Grouping – XOR and XNORs

With XOR and XNOR operations, grouping terms on either side of the XOR or XNOR function makes a difference

$$AB \oplus (C + B) \qquad AB \oplus (C) + B$$

$$AB \oplus (C + B) \qquad AB \oplus (C) + B$$

$$\overline{A}\,B + \overline{A}\,C + \overline{B}\,C \qquad B + \overline{A}\,C + \overline{B}\,C$$

$$\overline{A}\,B + \overline{A}\,C + \overline{B}\,C \neq B + \overline{A}\,C + \overline{B}\,C$$

Using the truth table, it can be shown that the correct solution is

$$\overline{A}\,B + \overline{A}\,C + \overline{B}\,C$$

$$A \oplus B = A\,\overline{B} + \overline{A}\,B$$

Grouping – XOR and XNORs

We can simplify the following problem by grouping

$$A \oplus B \oplus C$$

$$A \oplus (B \oplus C) \qquad (A \oplus B) \oplus C$$

$$A(\overline{B \oplus C}) + \overline{A}(B \oplus C) \qquad C(\overline{A \oplus B}) + \overline{C}(A \oplus B)$$

$$A(BC + \overline{B}\,\overline{C}) + \overline{A}(B\overline{C} + \overline{B}C) \qquad C(AB + \overline{A}\,\overline{B}) + \overline{C}(A\overline{B} + \overline{A}B)$$

$$A\overline{B}\,\overline{C} + ABC + \overline{A}B\overline{C} + \overline{A}\,\overline{B}C$$

Use the truth table to show the equivalence

$$A \oplus B \oplus C = A\overline{B}\,\overline{C} + ABC + \overline{A}B\overline{C} + \overline{A}\,\overline{B}C$$

$$A \oplus B = A\overline{B} + \overline{A}B \qquad \overline{A \oplus B} = AB + \overline{A}\,\overline{B}$$