

1. Consider the logical expression:

$$Y = abc f + abdf + abef + abcg + abdg + abeg$$

( $a, b, c, d, e, f, g$  are boolean variables; this is a sum-of-products expression.)

- (a) Is this in minimum sum-of-products form?  
(if not, reduce to minimum-sum-of-products; how many Pterms?)
- (b) If you implement directly with 2-input gates (assume can have any two-input gate), how many gates are required to implement this function?
- (c) Optimize the expression to reduce the number of 2-input gates required.

- i. Provide the optimized expression.

- ii. How many gates are required for your optimized solution?

2. Consider the  $n$ -input parity calculation:

$$Y = a_1 \oplus a_2 \oplus a_3 \oplus \dots a_n$$

( $\oplus$  is the exclusive-OR function:  $a \oplus b = a/b + /ab$ .)

- (a) How many Pterms would it require to implement this?   
(answer is a function of  $n$ )
- (b) Assuming you try to minimize the number of 2-input gates, how many two-input gates are required?