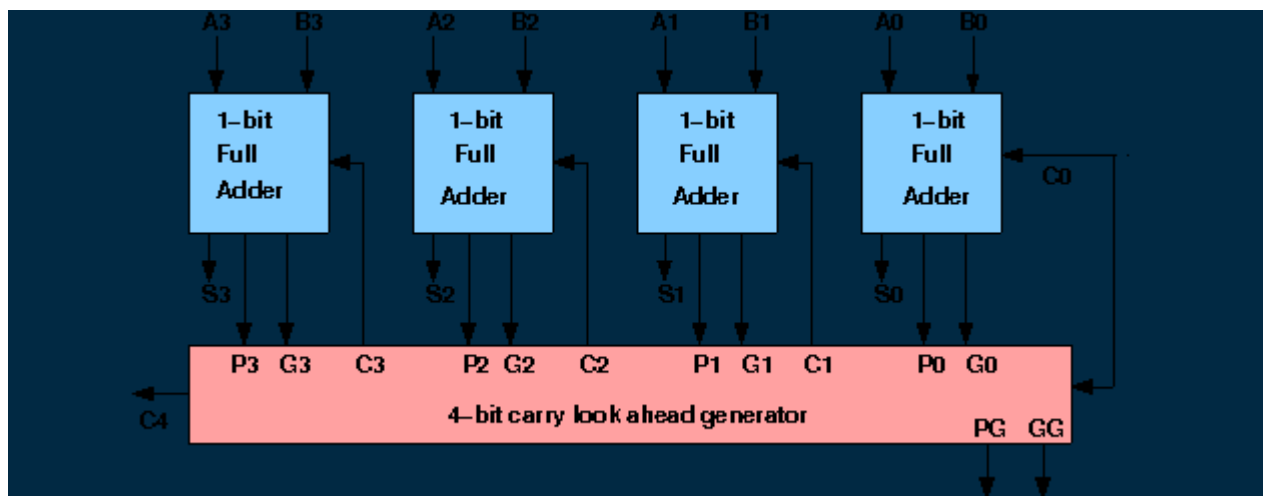


Experiment-5

Aim: Examining behaviour of carry lookahead adder for the module designed Theory

Design of Carry Lookahead Adders

To reduce the computation time, there are faster ways to add two binary numbers by using carry lookahead adders. They work by creating two signals P and G known to be **Carry Propagator** and **Carry Generator**. The carry propagator is propagated to the next level whereas the carry generator is used to generate the output carry, regardless of input carry. The block diagram of a 4-bit Carry Lookahead Adder is shown here below –



The number of gate levels for the carry propagation can be found from the circuit of full adder. The signal from input carry C_{in} to output carry C_{out} requires an AND gate and an OR gate, which constitutes two gate levels. So if there are four full adders in the parallel adder, the output carry C_5 would have $2 \times 4 = 8$ gate levels from C_1 to C_5 . For an n -bit parallel adder, there are $2n$ gate levels to propagate through.

Design Issues :

The corresponding boolean expressions are given here to construct a carry lookahead adder. In the carry-lookahead circuit we need to generate the two signals carry propagator(P) and carry generator(G),

$$P_i = A_i \oplus B_i$$

$$G_i = A_i \cdot B_i$$

The output sum and carry can be expressed as

$$\text{Sum}_i = P_i \oplus C_i$$

$$C_{i+1} = G_i + (P_i \cdot C_i)$$

Having these we could design the circuit. We can now write the Boolean function for the carry output of each stage and substitute for each C_i its value from the previous equations:

$$C_1 = G_0 + P_0 \cdot C_0$$

$$C_2 = G_1 + P_1 \cdot C_1 = G_1 + P_1 \cdot G_0 + P_1 \cdot P_0 \cdot C_0$$

$$C_3 = G_2 + P_2 \cdot C_2 = G_2 + P_2 \cdot G_1 + P_2 \cdot P_1 \cdot G_0 + P_2 \cdot P_1 \cdot P_0 \cdot C_0$$

$$C_4 = G_3 + P_3 \cdot C_3 = G_3 + P_3 \cdot G_2 + P_3 \cdot P_2 \cdot G_1 + P_3 \cdot P_2 \cdot P_1 \cdot G_0 + P_3 \cdot P_2 \cdot P_1 \cdot P_0 \cdot C_0$$

Procedure

Design of Carry Lookahead Adders :

