6.29 a) The maximal sample frequency is determined by the critical loop.

$$T_{sample\ min} = (2\ t_{mult} + 2\ t_{add})/2 = (2 \cdot 2 + 2 \cdot 1)/2 = 3$$

b) We have $x = d + c(b + a\ z^{-2}\ x)$

This expression can be rewritten by using the distributive rule

$$x = d + c\ b + c\ a\ z^{-2}\ x$$

This does, however, not change the critical loop, as shown in the figure. If we now use the associative rule, the expression can be rewritten

$$x = ((c\ a)\ z^{-2}\ x + (d + c\ b))$$

The cirtical loop has now only two operations. We have

$$T_{sample\ min} = (t_{mult} + t_{add})/2 = (2 + 2\ )/2 = 2$$

Note that the number of operations has changed and the length of the other computational paths that are not part of the critical loop has also changed.