EXPERIMENT NO: 8

Title: To implement : i)Ripple Carry Adder and ii) Carry look-ahead adder using simulator

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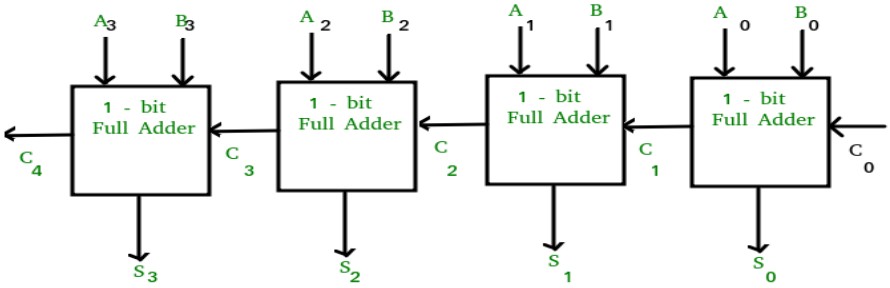
EXPERIMENT NO: 8

Simulate ripple carry and carry lookahead adder

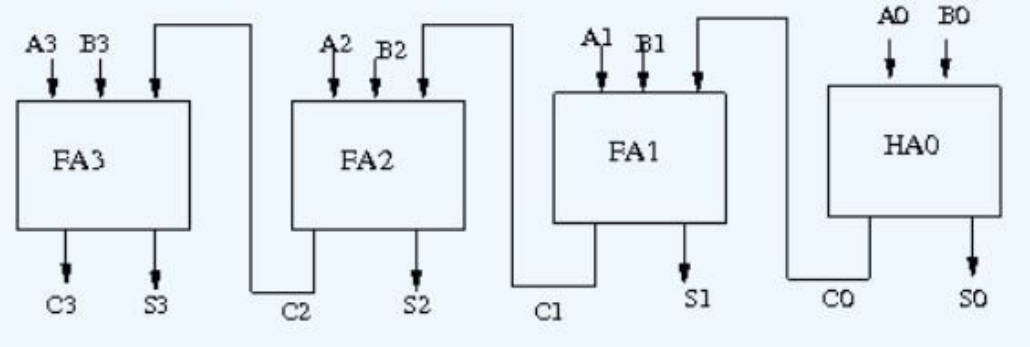
AIM	To implement a Ripple Carry Adder and Carry lookahead adder using simulator
LEARNING OBJECTIVE	To explore a simulation tool for computer organization components.
LEARNING OUTCOME	Students can simulate the operation of adder unit .
LAB OUTCOME	CSL 403.2: Ability to estimate the output of computer hardware operation using simulator.
PROGRAM OUTCOME	PO11, PO32, PO41, PO52, PO83, PO93, PO122, PSO11
BLOOM'S TAXONOMY LEVEL	Evaluate
THEORY	Ripple Carry Adder: Multiple full adder circuits can be cascaded in parallel to add an N-bit number. For an N- bit parallel adder, there must be N number of full adder circuits. A ripple carry adder is a logic circuit in which the carry-out of each full adder is the carry in of the succeeding next most significant full adder. It is called a ripple carry adder because each carry bit gets rippled into the next stage. In a ripple carry adder the sum and carry out bits of any half adder stage is not valid until the carry in of that stage occurs.Propagation delays inside the logic circuitry is the reason behind this. Propagation delay is time elapsed between the application of an input and occurance of the corresponding output.



