

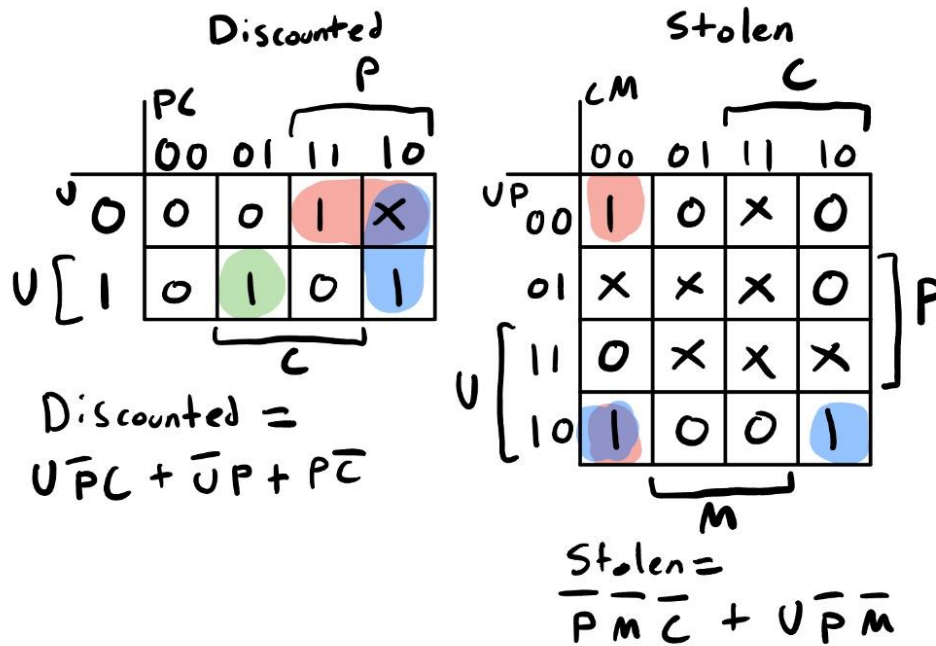
Lab 3

Digital Design using FPGAs

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The K-maps or Boolean simplification you did to create your design (*Discounted and Stolen*).

K-Maps for Discounted and Stolen Circuits



Boolean Simplification for Discounted Circuit

$$\begin{aligned}
 &\overline{U}\overline{P}\overline{C} + \overline{U}P + P\overline{C} \\
 &\overline{P}\overline{U}\overline{C} + P\overline{U} + P\overline{C} \\
 &\overline{P}\overline{U}\overline{C} + P(\overline{U} + \overline{C}) \\
 &\overline{P}\overline{U}\overline{C} + P(\overline{U}\overline{C}) \\
 &\overline{U}\overline{C} \oplus P
 \end{aligned}$$

Boolean Simplification for Stolen Circuit

$$\overline{P} \overline{M} \overline{C} + U \overline{P} \overline{M}$$

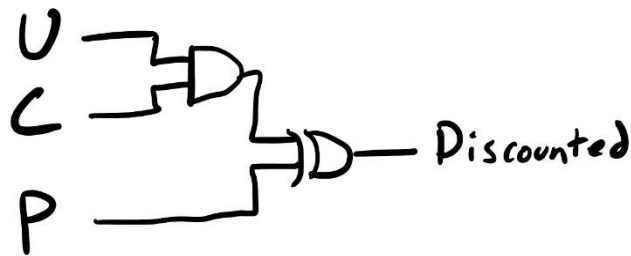
$$\overline{P} \overline{M} \overline{C} + \overline{P} \overline{M} U$$

$$\overline{P} \overline{M} (\overline{C} + U)$$

$$\overline{(P+M)} (\overline{C} + U)$$

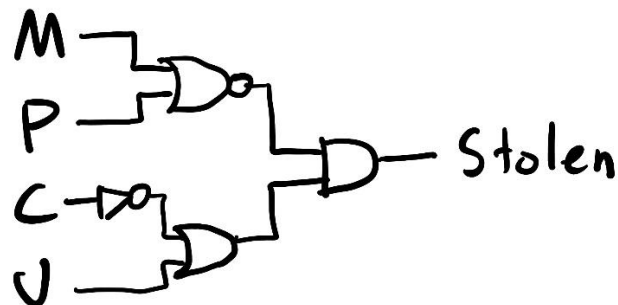
Your circuit diagrams (separate) for *Discounted* and *Stolen*.

Circuit Diagram for Discounted



This circuit takes in an item's UPC, encoded as a 3-bit integer (inputs U, P, C), and outputs 1 if and only if the corresponding item is discounted.

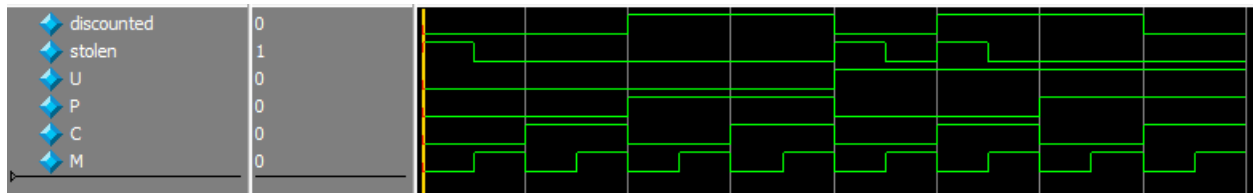
Circuit Diagram for Stolen Circuit



This circuit takes in an item's UPC, encoded as a 3-bit integer (inputs U, P, C) and a signal that indicates if the item was marked (input M), and outputs 1 if and only if the item is stolen.

A screenshot of the ModelSim simulation with explanation.

Nordstrom Circuit Simulation



This simulation shows the *Discounted* and *Stolen* outputs for each of the 8 possible UPCs each being “marked” and “unmarked.” Notice that the “discounted” signal is 1 only when the corresponding UPC matches to a discounted item, or the UPC is unused. Also notice that for any UPC that corresponds to an expensive item, the “stolen” signal is 1 when the marked signal “M” is 1, and the “stolen” signal goes to 0 when “M” goes to 0.

Time Estimation

This lab took approximately 4 hours, in total, to complete.