

## Assignment # 6: Problem Set 4, Problem 1 - Due 2/13/2013

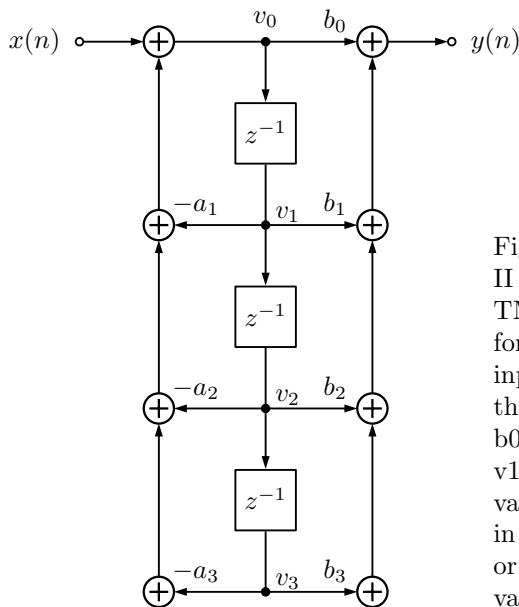


Figure 1: Shown to the left is the design of an “IIR direct form type II filter,” described in Chapter 5 of the text. Design a program for the TMS 32C5x DSP, discussed in class, to implement this filter, using the format of the class examples. Data sample  $x(n)$  is to be read from an input port, and filter output  $y(n)$  is to be sent to an output port, as in the “Low Pass Filter” example in the class slides. The values  $a_1, a_2, a_3, b_0, b_1, b_2, b_3$  are constants, stored in program memory. Variables  $v_0, v_1, v_2, v_3$  are to be stored in data memory. You may assume that all values are in the “proper format” to use for this calculation, as shown in the examples on the class slides. Submit the source program (typed or hand written). On the submitted program, show how you have the variables arranged and stored in memory.

PS4\_1.s

```

1  ;;;;;;;;;;;;;;
2  ;;      Brian Arnberg      ;;
3  ;;      Problem Set #4 – Problem 1      ;;
4  ;;      IIR direct form type II filter      ;;
5  ;;      TMS 32C5x DSP      ;;
6  ;;      y(n) = b3*v3 + b2*v2 + b1*v1 + b0*v0      ;;
7  ;;      v0 = x(n) – a3*v3 – a2*v2 – a1*v1      ;;
8  ;;      A3 = –a3      B3 = b3      B0 = b0      ;;
9  ;;      A2 = –a2      B2 = b2      ;;
10 ;;      A1 = –a1      B1 = b1      ;;
11 ;;      ;;
12 ;;;;;;;;;;;;;;
13
14      IN X0, PA0      ; read x(n) from PA0, set as X0
15      ZAP      ; clear A and P
16      ADD X0      ; A = A + X0
17      MAC A3, v3      ; –a3*v3
18      MAC A2, v2      ; –a2*v2
19      MAC A1, v1      ; –a1*v1
20      APAC      ; A = A+P
21      SACH v0      ; save LSB to V0
22      ZAP      ; clear A and P
23      MAC B3, v3      ; b3*v3
24      MACD B2, v2      ; +b2*v2, move v2 to v3
25      MACD B1, v1      ; +b1*v1, move v1 to v2
26      MACD B0, v0      ; +b0*v0, move v0 to v1
27      APAC      ; A=A+P
28      SACH Yn      ; save LSB
29      OUT Yn,PA1      ; write y(n) to PA1
30
31 ;;;;;;;;;;;;;;
32 ;;
33 ;;      Program Memory      |      Data Memory      ;;
34 ;;      -----      |      -----      ;;
35 ;;      A3 = –a3      |      X0      ;;
36 ;;      A2 = –a2      |      V0      (low)      ;;
37 ;;      A1 = –a1      |      V1      ;;
38 ;;      B0 = b0      |      V2      ;;
39 ;;      B1 = b1      |      V3      (high)      ;;
40 ;;      B2 = b2      |      ;;
41 ;;      B3 = b3      |      ;;
42 ;;;;;;;;;;;;;;

```