Worksheet 9
EEL 4705
Emerging Logic Devices – K-Map based Mapping
(To convert AND/OR Logic to Majority Logic)

**Question 1:** Making use of the Algorithm and the K-Maps depicted, reduce the following function into a Majority Logic function. Each of the three functions \( f_1, f_2, f_3 \) will be only from the Library of K-Map patterns depicted above.

- \( n = \overline{a} \overline{b} \overline{c} + \overline{a} \overline{b} \overline{c} + \overline{a} \overline{b} \overline{c} + a \overline{b} \overline{c} \)
- Function needs to be broken in the form \( n = \text{Maj} (f_1, f_2, f_3) \)
- Find an admissible pattern for \( f_1 \) from the above library.
- For finding \( f_2 \), set \( \psi_1 \) is obtained as follows: if a minterm of \( n \) is not a minterm of \( f_1 \), add this minterm to \( \psi_1 \).
- Similarly, for finding \( f_2 \), set \( \psi_0 \) is obtained as follows: if a maxterm of \( n \) is not a maxterm of \( f_1 \), add this maxterm to \( \psi_0 \).
- A suitable pattern for \( f_2 \) is then determined using new \( \psi_1 \) and \( \psi_0 \) (from the above library).
- Furthermore, to determine \( f_3 \), \( \psi_1 \) and \( \psi_0 \) are updated again as follows: if a minterm (maxterm) of node \( n \) is not a minterm (maxterm) of both \( f_1 \) and \( f_2 \), add this minterm (maxterm) to \( \psi_1 \) (\( \psi_0 \)).

\[
\begin{align*}
n &= \overline{a} \overline{b} \overline{c} + \overline{a} \overline{b} \overline{c} + \overline{a} \overline{b} \overline{c} + a \overline{b} \overline{c} \\
\psi_1 &= \ldots \\
\psi_0 &= \ldots \\
f_2 &= \ldots \\
f_3 &= \ldots \\
n &= \overline{a} \overline{b} \overline{c} + \overline{a} \overline{b} \overline{c} + \overline{a} \overline{b} \overline{c} + a \overline{b} \overline{c} \\
f_1 &= \ldots \\
\psi_1 &= \ldots \\
\psi_0 &= \ldots \\
\end{align*}
\]
Question 2: Perform the AND/OR mapping of the same expression $n = \overline{a} \overline{b} \overline{c} + \overline{a} b \overline{c} + \overline{a} \overline{b} \overline{c} + a b c$. Then see the difference in the number of majority gates used for K-map method and AND/OR method.