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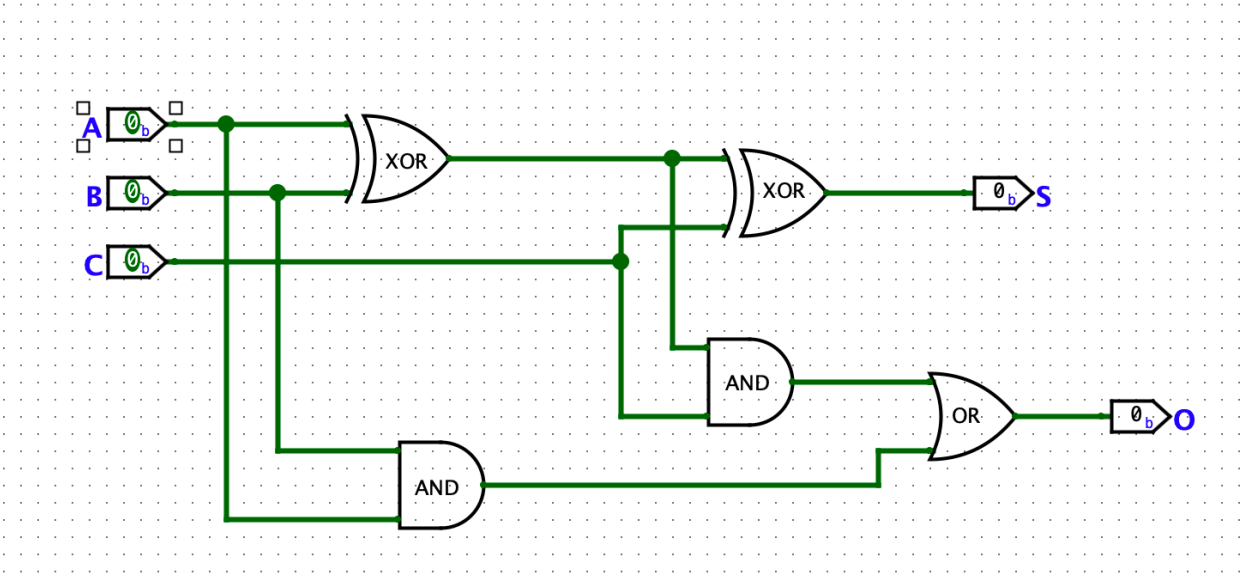
Mystery Circuit:



Truth Table of Mystery Circuit:

A	B	C	S	O
0	0	0	0	0
1	0	0	1	0
0	1	0	1	0
1	1	0	0	1
0	0	1	1	0
1	0	1	0	1
0	1	1	0	1
1	1	1	1	1

Circuit Equations:

S = AB'C' + A'BC' + A'B'C + ABC

O = ABC' + AB'C + A'BC + ABC
= BC (A' + A) + ABC' + AB'C
= BC + ABC' + AB'C + ABC + ABC
= BC + AC (B' + B) + AB (C' + C)
= BC + AC + AB

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Description:

When A is high and BC are low then S is high. When B is high and AC are low, then S is high. When C is high and AB are low then S is high.

S is only high when an odd number of inputs are high. As well, S is high when the decimal value of input ABC is part of the quadratic sequence (refer below).

Binary (ABC)	Decimal Value
001	1
010	2
100	4
111	7

S: 1, 2, 4, 7
+1 +2 +3
+1 +1

➔ Quadratic sequence

O is high when 2 or more inputs are high. When AB are high, then O is high. When AC are high and B is low, O is high. When BC are high and C is low, O is high.

When ABC is high, then S and O are high, and the number value of ABC is a multiple of 7 (refer below). When all inputs are low, S and O are low.

Binary: 111 → 7 (decimal number)