Exercise 2. (a)The maximum sample rate is limited by the critical path:

$$SampleRate_{max} = \frac{1}{T_{critical}} = \frac{1}{30} \qquad (4.3)$$

(b)The fundamental limit on the sample period is deteminded by the iteration bound:

$$SamplePeriod_{limited} = T_{IBound} = max[\frac{30}{2}, \frac{25}{1}] = 25 \qquad (4.4)$$
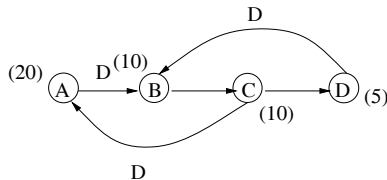
(c)The answer is shown in Figure 4.2

Fig. 4.2 Answer of Exercise 2(c)

Exercise 5. (a)

$$T_\infty = 4 \tag{4.7}$$

$$T_{critical} = 7 \tag{4.8}$$

(b)The minimum achievable clock period obtained with pipelining and retiming is the iteration bound of the DFG, which equals to 4 u.t. in this problem.
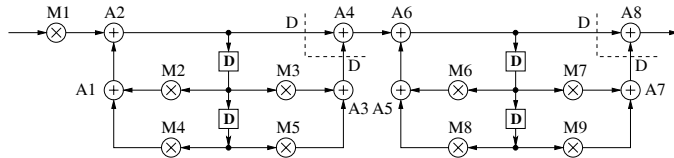

Fig. 4.5 Retimed data flow graph for Exercise 5.

Exercise 7. According to w_r(u-v)=w(u-v)+r(v)-r(u), we get the retimed DFG as in Figure 4.8.
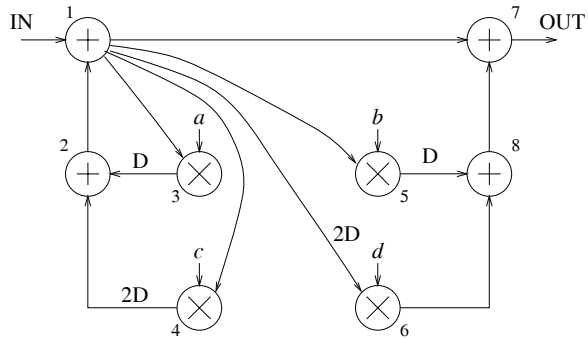
Fig. 4.8   Retimed DFG for Exercise 7.

Exercise 12. (a) The critical path time = the minimum clock period = $3 \times 25 = 75$ u.t.

(b) The 2-slow transformed and retimed filter structure is given in Figure 4.14. The clock period of the retimed filter is 3 u.t., and the sample period is $2 \times 3 = 6$ u.t.
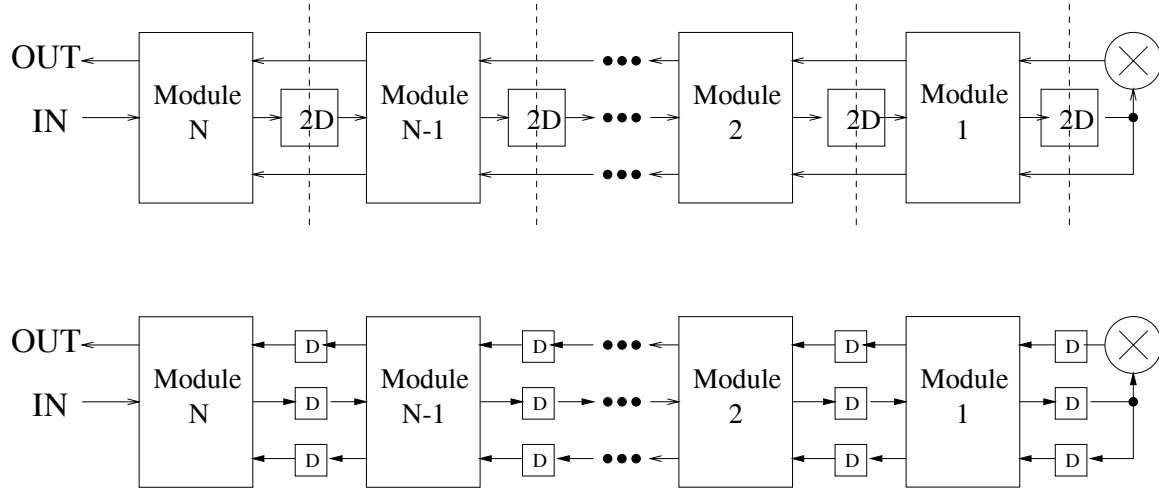

Fig. 4.14   The 2-slow and retiming transformed filter structure.

Exercise 13. The numbering of the nodes is shown in Figure 4.15. The minimum clock period is 4 u.t. The retiming solution and program are given at the end of this chapter.
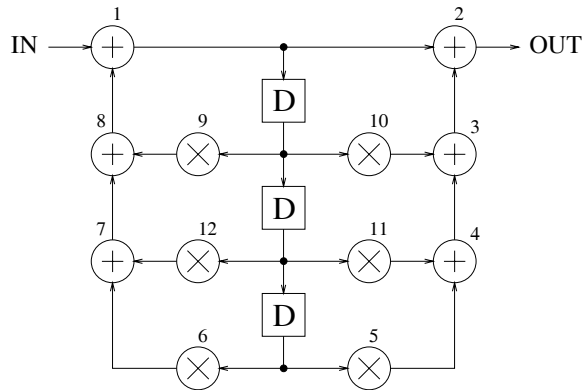
Fig. 4.15 Direct-form third order IIR filter.