FULL ADDER

(i) **Definition** - The full adder is a combinational circuit which is used to perform BINARY addition of three single bits.

(ii) **No. of inputs and outputs**

Number of inputs – 3

Number of outputs – 2

(iii) **Assigning symbols**

Symbols of inputs – X, Y, Z

Symbols of outputs – S (sum) and C (carry)

(iv) **Truth table**

<table>
<thead>
<tr>
<th>INPUT</th>
<th>OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
(v) **Boolean equation**

\[
S = X'Y'Z + X'YZ' + XY'Z' + XYZ
\]

\[= X' (Y'Z + YZ') + X (Y'Z' + YZ)\]

\[= X'(Y \text{ (XOR) } Z) + X(Y \text{ (XNOR) } Z)\]

\[= X \text{ (XOR) } Y \text{ (XOR) } Z\]

\[
C = X'YZ + XY'Z + XYZ' + XYZ
\]

\[= Z (X'Y + XY') + XY (Z' + Z)\]

\[= Z (X \text{ (XOR) } Y) + XY\]

(vi) **Logic Diagram**

![Logic Diagram](http://www.knowelectronics.org/full-adder/)