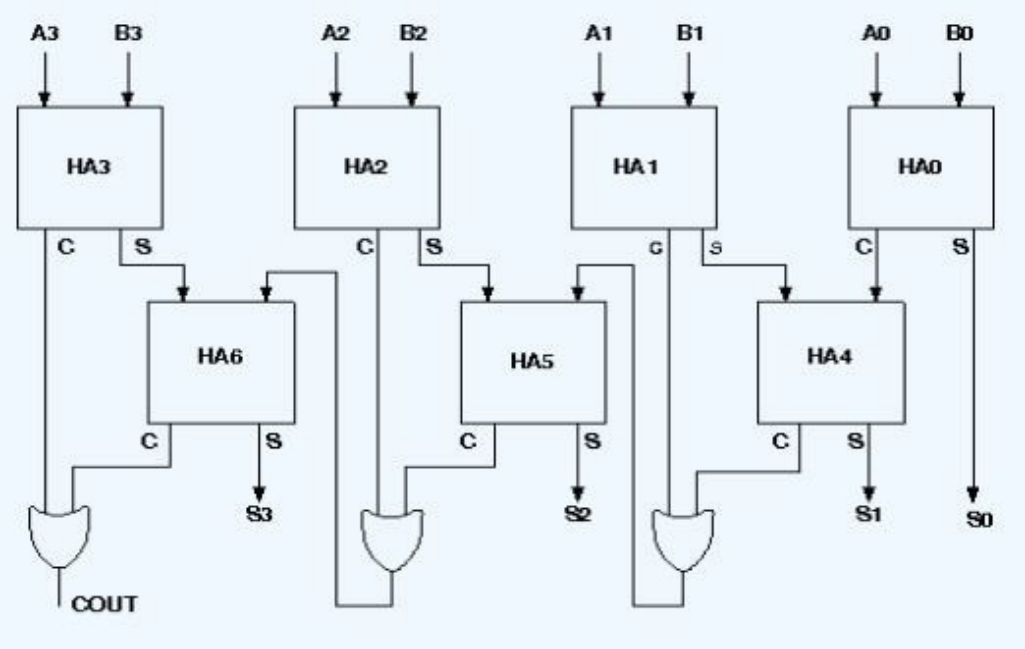
Carry Look-Ahead Adder :
In ripple carry adders, for each adder block, the two bits that are to be added are available instantly. However, each adder block waits for the carry to arrive from its previous block. So, it is not possible to generate the sum and carry of any block until the input carry is known. The i^{th} block waits for the $i-1^{th}$ block to produce its carry. So there will be a considerable time delay which is carry propagation delay.Consider the above 4-bit ripple carry adder. The sum S_4 is produced by the corresponding full adder as soon as the input signals are applied to it. But the carry input C_4 is not available on its final steady state value until carry C_3 is available at its steady state value. Similarly C_3 depends on C_2 and C_2 on C_1. Therefore, though the carry must propagate to all the stages in order that output S_3 and carry C_4 settle their final steady-state value.

CIRCUIT DIAGRAM

Ripple Carry Adder:

