stop stop stop stop yield stop stop , notr , stop, dne, stop , yield, notr , stop, yield,

stop stop dne yield notr

stop : 11

yield : 4

notr : 3

dne : 2

1̶ 2 3̶ 4̶ 5̶ 6̶   7̶ 8̶ 9̶
1̶0̶ 1̶1̶ 1̶2̶ 1̶3̶ 1̶4̶ ⑮ 1̶6̶ 1̶7̶ 1̶8̶ 1̶9̶

2) $\frac{Cache}{Block\ size} = \frac{2^{10}}{2^5} = 2^5 = 32$

Sets → $\frac{total}{blocks\ per\ set} = \frac{32}{2} = 16 = 2^4$

tag size $= 30 - (4+5) = 21$ bits

Total $= 16 \cdot 2 = 32$

3) cache size $= 2048$ set

Data 0 - Data 7   - 8 blocks, 8 set associative

data size $= 32$ bit   4 byte

address - 32 bit

$log_2(4) = 2$ bits $log_2(2048) = 11$ bits

tag bits $= 32 - 11 - 2 = 19$

4) sets $= \frac{128}{4} = 32$

5) $2(\frac{1}{100} + \frac{1}{100}) = \frac{4}{100}$ Miss Rate $= 0.04$

6) $20\% \cdot \frac{1}{4} = 5\%$ 0.05

CPI $= 1$ 0.05 stores per cycle

$\frac{1}{0.05} = 20$ cycles/write.

min write buffer - 5

7) CPI $= 1$

I cache miss - 1%

Dcache   5%

Instruction mix - 30%.

Miss Penalty 250 cycles

a) Per instruction miss rate $= (0.3 \cdot 0.01) + (0.7 \cdot 0.05) = 0.03 + 0.035 = 0.038$ 3.8%

b) effective overall CPI $=$ base CPI $+ \left(\dfrac{\text{per instruction}}{\text{Miss rate}} \cdot \text{Miss Penalty} \right)$

$= 1 + (0.038 \cdot 250) = 1 + 9.5 = 10.5$

c) $\dfrac{\text{base}}{\text{effective}}$ CPI $= \dfrac{1}{10.5} = 0.0952$

d) Overall $=$ base $+ \left(\dfrac{\text{per instruction}}{\text{miss}} \cdot (\text{primary miss penalty} + \text{secondary miss} \cdot \dfrac{\text{sm}}{\text{rate}} \cdot \text{penalty}) \right)$

$= 1 + (0.038 \cdot (250 + 0.025 \cdot 20)) = 1 + (0.038 (250 + 0.5)) = 1 + (0.038 \cdot 250.5) \approx 10.525$

e) $0.5 \cdot$ base

8) Virtual address size $= 32$ bit

plays size $- 34$ bit

entries in each level $= 2^{10} = 1024$

$2^{12} B = 4096 B = 4KB$ page size

$\dfrac{16 kB}{4 kB} = 4$ entries

1. $1024 \cdot 4 = 4096 \, kB = 4 MB$ $\dfrac{8 MB}{4 MB} = 2$ entry

9)

10) $S_0 = (1,0,1,0,1,0,1) \Rightarrow 0$

$S_1 = (1,1,1,1,1,1,1,1) \Rightarrow 1$

$S_2 = (0,1,1,1,0,1,1) \Rightarrow 1$

$S_3 \Rightarrow (0,1,1,1,0,1,1) \Rightarrow 1$

$S_3 S_2 S_1 S_0 = 1110 = 14$ error position

1) $d=4$ $m=3$ $2^M = M + d + 1$

   $m<3$ $d<4$

   $2^2 = 2 + 1 + 1$ $M=2$ $d=1$

   $\begin{array}{ccc} p_2 & p_1 & D \\ 0 & 0 & 0 \\ 1 & 1 & 1 \end{array}$
2|

12) $G(x) = x^3 + 1 \ (k=3)$

13) $f'(x) = (1 \cdot 3) x^{3-1} + (3 \cdot 2) x^{2-1} + (1 \cdot 1) x^{1-1}$

   $= (1+1+1) x^2 + (1+1) x + 1)$

   $= 1x^2 + 0x + 1 = 1x^2 + 1$

14) δ post : $t \cdot 2 = 2t$

15) $P'(v) = C \sum\limits_{v \in B_v} \dfrac{R \cdot (v)}{N_v} + c E(v)$ $v_1 = 7$ $c=1$
                                                                                    $v_2 = 4$ $E(v) = 0$

   $E(v) = 0$ $v_3 = 3$
   $c = 1$ $R'(v)$ $v_4 = 6$ $R'(v) = 1 (\frac{7}{6} + \frac{t4}{1} + \frac{3}{2} + \frac{t6}{1}) + 1 = 0$

   16) $\dfrac{1}{(1 + e^{-2})}$ $e = 2$ $R'(v) = (\frac{2}{6} + 4 + \frac{8}{2}) + 6$

                                                                                    $R'(v) = \frac{76}{6}$

19) $R = \begin{pmatrix} i^4, & i^1 \\ i^3, & i^2 \end{pmatrix}$ $S = \begin{pmatrix} 3, & 9 \\ 7, & 1 \end{pmatrix}$

$$= \begin{bmatrix} 2+12i & 1+16i \\ 4+9i & 2+12i \end{bmatrix}$$