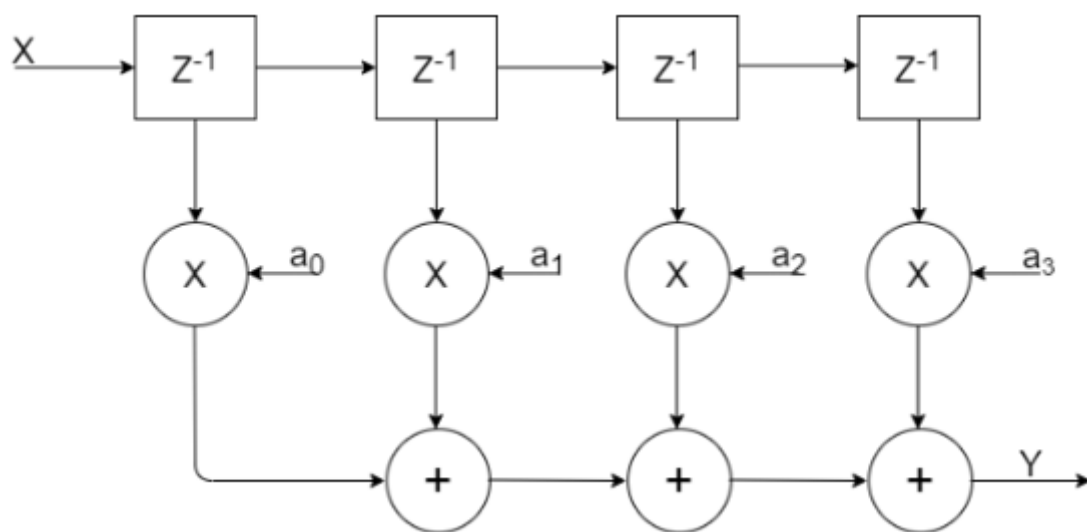


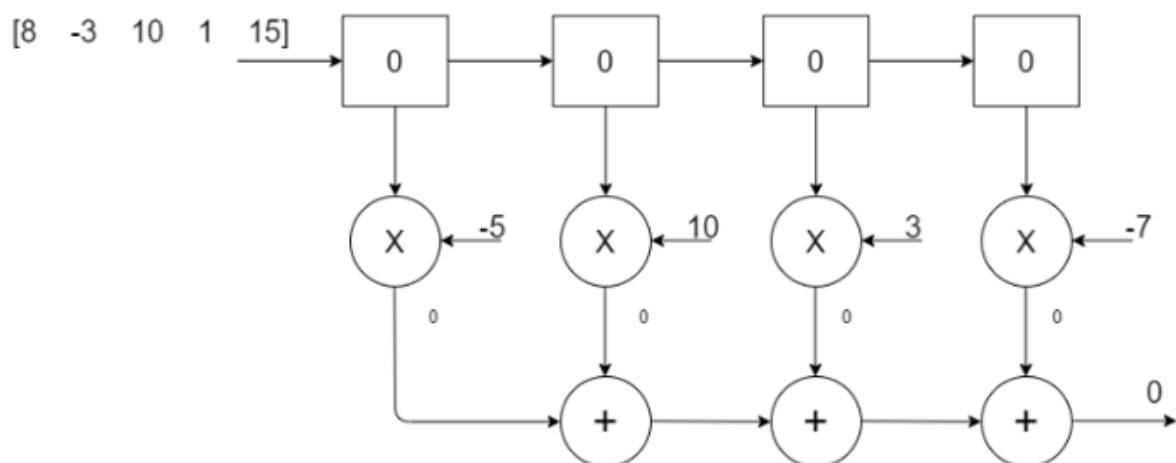
An FIR (finite impulse response) filter, takes the digital input data, manipulates it, and outputs the digital data. In this example, a simple convolution operation course between the input data (X), the FIR filter coefficients (a) to give an output (Y) which is the convolution between X and a.

Shown below is a generic design of a 4 tap FIR filter. As we can see, a FIR filter tap consists of delay block (z^{-1}), a multiplication block (\otimes), and the addition block (\oplus).



