

ANOTHER WAY OF DIAGRAMMING SWITCHING CIRCUITS

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The relationship between symbolic logic and switching circuits is susceptible to an interesting treatment if we introduce the use of more complicated switches than the single-pole single throw (SPST) switches commonly found in diagrams. A single-pole double-throw switch (SPDT) can control more complex circuitry, as Figure 1 shows. The SPST can open or close only circuit C_1 , while the SPDT switch can control both circuits C_2 and C_3 , although it cannot close both at the same time, a useful fact. If the SPST switch is used to represent the values of a variable, P , then when the switch is closed, this is used to represent P as true, or as having the value 1, and when the switch is open, this represents P' , or P as having the value 0. The SPDT can be used to the same end, but represents P when closed on one side, and P' when closed on the other. Thus, circuit C_2 , when activated, could represent P , and circuit C_3 , when activated, represents P' .

If we employ two variables, P and Q , and one SPDT switch for each, an incomplete circuit such as the one in Figure 2 might be constructed. If to this certain additional connections be added, between the points of the P and Q switches, as would be necessary to make a complete circuit possible, these connections can be so made as to permit completion of the circuit, by throwing of the switches, only if one of the 16 functional relations between P and Q is satisfied. If, for example, we want the circuit closed only if P and Q have the value 1, which amounts to Conjunction, a connection may be made as in Figure 3. This circuit will be closed only if the switches are set at P and Q .

If the two SPDT switches are given simplified representation as in Figure 4, where the arrows indicate further connection into the circuit, all the useful connections between the points of those switches will be as shown and numbered. Each of the four connections in the figure corresponds to one row in the truth-table for P and Q , numbering the rows as follows: