1 Question

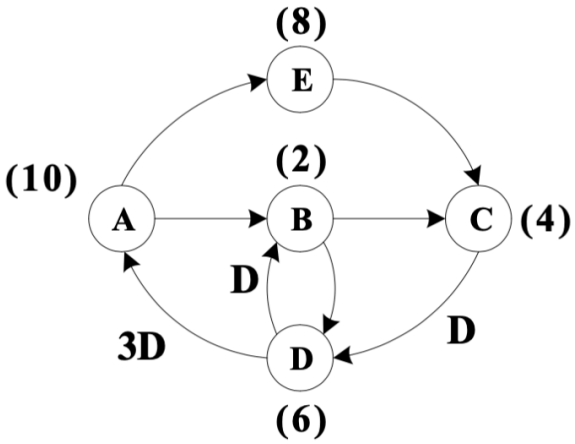
Consider the DFG below. The numbers in parentheses are the computation times of the nodes.

a) What is the iteration bound of this DFG? What is the actual iteration period?

b) Retime this DFG to minimize the iteration period. What is the actual iteration period of the retimed DFG?

c) Unfold both the original DFG and the retimed DFG by a factor of 2. what are their actual iteration periods?

d) Determine the minimum unfolding factor J such that the J-unfolded DFG (unfold from the original DFG) can be retimed so that the critical path of this unfolded and retimed DFG is , where is the iteration bound of the original DFG below. Unfold the DFG by this minimum unfolding factor and retime the unfolded DFG so that its critical path is .



2 Answer

(a) By inspection, we observe several loops in the DFG:

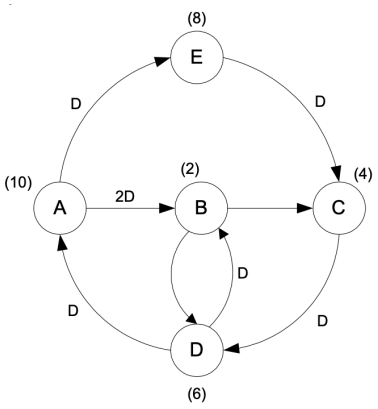
So, the boundary iteration is as below:

$$T^{(\infty)} = max\{\frac{10+8+4+6}{4}, \frac{10+2+4+6}{4}, \frac{10+2+6}{3}, \frac{6+2}{1}, \frac{6+4+2}{2}\} = 8$$

BI is 8 u.t.

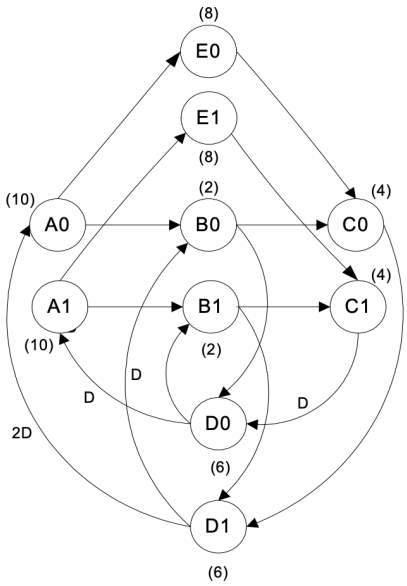
The actual iteration period is A->E->C->D (critical path), the value is 22 u.t

(b) We can retime the item of A. and E. the result DFG is like below:



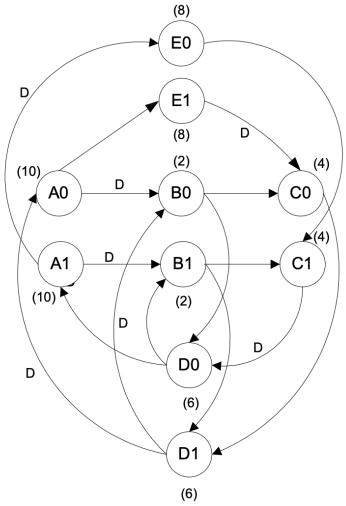
The minimum iteration period is 10 u.t. (because a single **A** is 10 u.t.), so the actual iteration period is A itself.

(c) Unfolding the original DFG by a factor of J=2, the new DFG is like follows:



The critical path is 28 u.t (A0->E0->C0->D1)

Unfolding the retimed DFG by J=2, the new DFG is like this:

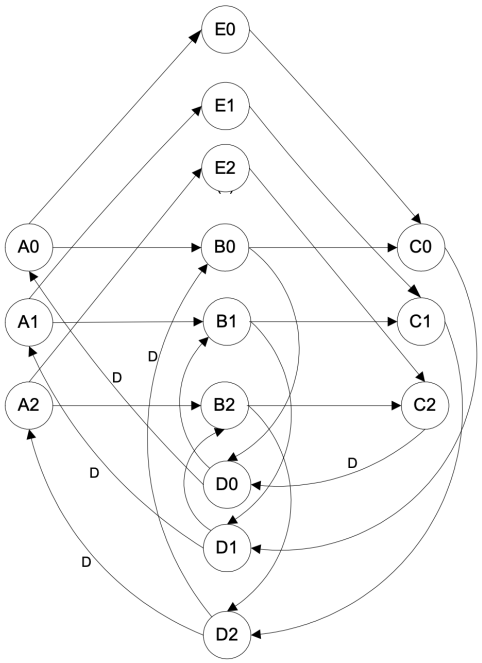


The critical path is 18 u.t (A0->E1)

(d) Solving the following equation retiming problems for the original DFG:

- For all edges U -> V in the DFG, $r(U) - r(V) \leq w(e)$;
- If $D(U, V) \geq c$, then $r(U) - r(V) \leq W(U, V) - J$

with increasing value of J until a solution is feasible and $c = 8J$ .Then this J is the minimum unfolding factor. It turns out that the minimum unfolding factor is equal to 3, and the 3-unfolded DFG is shown below:



Without further retiming, this DFG has an iteration period equal to $JxT_{\infty} = 24u.t.$ where T_{∞} is the iteration bound of the original graph.