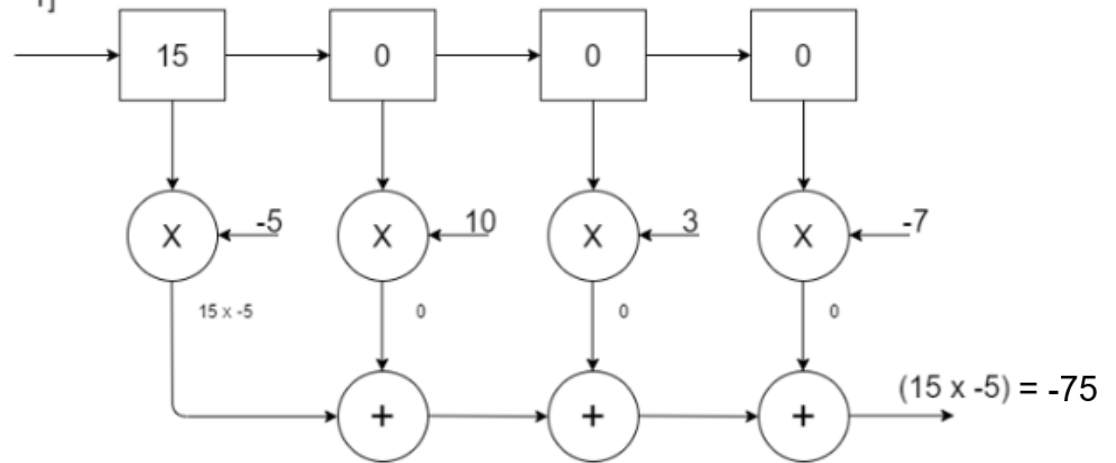
Shown below is a step by step process of the convolution operation between the input [8 -3 10 1 15] and the coefficients [-5 10 3 -7]. It should be noted, all the steps shown below, will occur at the positive edge of the system clock signal.

1)



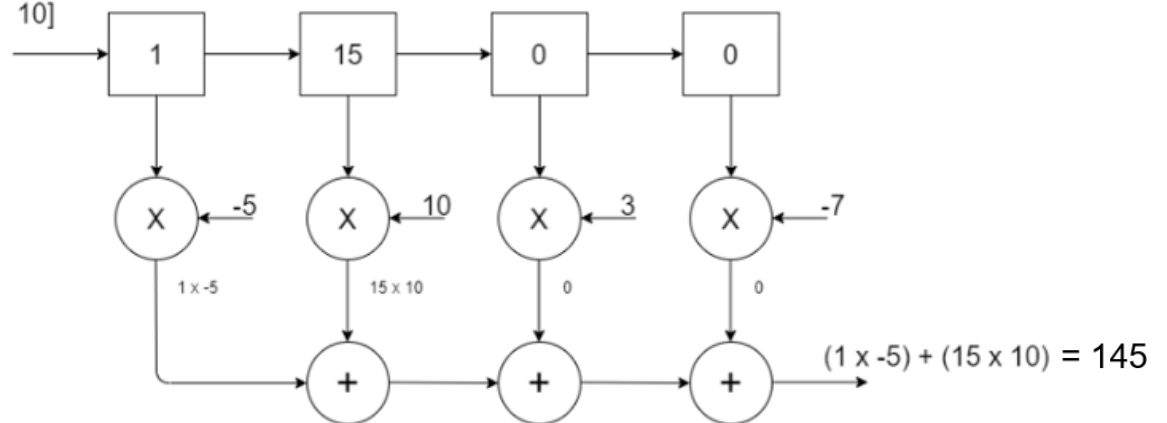
2)

[8 -3 10 1]



