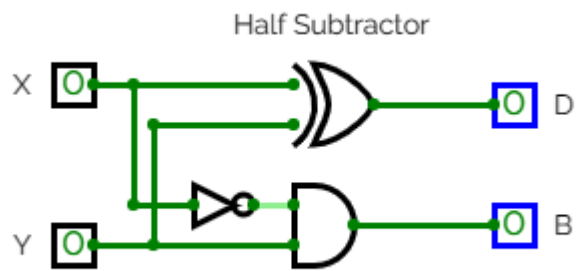 **Circuit:**

- **Problem 1:** Half Subtractor:
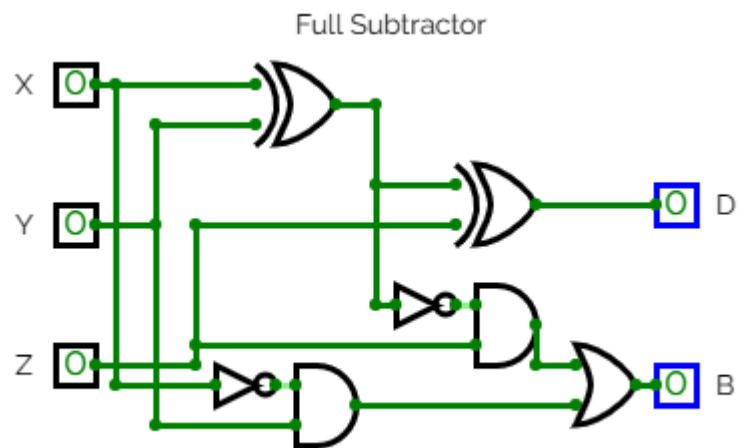 $D = X \oplus Y$
  $B = X'Y$
  Circuit:

Half Subtractor

- **Problem 1:** Full Subtractor:
  D = X ⊕ Y ⊕ Z
  B = X'Y + X'Z + YZ
  Circuit:

Full Subtractor

- **Problem 2:** F(a, b, c, d) = (b'c'd' + bcd' + abcd') + d(b'cd' + a'bc'd)

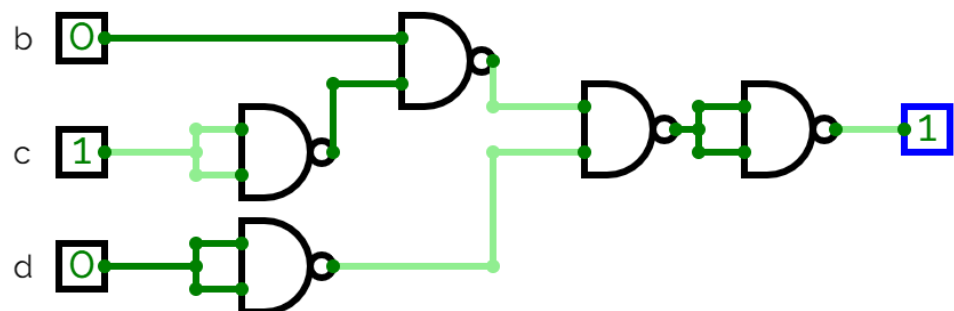| K-map	cd	00	01	11	10
ab	-	-	-	-	-
00	-	1	0	0	X
01	-	0	X	0	1
11	-	0	0	0	1
10	-	1	0	0	X

F(a, b, c, d) =b'd' +cd'

Circuit:
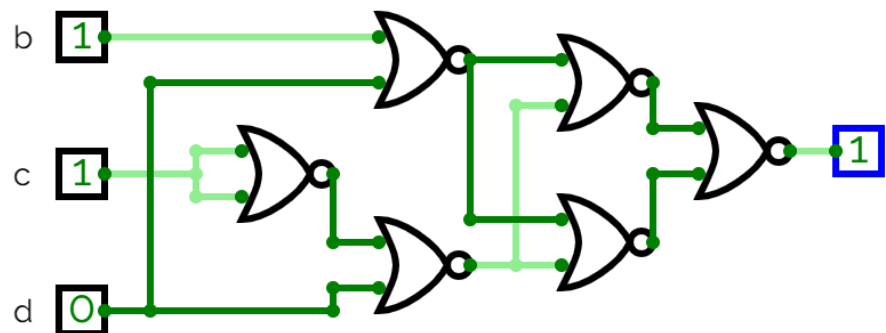
Logic Diagram using only NOR Gates

Logic Diagram using only NAND Gates