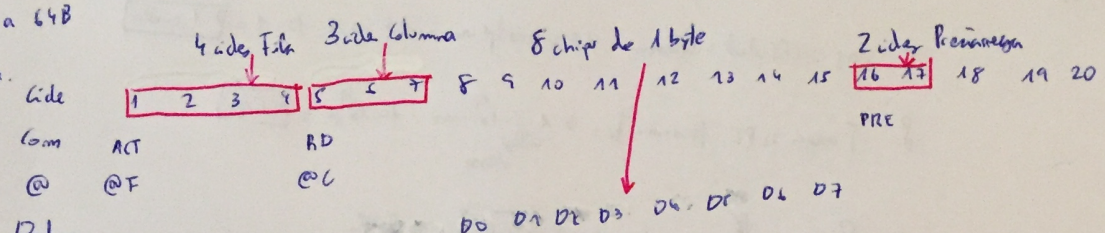
Marta Guerra I Marti

Problema 3.17:

- 8 chips 16 bits
- Latència fila = 4 cicles
- Latència d columna = 3 cicles
- Latència de precàrrega = 2 cicles
- Freqüència de rellotge = 200 MHz
- Read a 64B

a.



b. $f = \frac{1}{T_c} \Leftrightarrow T_c = \frac{1}{f} = \frac{1}{200 \cdot 10^6 \text{ Hz}} = \boxed{5 \text{ ns}}$

$T_c \text{ Memòria} = \#\text{cicles} \cdot T_c = 17 \text{ cicles} \cdot 5 \text{ ns} = \boxed{85 \text{ ns}}$

c. $\text{AmpleBanda} = \frac{\#\text{bytes}}{\text{temps}} = \frac{8B}{5 \text{ ns}} \cdot \frac{1 \text{ ns}}{10^9 \text{ s}} = 1.6 \cdot 10^9 \text{ B/s} = \boxed{1.66 \text{ GB/s}}$

d. $\text{AmpleBandaR} = \frac{\#\text{bytes}}{\text{temps}} = \frac{64B}{85 \text{ ns}} \cdot \frac{1 \text{ ns}}{10^9 \text{ s}} = 1.52 \cdot 10^9 \text{ B/s} = \boxed{752.94 \text{ MB/s}}$

e. def: # ACT (4 cicles) + RD (3 cicles) + PRE (2 cicles)

$I_{\text{fuita}} = 200 \text{ mA}$

$V = 1.5 \text{ V}$

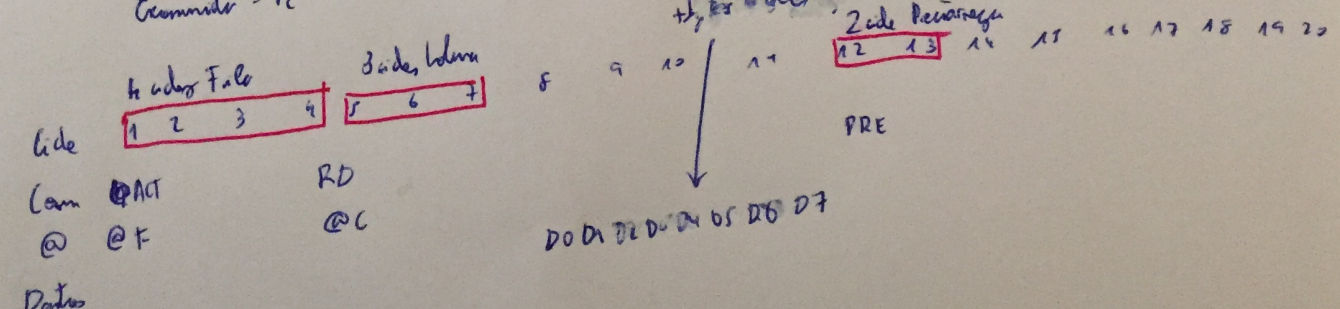
$\text{Potència Consumida} = \sum_{i=1}^{n} V_i \cdot I_i = (200 \text{ mA} + 100 \text{ mA}) \cdot \frac{1 \cdot 10^{-3} \text{ A}}{1 \text{ mA}} \cdot 1.5 \text{ V} \cdot \frac{9 \text{ cicles}}{25 \text{ accessos}} +$