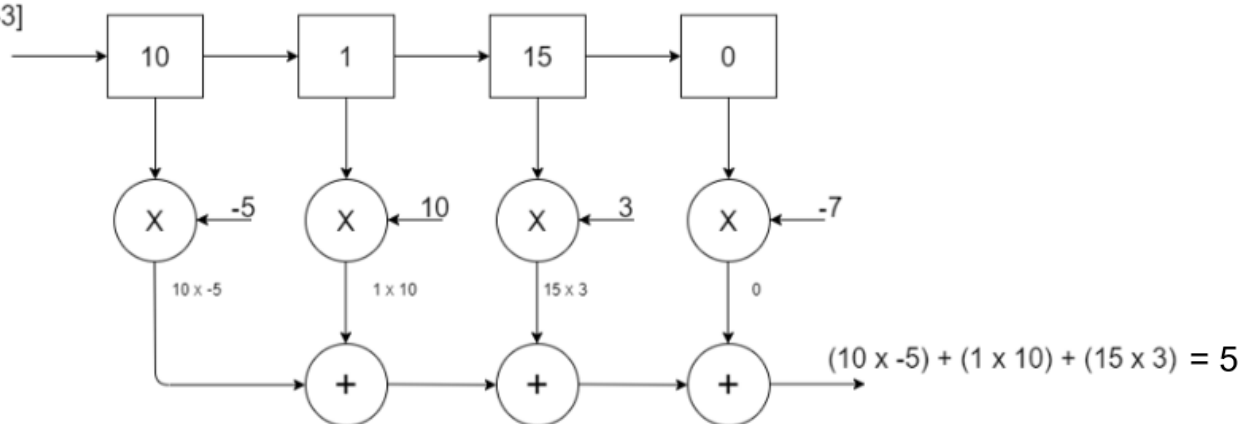
3)

[8 -3 10]

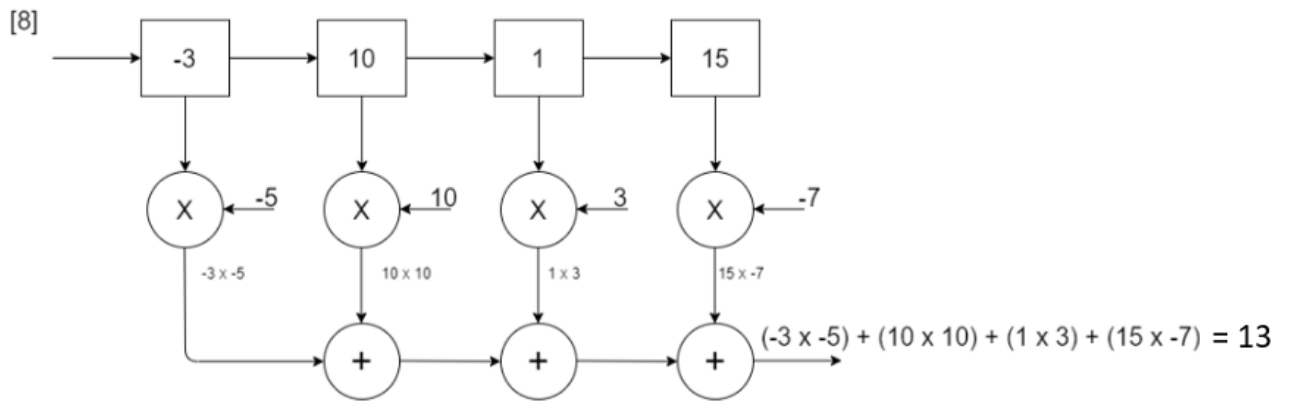


4)

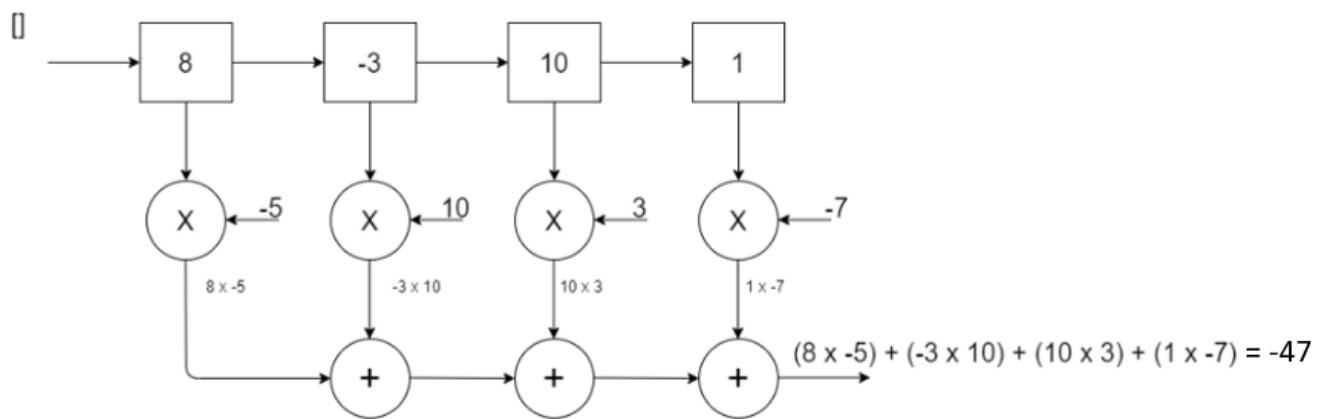
[8 -3]



