12/12/23

ML-RC List Scheduling

$U_{lk} = \{ v_j \mid \gamma(v_j) = k \wedge t_i + d_i \leq l \quad \forall (v_i, v_j) \in E \}$

U_{lk}: l — time stamp; k — resource type

= set of all nodes whose predecessors are all scheduled and completed the execution before time stamp "l".

$T_{lk} = \{ v_j \mid \gamma(v_j) = k \wedge t_j + d_j > l \}$

= set of all nodes that are scheduled earlier and running in time stamp "l".

Select function :- Longest path to sink node

ML_RC_List $(a, \bar{a})$ {

$l = 1$

while (any node is not scheduled) {

For each type of resource k {

① Determine U_{lk}

② Determine T_{lk}

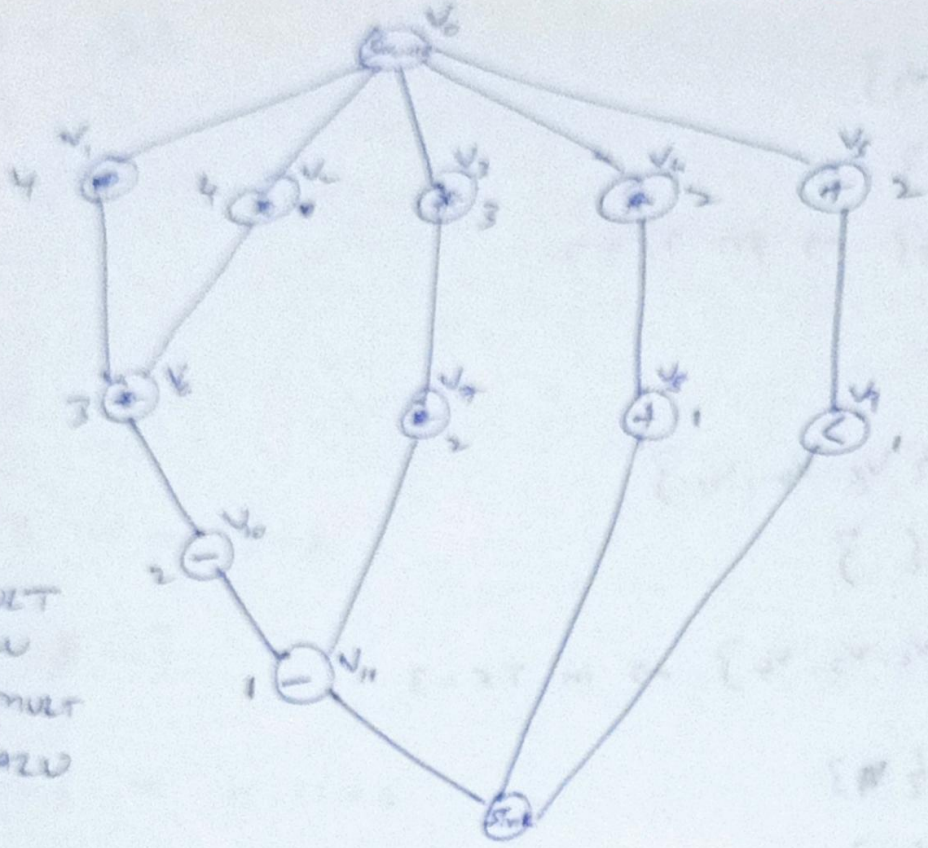
③ Select $S_k \subseteq U_{lk}$ such that $|S_k| + |T_{lk}| \leq a_k$ based on priority fun^c

④ Schedule S_k in l

}

l++

}



Comm:

$q_1 = 3 \Rightarrow$ MULT
$q_2 = 1 \Rightarrow$ ALU
$d_1 = 2 \Rightarrow$ MULT
$d_2 = 1 \Rightarrow$ ALU