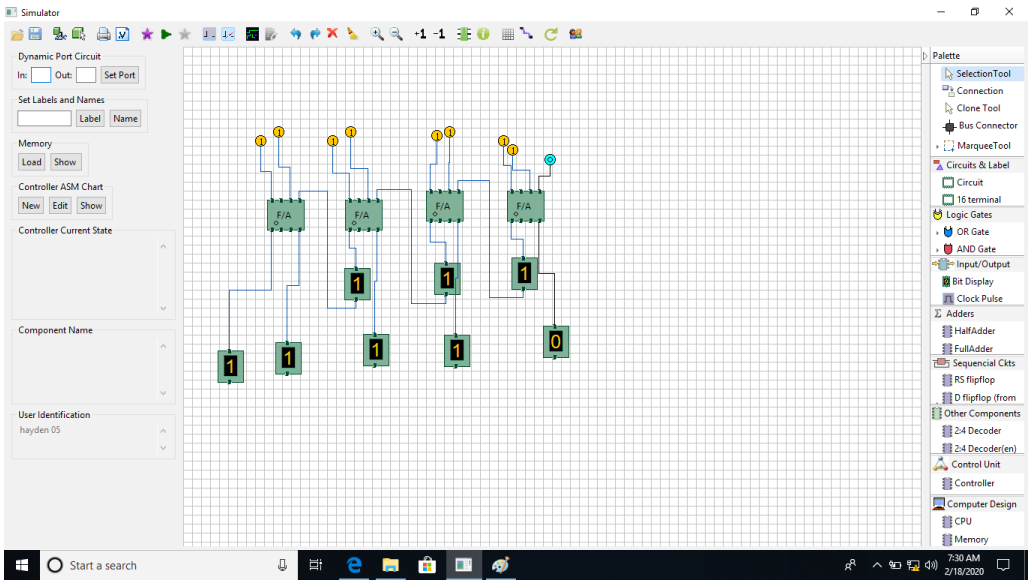


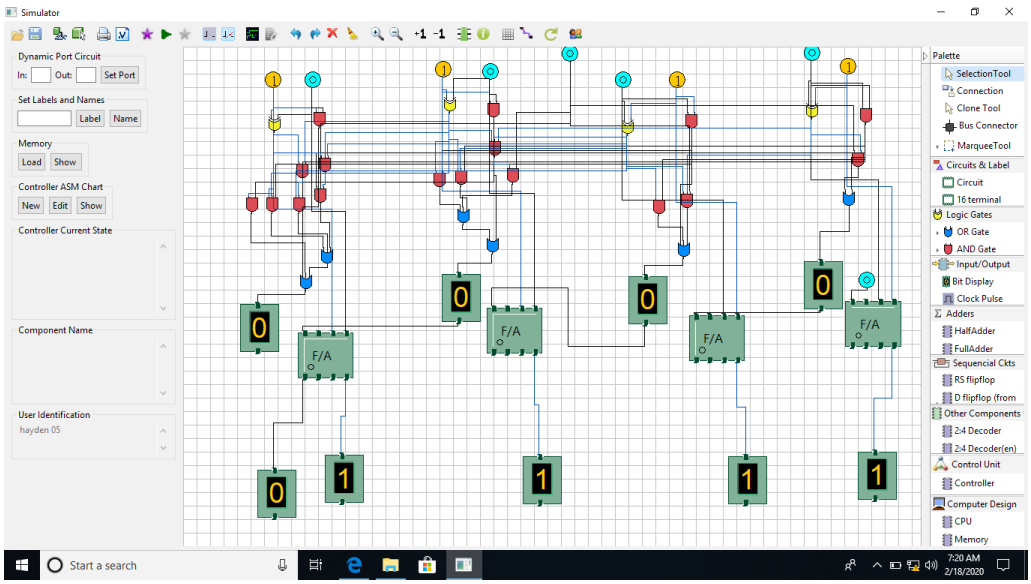
Carry Lookahead Adder:

	
COMPONENTS USED	**Ripple Carry Adder:** The components needed to create 4 bit ripple carry adder is listed here • 4 fulladders • wires to connect • LED display to obtain the output or we can use • 3 fulladders • 1 half adder • wires to connect • LED display to obtain the output **Carry Lookahead Adder:** The components needed to create 4 bit carry lookahead adder is listed here • 7 halfadders: 4 to create the look adder circuit, and 3 to evaluate Si and Pi • Ci • 3 OR gates to generate the next level carry Ci+1 • wires to connect • LED display to obtain the output
STEPS TO DESIGN THE CIRCUIT	**Ripple Carry Adder:** Start the simulator as directed. This simulator supports 5valued logic. 1. To design the circuit we need 3 full adder, 1 half adder, 8 Bit switch(to give input), 3 Digital display(2 for seeing input and 1 for seeing output sum), 1 Bit display(to see the carry output), wires.

	2. 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. 3. For half adder input is in pin5,8 output sum is in pin4 and carry is pin1, For full adder input is in pin5,6,8 output sum is in pin4 and carry is pin1 4. 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 3 full adders(from the Adder drawer in the pallet), 8 Bit switches, 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) 5. 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 4 bit switches to the 4 terminals of a digital display and another set of 4 bit switches to the 4 terminals of another digital display. connect the pin1 of the full adder which will give the final carry output. connect the sum(pin4) of all the adders to the terminals of the third digital display(according to the circuit diagram shown in screen shot). After the connection is over click the selection tool in the pallet. 6. To see the circuit working, click on the Selection tool in the pallet then give input by double clicking on the bit switch, (let it be 0011(3) and 0111(7)) you will see the output on the output(10) digital display as sum and 0 as carry in bit display. **Carry Lookahead Adder:** Start the simulator as directed. This simulator supports 5valued logic. 1. 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. 2. 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. 3. For half adder input is in pin5,8 output sum is in pin4 and carry is pin1 4. 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 pallete), 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) 5. 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 pin1 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 pallete. 6. 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.
SIMULATED RESULTS	

	
CONCLUSION	We have successfully implimented and simulated ripple carry adder and carry look ahead adder
REFERENCES	**https://cse.iitkgp.ac.in/~chitta/coldvl/rca_design.html**