CSC 462 Homework #9 (chapters 4 and 5)
Due date: Wednesday, May 1

Do questions 2 and 6 and two other problems.

1. The textbook cites the time to execute a program of m convoys and a vector length of n as m * n cycles (assuming 1 lane). Answer the following questions.
    a. Why is this not actually m * n * o where o is the number operations within each of the m convoys?
    b. Given that the vector operates on parallel hardware, why are we multiplying by n? Shouldn't all n of the vector elements operate in parallel?
    c. If n is larger than mvl (maximum vector length), how does this impact the formula of m * n, if at all? Rewrite the formula using mvl as part of the equation.

2. Assume mvl = 64 doubles and the processor has 4 lanes. A program contains the following loop where a and b are arrays of 5000 doubles. The functional unit is pipelined whereby the multiplication takes 7 cycles to compute.

```
for(i=0;i<5000;i++) a[i] = a[i] * b[i];
```

    a. How many total iterations will the vector code require?
    b. The first iteration will have the strip mined value, that is, the leftover length, what is this value? How many array elements need to be processed per lane?
    c. Assuming no stalls and that the vld and vst require 1 cycle each, and that the loop mechanism requires 3 cycles per iteration, how many total clock cycles will elapse from the start of the code until the last product is stored?

3. Explain the following terms from chapter 4:
    a. convoy
    b. chime
    c. stride
    d. gather-scatter

4. Rewrite the following C code using PTX. Assume arrays x, y, z and a start at addresses stored in registers x1, x2, x3, and x4 respectively and each is an array of doubles.

```
for(i=0;i<n;i++) {
     x[i]=y[i]*z[i];
     if(x[i]<a[i]) x[i]=0;
     else a[i]=x[i];
}
```

5. Similar to chapter 5 sample problem 2, describe each row of figure 5.19 on page 407 in terms the conditions by which that particular event occurs and what the result is.

6. Do problem 5.1 on pages 446-447.