l = 1

$U_{11} = \{v_1, v_2, v_3, v_4\}$

$T_{11} = \{\}$

$S_1 = \{v_1, v_2, v_3\} \Rightarrow$ in TS = 1

$U_{12} = \{v_5\}$

$T_{12} = \{3\}$

$S_2 = \{v_5\} \Rightarrow$ in TS = 1

l = 2

$U_{21} = \{v_6\}$

$T_{21} = \{v_1, v_2, v_3\}$

$S_3 = \{\bullet\} \Rightarrow$ in TS = 2

$U_{22} = \{v_9\}$

$T_{22} = \{\}$

$S_2 = \{v_9\} \Rightarrow$ in $TS = 2$

$l = 3$

$U_{31} = \{v_6, v_7, v_4\}$

$T_{31} = \{\}$

$S_1 = \{v_6, v_7, v_4\} \Rightarrow$ in $TS = 3$

$U_{32} = \{\}$

$T_{32} = \{\}$

$S_2 = \{\} \Rightarrow$ in $TS = 3$

$l = 4$

$U_{41} = \{\}$

$T_{41} = \{v_6, v_7, v_4\}$

$S_1 = \{\} \Rightarrow$ in $TS = 4$

$U_{42} = \{\}$

$T_{42} = \{\}$

$S_2 = \{\} \Rightarrow$ in $TS = 4$

$l = 5$

$U_{51} = \{\}$

$T_{51} = \{\}$

$S_1 = \{\} \Rightarrow$ in $TS = 5$

$U_{52} = \{v_{10}, v_8\}$

$T_{52} = \{\}$

$S_2 = \{v_{10}\} \Rightarrow$ in $TS = 5$

$l = 6$

$U_{61} = \{\}$

$T_{61} = \{\}$

$S_1 = \{\} \Rightarrow$ in $TS = 6$

$U_{62} = \{v_8, v_{11}\}$

$T_{62} = \{\}$

$S_2 = \{v_8\} \Rightarrow$ in $TS = 6$

$l = 7$

$U_{71} = \{\}$

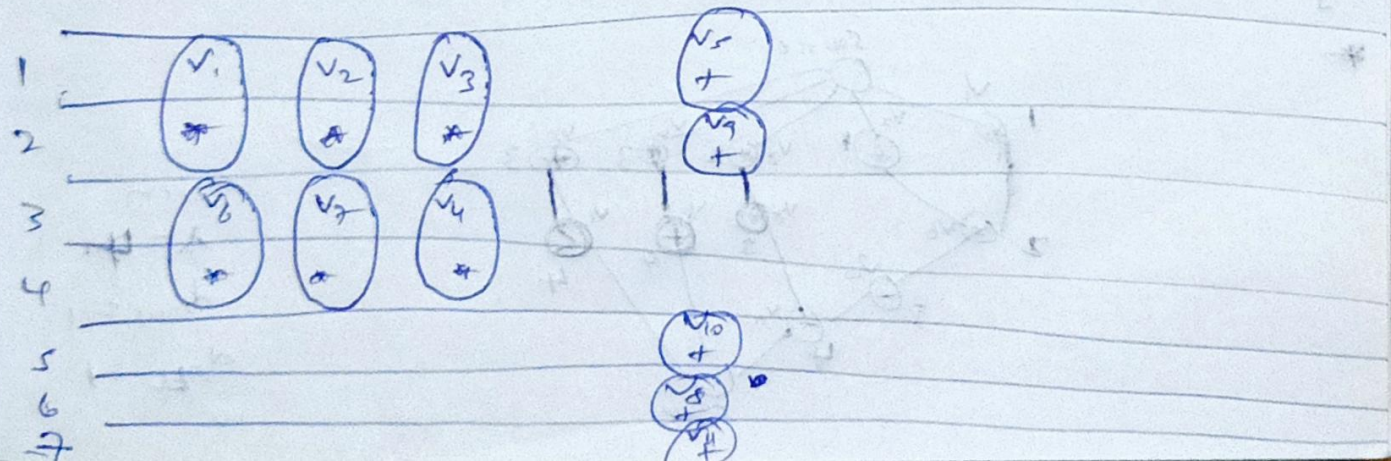
$T_{71} = \{\}$

$S_1 = \{\} \Rightarrow$ in $TS = 7$

$U_{72} = \{v_{11}\}$

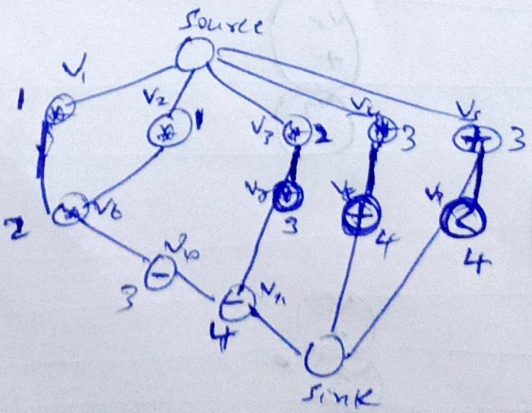
$T_{72} = \{\}$

$S_2 = \{v_{11}\} \Rightarrow$ in $TS = 7$



MR-LC list scheduling

```
MR_LC_List (G, λ) {
    T^ALAP = ALAP (G, λ)
    if (T_0^ALAP < 0) no valid scheduling possible
    l = 1
    while (any node needed to be scheduled) {
        for each type of resource {
            ① Determine U_lk, T_lk
            ② Compute slack s_i = t_i^ALAP − l  ∀ v_i ∈ U_lk
            ③ Schedule all the zero slack nodes in time stamp l
              and update the a_k if needed
            ④ Update resource a_k if needed for T_lk
            ⑤ If resource available, schedule non-zero slack nodes
        }
        l++
    }
}
```



Given
λ = 4
$d_{mul} = 1$
$d_{ALU} = 1$

$l=1$ ① ⇒ MUL ② ⇒ ALU

$a_1 = 1 \quad a_2 = 1$

$U_{11} = \{v_1, v_2, v_3, v_4\}$

$T_{11} = \{\}$

Slack $= \{0, 0, 1, 2\}$

Schedule $v_1, v_2 \quad [a_1, a_2] = [2, 1]$

$U_{12} = \{v_5\}$

$T_{12} = \{\}$

Slack $= \{2\}$

Schedule v_5

$l=2$

$U_{21} = \{v_6, v_3, v_4\} \quad T_{21} = \{\}$

Slack $= \{0, 0, 1\}$

Schedule v_6, v_3

$U_{22} = \{v_9\}$

$T_{22} = \{\}$

Slack $= \{2\}$

Schedule v_9

$l=3$

$U_{31} = \{v_4, v_7\} \quad T_{31} = \{\}$

Slack $= \{0, 0\}$

Schedule v_4, v_7

$U_{32} = \{v_{10}\} \quad T_{32} = \{\}$

MC

$Slack = \{0\}$

Schedule V_{10}

MU

$l = 4$

$U_{41} = \{\}$ $T_{41} = \{\}$

$U_{42} = \{V_{11}, V_8\}$ $T_{42} = \{\}$

$Slack = \{0, 0\}$

Schedule V_{11}, V_8 $[a_1, a_2] = [2, 2]$