

Simulation of Stack & Postfix/Prefix Evaluation Using Logisim.

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Introduction:

- Stack is Data Structure that follows LIFO Principle. It means the element added last will be removed first.
- It has basically 2 operations
 - Push
 - Pop
- These operations are controlled by a Top pointer.
- Push operation pushes the element until memory allocated to the stack is depleted. This is achieved with the help of Top pointer.
- Pop operation is used to remove the top most element from the stack.

Uses:

- Stack is used in Expression Evaluation and Expression Conversion (i.e. Infix, Prefix, Postfix).
- Many compilers use a stack for parsing the syntax of expressions, program blocks etc.
- Stack has its most important application in Backtracking (Recursion) & function call. This is done with the help of internal stack of the system.

Working:

- ❖ In our circuit **0 is used for pop operation** and **1 is used for push operation in stack.**
- ❖ If counter value is **1 then Top value is incremented by one** and the given input is stored in **RAM.**
- ❖ Another counter keeps track of the Top value of the stack.
- ❖ One register is used for Pop operation. It shows the value which was popped.
- ❖ If the clock is 1 then according to the value of push/pop, the operation is performed in the circuit.
- ❖ If the push operation is enabled then the input value is stored in RAM and the Top pointer is incremented by one.
- ❖ If the pop operation is enabled then the value pointed by Top pointer in RAM is popped and is stored in the Pop O/P register. Now, the Top pointer is decremented by one.
- ❖ Controller is the main part of the circuit that allows different operations like read/write etc.
- ❖ It takes care about when to read/write any values from/to RAM and it also takes care about incrementing/decrementing the Top pointer according to the input provided by user.
- ❖ Main circuit is implemented for Postfix/Prefix Evaluation. It uses the Stack circuit for push/pop operations. Input provides input to be pushed.

- ❖ Different operations like Addition/Subtraction/Multiplication/Division are used and are controlled with the help of multiplexers.
- ❖ Also, the output now is again pushed to the stack circuit. Select bit tells which input to be selected. Inp/Opr tells whether there is operator so that to pop 2 values from stack or an input to be pushed.
- ❖ Clock generates the clock pulses. Register A, B will store the popped elements. There is also Clr pin which will clear the previous values stored in the register so that there is no ambiguity.
- ❖ Carry O/P will store the carry O/P bits or any remainder.
- ❖ 2 clock pulses are required to push elements in the stack because 1 clock cycle for incrementing the Top pointer and 2nd one to store the element in the stack.
- ❖ 1 clock cycle is required to pop element from the stack as it decrements the top pointer by 1 and stores the popped value in the register in the same clock cycle.
- ❖ Post/Pre bit tells whether expression is a postfix/prefix. **1 for Postfix 0 for Prefix.**
- ❖ If expression is postfix then user must enter the expression from left.
- ❖ If the expression is prefix the user must enter the expression from right.