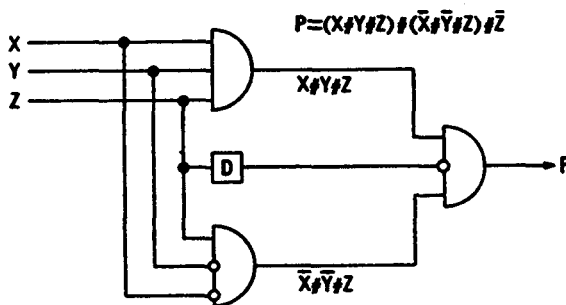


# DERIVING MAJORITY LOGIC NETWORKS

**FUND THM:**  $f(X,Y,Z) \equiv (\bar{X}\bar{Y}f_{\bar{X}\bar{Y}}) \oplus (\bar{X}Yf_{\bar{X}Y}) \oplus (X\bar{Y}f_{X\bar{Y}}) \oplus (XYZ)$   
**DEFINITIONS:**  $X\bar{Y}\bar{Z} \equiv \text{Maj}(X,Y,Z)$ ;  $f_{\bar{X}\bar{Y}} \equiv f(X,\bar{X},Z)$ ;  $f_{\bar{X}Y} \equiv f(X,\bar{X},Z)$   
**DERIVATION:** Let  $f(X,Y,Z)$  be even-parity function  $P$ .  
 Then  $f_{\bar{X}\bar{Y}} \equiv \bar{Z}$  and  $f_{\bar{X}Y} \equiv Z$  so



The fundamental theorem of majority-decision logic, a typical product of Univac's Mathematics and Logic Research Department, has practical as well as theoretical interest. The even-parity checker derived above from the fundamental theorem can be used to determine the parity of  $2^n$  bits in  $n$  logic levels using only  $\sum_{i=0}^{n-1} 2^i$  three-input majority gates.

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