

CompArch_HW5

PB19111713钟颖康

1.

(1):

根据题意,

	缓冲缺失	预测正确	预测错误
发生概率	$15\% \times (1 - 90\%) = 1.5\%$	$15\% \times 90\% \times 90\% = 12.15\%$	$15\% \times 90\% \times (1 - 90\%) = 1.35\%$
代价	3	0	4

$$CPI = 1 + 3 * 1.5\% + 0 * 12.15\% + 4 * 1.35\% = 1.099$$

(2):

$$CPI' = 1 + 2 * 15\% = 1.3$$

$$speedup = \frac{1.3}{1.099} = 1.183$$

故(1)中的更快。

2.

(1):

每6个FLOPs读4个浮点数, 写2个浮点数, 密度为6/6=1

(2):

不妨MVL=64

```
1      li      $vL,44          # perform the first 44 ops
2      li      $r1,0           # initialize index
3  loop:  lv     $v1,a_re+$r1     # load a_re
4        lv     $v3,b_re+$r1     # load b_re
5        mulvv.s $v5,$v1,$v3     # a_re*b_re
6        lv     $v2,a_im+$r1     # load a_im
7        lv     $v4,b_im+$r1     # load b_im
8        mulvv.s $v6,$v2,$v4     # a_im*b_im
9        subvv.s $v5,$v5,$v6     # a_re*b_re - a_im*b_im
10       sv     $v5,c_re+$r1     # store c_re
11       mulvv.s $v5,$v1,$v4     # a_re*b_im
12       mulvv.s $v6,$v2,$v3     # a_im*b_re
13       addvv.s $v5,$v5,$v6     # a_re*b_im + a_im*b_re
14       sv     $v5,c_im+$r1     # store c_im
15       bne    $r1,0,else       # check if first iteration
16       addi   $r1,$r1,#44      # first iteration, increment by 44
17       j      loop            # guaranteed next iteration
18  else:  addi   $r1,$r1,#256    # not first iteration, increment by 256
19  skip:  blt    $r1,1200,loop   # next iteration?
```

(3):

```
1 1. mulvv.s mulvv.s # a_re * b_re (assume already loaded), load a_im
2 2. lv      mulvv.s # load b_im, a_im*b_im
3 3. subvv.s sv      # subtract and store c_re
4 4. mulvv.s lv      # a_re*b_im, load next a_re vector
5 5. mulvv.s lv      # a_im*b_re, load next b_re vector
6 6. addvv.s sv      # add and store c_im
```

共计6chimes

(4):

$$6chimes \times 64elements + 15cycles(load/store) \times 6 + 8cycles(multiply) \times 4 + 5cycles(add/subtract) \times 2 = 516$$

即每次迭代需要516个周期

故每个结果所需周期数516/128=4

3.

(1):

$$1.5 \times 16 \times 16 = 384GFLOPS/s$$

(2):

假设每次需要 2 个 4byte 操作数并输出 1 个 4byte 结果,

$$12bytes/FLOP \times 384GFLOPs/s = 4.6TB/s$$

则需要4.6TB/s的带宽, 而给定的带宽仅为100GB/s, 故不能持续。