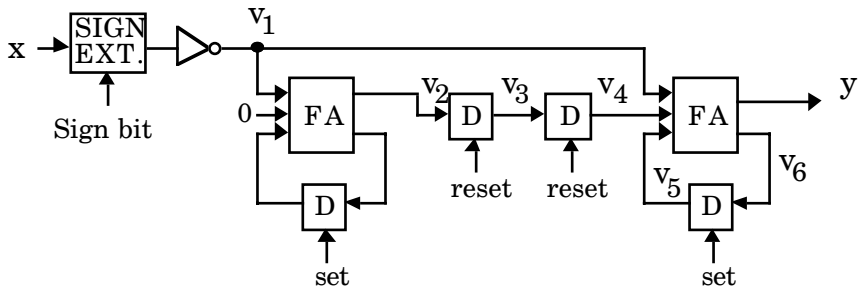
11.7 a) The number is negative and the numer of 1s in the coefficient $\alpha = (1.11011)_2$ is large and the usual method for optimization does therefore not yielda significant simplification. A better solution can be obtained by changing the sign of both the data and coefficient. The changing of sign of a two's-compliment number can be done by bitwise inversion and adding 1 at the LSB.

$$y = \alpha x = (-\alpha)(-x) = (-\alpha)(\bar{x} + 2^{-n}) = (-\alpha)\bar{x} + (-\alpha)2^{-n}$$

where $\bar{x}$ is the bitwise inversion of x.
The optimized block diagram is shown below.



b) Validation with x = $(1.001)_2$

x	v1	v2	v3	v4	v5	v6	y	
1	0	1	0	0	1	0	1	(LSB)
0	1	1	1	0	0	0	1	
0	1	1	1	1	0	1	0	
1	0	0	1	1	1	1	0	
-	0	0	0	1	1	1	0	
-	0	0	0	0	1	0	1	
-	0	0	0	0	0	0	0	
-	0	0	0	0	0	0	0	
-	0	0	0	0	0	0	0	(MSB)

$x \cdot \alpha = (-0.875)(-0.15625) = 0.13671875 = (0.00100011)2 = y$