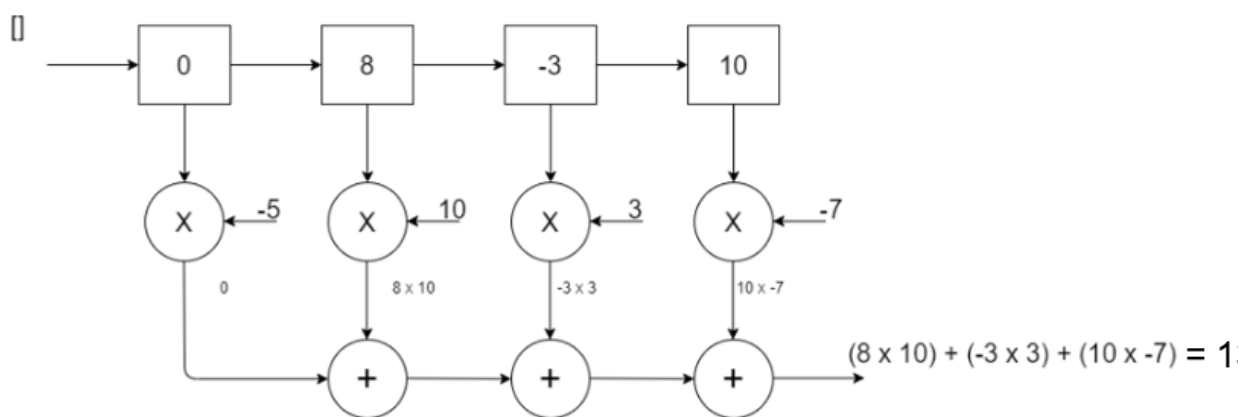
5)



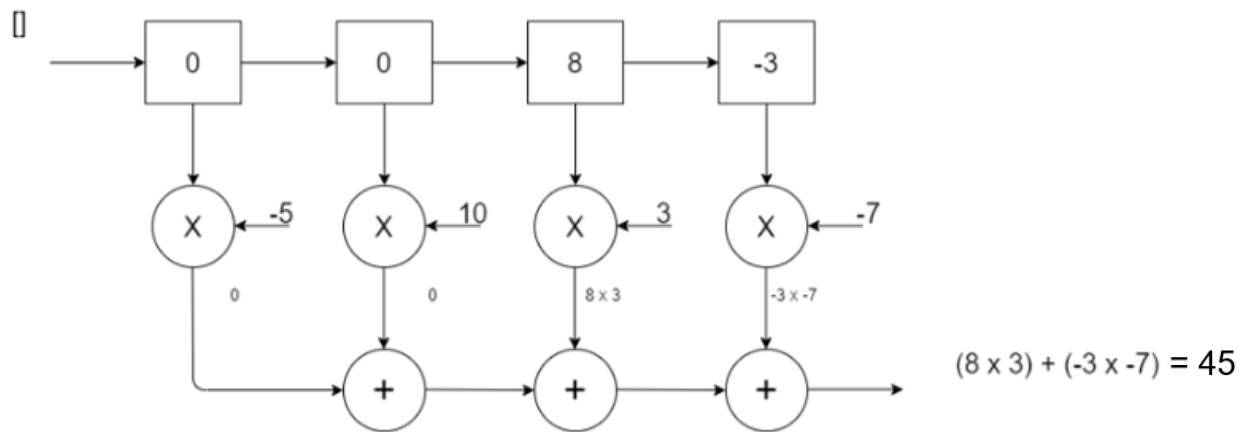
6)



