

# ECE M16 Homework 1

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## Problem 1

Since there are 26 letters in the English Alphabet, we would need  $\lceil \log_2(26) \rceil = 5$  bits to represent this signal. Therefore we could create a way of encoding the English Alphabet as 5 bits with each letter being encoded as 1+ the encoding of the previous letter, for instance A=00000 and B=00001, etc.

## Problem 2

(a)

The equation for the circuit is

$$f(a, b, c) = ((a \vee \bar{b}) \wedge \bar{c}) \vee \overline{((c \wedge \bar{a}) \vee b)}$$

Expanding it we get

$$\begin{aligned} f(a, b, c) &= ((a \wedge \bar{c}) \vee (\bar{b} \wedge \bar{c})) \vee \overline{((c \wedge \bar{a}) \vee b)} \\ &= ((a \wedge \bar{c}) \vee (\bar{b} \wedge \bar{c})) \vee \overline{((c \vee b) \wedge (\bar{a} \vee b))} \\ &= ((a \wedge \bar{c}) \vee (\bar{b} \wedge \bar{c})) \vee (\overline{(c \vee b)} \vee \overline{(\bar{a} \vee b)}) \\ &= (a \wedge \bar{c}) \vee (\bar{b} \wedge \bar{c}) \vee (\bar{c} \wedge \bar{b}) \vee (a \wedge \bar{b}) \\ &= \boxed{(a \wedge \bar{c}) \vee (\bar{c} \wedge \bar{b}) \vee (a \wedge \bar{b})} \end{aligned}$$