计算机体系结构第五次作业答案

题目 1

(a.)

每 6 个 FLOPs 读 4 个浮点数，写 2 个浮点数，密度为 6/6 = 1

(b.)

假设 MVL=64

```
        li          $VL,44          # perform the first 44 ops
        li          $r1,0           # initialize index
loop:   lv          $v1,a_re+$r1    # load a_re
        lv          $v3,b_re+$r1    # load b_re
        mulvv.s     $v5,$v1,$v3     # a+re*b_re
        lv          $v2,a_im+$r1    # load a_im
        lv          $v4,b_im+$r1    # load b_im
        mulvv.s     $v6,$v2,$v4     # a+im*b_im
        subvv.s     $v5,$v5,$v6     # a+re*b_re - a+im*b_im
        sv          $v5,c_re+$r1    # store c_re
        mulvv.s     $v5,$v1,$v4     # a+re*b_im
        mulvv.s     $v6,$v2,$v3     # a+im*b_re
        addvv.s     $v5,$v5,$v6     # a+re*b_im + a+im*b_re
        sv          $v5,c_im+$r1    # store c_im
        bne         $r1,0,else      # check if first iteration
        addi        $r1,$r1,#44     # first iteration,
                                    increment by 44
        j loop                      # guaranteed next iteration
else:   addi        $r1,$r1,#256    # not first iteration,
                                    increment by 256
skip:   blt         $r1,1200,loop   # next iteration?
```

(c.)

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

一共 6chimes

(d.)

每次迭代所需的周期数 =

6 chimes * 64 + 15 (load/store) * 6 + 8 (乘法) * 4 + 5 (add/subtract) * 2 =

516

每个结果所需的平均周期数 =

516 / 128 = 4

题目 2

4.13 a. 1.5 GHz × .80 × .85 × 0.70 × 10 cores × 32/4 = 57.12 GFLOPs/s

b. **Option 1:**

1.5 GHz × .80 × .85 × .70 × 10 cores × 32/2 = 114.24 GFLOPs/s (speedup = 114.24/57.12 = 2)

Option 2:

1.5 GHz × .80 × .85 × .70 × 15 cores × 32/4 = 85.68 GFLOPs/s (speedup = 85.68/57.12 = 1.5)

Option 3:

1.5 GHz × .80 × .95 × .70 × 10 cores × 32/4 = 63.84 GFLOPs/s (speedup = 63.84/57.12 = 1.11)

Option 3 is best.

题目 3

GPU 的峰值单精度浮点吞吐率是 **1.5*16*16 = 384 GFLOPS/s**
但是假设每次需要 2 个 4byte 操作数并输出 1 个 4byte 结果，则需要 12bytes/FLOP * 384 GFLOPs/s = 4.6TB/s 的带宽。
所以在给定的存储器带宽下，这一吞吐量不能持续