$(500 \text{ mA} + 200 \text{ mA} + 100 \text{ mA}) \cdot \frac{1 \cdot 10^{-3} \text{ A}}{1 \text{ mA}} \cdot 1.5 \text{ V} \cdot \frac{8 \text{ cicles}}{25 \text{ accessos}} +$

$+ \left(1 - \frac{9}{25} - \frac{8}{25}\right) \cdot \frac{1 \cdot 10^{-3} \text{ A}}{1 \text{ mA}} \cdot 200 \text{ mA} \cdot 1.5 \text{ V} = \boxed{0.642 \text{ W/accessos}}$

$E_{\text{consumida}} = P_c \cdot t = 0.642 \text{ W} \cdot (5 \cdot 10^{-9} \frac{\text{cicles}}{\text{s}} \cdot 100 \text{ cicles}) = \boxed{321 \text{ nJ}}$

f.



Marta Cuenca i Martí

Problema 3.18:

$T_c = 10\,ns$

$P \Rightarrow \#instr_{cam} = 5 \cdot 10^9\ inst$

$T_{acc\acute{e}s\,Mem} = 1\,cicle$

$CPI = 1.8\ cicles/instrucció$

L2 combé: 32B

$m_2 = 0.3$

a. $T_{exec} = CPI \cdot \#IN \cdot T_c = 1.8\ \frac{cicles}{inst} \cdot 5 \cdot 10^9\ inst \cdot 10 \cdot 10^{-9}\ s = \boxed{90\ s}$

b. **Fa $5 \cdot 10^9$ accessos a memòria d'instruccions**

c. $\boxed{T_{pf} = 13\ cicles}$

$f = \frac{1}{10 \cdot 10^{-9}}$

d. $T_{mamInstruccions} = T_{hit} + T_{mem}^{exclusiva} \cdot T_{pf} = 1 + 0.1 \cdot 13 = 2.3\ cicles \cdot \frac{10 \cdot 10^{-9}\ s}{1\ cicle} = \boxed{23\ ns}$

e. $CPI = CPI_{ideal} + CPI_{mem} = 1.8 + \#rot_{pf \cdot m} = 1.8 + 0.1 \cdot 13 \cdot 1 = \boxed{3.1\ cicles}$

f. $T_{exec} = CPI \cdot \#ins \cdot T_c = 3.1 \cdot 5 \cdot 10^9\ \frac{cicles}{ins} \cdot 10 \cdot 10^{-9}\ s = \boxed{155\ s}$

g. $P_{r(accessos)} = 0.1 \cdot (1 - 0.3) = \boxed{0.07} \Rightarrow 7\%$

h. $P_{r(encerts)} = 0.1 \cdot (0.3)^{m_2} = \boxed{0.03} \Rightarrow 3\%$

i. $\boxed{5\ cicles}$

j. $\boxed{15\ cicles}$

k. $T_{mam} = T_{hit} + T_{accessos} \cdot T_{pf} = 1 + 0.03 \cdot 15 + 0.07 \cdot 5 = 1.8\ cicles \cdot \frac{10 \cdot 10^{-9}\ s}{1\ cicle} = \boxed{18\ ns}$

l. $CPI = CPI_{ideal} + CPI_{mem} = 1.8 + m \cdot t_{pf} \cdot \#r = 1.8 + \frac{cicles}{inst}(0.07 \cdot 5 + 0.03 \cdot 15)\ cicles/inst$

$= \boxed{2.6\ cicles/inst}$

m. $T_{exec} = CPI \cdot \#ins \cdot T_c = 2.6\ \frac{cicles}{inst} \cdot 5 \cdot 10^9\ inst \cdot 10 \cdot 10^{-9}\ s = \boxed{130\ s}$

n. $speedUp\,(theory) = \frac{155\ s}{130\ s} = \boxed{1.192}$