Sessió 12 ex. 1, 2, 3 ⟵ Tema 5

① a) push D   b) load A
   push C   sub B
   suba   store R
   push B   load C
   push A   sub D
   suba   store tmp
   div   load R
   push C   div tmp
   suba   store R
   pop R   load C
          sub R
          store R

② a) $10^9 \cdot 0.3 + 2(10^9 \cdot 0.1) = 5 \cdot 10^8$ accessos

b) $T_{exe} = \dfrac{N \cdot CPI}{f}$; $f = \dfrac{10^9 \cdot 2.5}{2.5} = 1 \cdot 10^9 \, Hz = 1 \, GHz$

c) $1.75 \cdot 10^9$ inst. d) $f = \dfrac{1.75 \cdot 10^9 \cdot 1.2}{2.5} = 0.85 \cdot 10^9 \, Hz = 0.85 \, GHz$

e) CISC : $I_{fuga} = 10A$ RISC : $I_{fuga} = 8A$
    $C = 50 \, mF$ $C = 40 \, mF$

$P_{fuga} = 10A \cdot 1V = 10 \, W$ $P_{fuga} = 8A \cdot 1V = 8 \, W$
$P_{comm} = 50 \cdot 10^{-9} F \cdot 1^2 \cdot 10^9 =$ $P_{comm} = 40 \cdot 10^{-9} \cdot 1^2 \cdot 8.4 \cdot 10^8 = 33.6 \, W$
$\quad = 50 \, W$ $P_{total} = 41.6 \, W$
$P_{total} = 60 \, W$ $E = P \cdot t = 41.6 \cdot 2.5 = 104 \, J$
$E = P \cdot t = 60 \, W \cdot 2.5 s = 150 J$

f) $Guany = \dfrac{150 J}{104 J} = 1.44 \rightarrow (1.44 - 1) \cdot 100 = 44.23\%$ g) $f = \dfrac{1.5 \cdot 10^9 \cdot 1.3}{2.5} = 0.78 \cdot 10^9 \, Hz$

h) $P_{total} = 8 W + (40 \cdot 10^{-9} F \cdot 1^2 \cdot 7.8 \cdot 10^8 \, Hz) = 39.2 \, W$ // $E = 39.2 \, W \cdot 2.5 s = 98 J$
$Guany = 150J / 98J = 1.53 \rightarrow (1.53 - 1) \cdot 100 = 53.06\%$.

③ a)   movl $0, %ecx   movl %ecx ⟵ $0
   loop: cmpl $1000000, %ecx   loop: cmpl $1000000, %ecx
       jge fin   jge fin
       movl x, %eax   load %eax ⟵ x
       imull V(,%ecx,4), %eax   load %e1 ⟵ V[%ecx·4]
       addl %eax, suma   imull %eax ⟵ %eax * %e1
       incl %ecx   load %e2 ⟵ suma
       jmp loop   addl %e2 ⟵ %e2 + %eax
   fin: store suma ⟵ %e2
                      addl %ecx ⟵ %ecx + $1
                      jmp loop
             fin:

c) $1.3 \, uops/cicle \rightarrow \dfrac{10000001 \, uops}{1.3 \, uops/cicle} =$
$\quad = 7.692.309 \, cicles$
$CPI = \dfrac{7.692.309 \, c}{7.000.001} = 1.0989 \, c/i$

b) instruccions dinàmiques $= 1000000 \cdot 7 + 1 = 7000001$
uops dinàmiques $= 1000000 \cdot 10 + 1 = 10000001$

d) $T_{exe} = \dfrac{N \cdot CPI}{f} = \dfrac{7.000.001 \cdot 1.0989}{3 \cdot 10^9} = 2.56 \cdot 10^{-3} s$

e) Tamany uops $= 6 \cdot 11 = 66 B$ // Tamany codi x86 $= 44 B$

f) Nº bytes llegits $= 44$ Bytes $\cdot 10^6 = 44 MB$ // Ample de banda $= 44 MB / 2.57 \cdot 10^{-3} s = 17.12 \, GB/s$

g) $10 \cdot 10^6$ uops $\cdot 6 B = 60 MB$ // Ample de banda $= 44 MB / 2.57 \cdot 10^{-3} s = 17.12 \, GB/s$

h) E sense caché uops $= (1mJ + 10mJ) \cdot 7 \cdot 10^6 = 77 \cdot 10^{-3} J = 77 \, mJ$
E amb caché uops $= (1mJ + 1mJ) \cdot 7 \cdot 10^6 = 14 \cdot 10^{-3} J = 14 \, mJ$
$Guany \; total = \dfrac{77 \cdot 10^{-3}}{14 \cdot 10^{-3}} = 5.5$