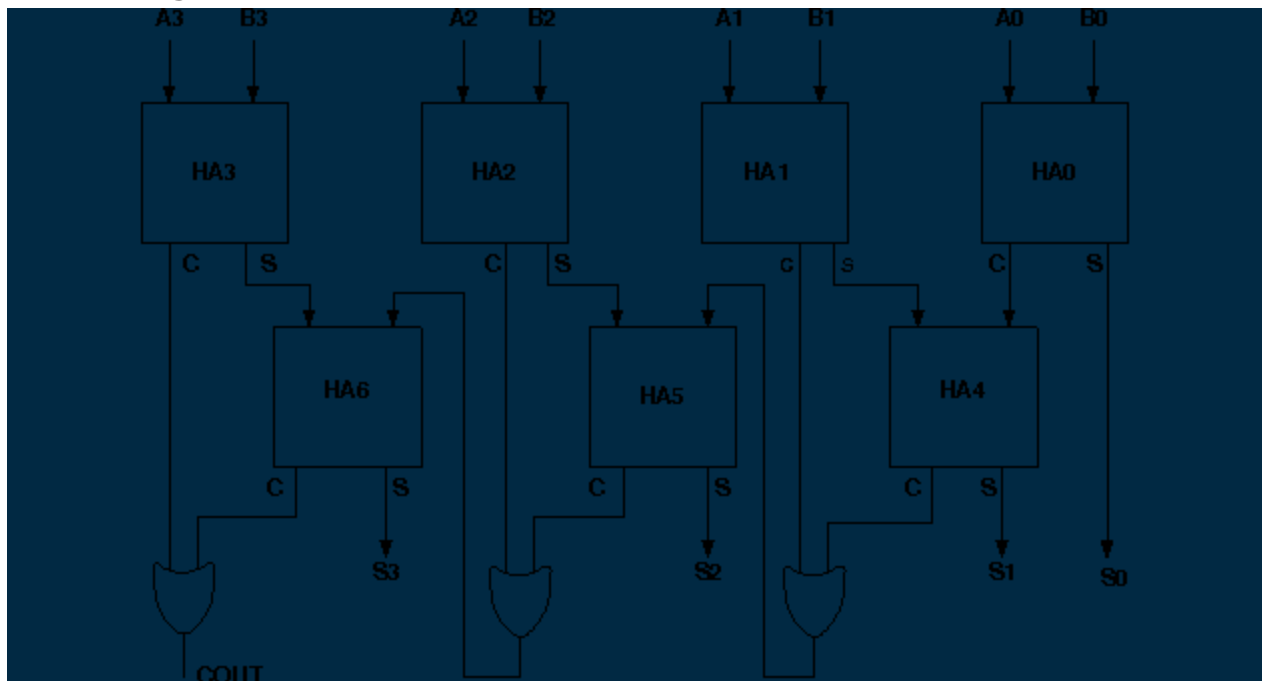
Procedure to perform the experiment: Design of Carry Lookahead Adders

1. Start the simulator as directed. This simulator supports 5-valued logic.
2. To design the circuit we need 7 half adder, 3 OR gate, 1 V+ (to give 1 as input), 3 Digital display (2 for seeing input and 1 for seeing output sum), 1 Bit display (to see the carry output), wires.
3. The pin configuration of a component is shown whenever the mouse is hovered on any canned component of the palette or press the 'show pinconfig' button. Pin numbering starts from 1 and from the bottom left corner (indicating with the circle) and increases anticlockwise.
4. For half adder input is in pin-5, 8 output sum is in pin-4 and carry is pin-1
5. Click on the half adder component (in the Adder drawer in the pallet) and then click on the position of the editor window where you want to add the component (no drag and drop, simple click will serve the purpose), likewise add 6 more full adders (from the Adder drawer in the pallet), 3 OR gates (from Logic Gates drawer in the pallet), 1 V+, 3 digital display and 1 bit Displays (from Display and Input drawer of the pallet, if it is not seen scroll down in the drawer)
6. To connect any two components select the Connection menu of Palette, and then click on the Source terminal and click on the target terminal. According to the circuit diagram connect all the components, connect V+ to the upper input terminals of 2 digital

displays according to you input. connect the OR gates according to the diagram shown in the screenshot connect the pin-1 of the half adder which will give the final carry output. connect the sum(pin-4) of those adders to the terminals of the third digital display which will give output sum. After the connection is over click the selection tool in the palette.

7. See the output, in the screenshot diagram we have given the value 0011(3) and 0111(7) so get 10 as sum and 0 as carry. you can also use many bit switches instead of V+ to give input and by double clicking those bit switches can give different values and check the result.

Circuit diagram of Carry Lookahead Adder:



Conclusion: Examination of carry look ahead adder is done.