1. Consider the logical expression:

Y = abcf + 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 in two-level logic? (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?