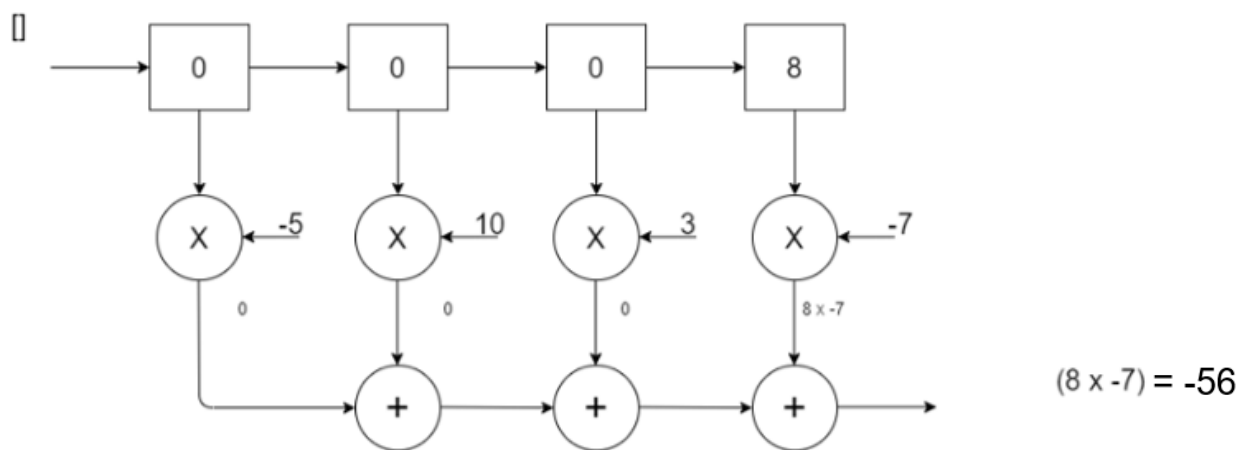
7)



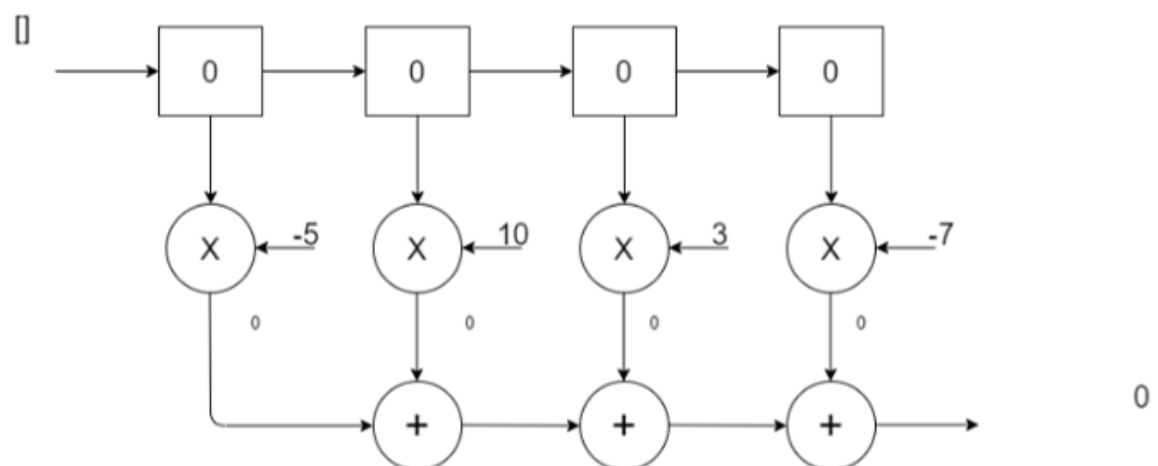
8)



9)



10)



The following convolution process between two complex numbers can be confirmed to be correct through by checking the corresponding operation in MATLAB, as shown below:

```
>> x = [15 1 10 -3 8];
```

```
>> a = [-5 10 3 -7];
```

```
>> conv(x,a)
```

```
ans =
```

```
    -75    145     5    13    -47     1    45   -56
```