# CS320 Homework

Due Friday March 31

1. Compute the dependence graphs and direction vectors for loops (1) - (10)
2. Apply loop distribution to loops (3), (4), (5), and (10). The last loop includes an `if` statement which complicates loop distribution. In fact, the rule discussed in class for distribution has to be extended for loop (10).
3. Determine whether or not loop interchange is possible for loops (6) - (8) and, if it is not possible, identify a transformation that enables the interchange.

```
      do i=1,n
S1    a(i)=a(i+1)-b(i)
S2    b(i)=a(i)+1
S3    if b(i) < a(i) then                                    (1)
S4          b(i)=a(i-1)+b(i-2)
      end if
      end do



      do i=1,n
        do j=1,n
S1        a(i,j)=a(i,j-1)+b(i,j+1)
S2        c(i,j)=b(i,j)+a(i,j)+a(i-1,j-1)                    (2)
S3        b(i,j)=a(i,j)+1
S4        d(i,j)=d(i,j+1)+d(i+1,j)+d(i-1,j)
        end do
      end do



      do i=1,n
        do j=1,n
S1        a(i,j)=a(i,k(j))+1
S2        a(i,j)=sin(a(i,j))                                 (3)
S3        b(i,j)=a(i,j)+a(i,j+1)
        end do
      end do


      do i=1,n
S1    a(i)=b(i)+1
S2    c(i)=d(i)-e(i)
S3    b(i+1)=a(i-2)+1                                        (4)
S4    d(i+1)=d(i)+f(i)
S5    e(i+1)=c(i)+1
      end do


      do i=1,n
S1    a(i)=b(i)+1
        do j=1,n
S2        c(i,j)=a(i)+ d(i,j)
S3        e = e + c(i,j)                                     (5)
S4        d(i,j) = e + d(i,j)
        end do
S5    b(i+1)=a(i) + 1
      end do
```

```
      do i=1,n
         do j=1,n
S1          a(i,j)=a(i-1,j-1)+2                              (6)
S2          c(i,j)=a(i,j)+c(i-1,j)+c(i,j+1)
         end do
      end do


      do i=1,n
         do j=1,n
S1          a(i,j)=a(i,j)+d
S2          a(i+1,j+1) = a(i,j) + c(i,j)                     (7)
         end do
      end do


      do i=1,n
         do j=1,n
S1          a(i,j) = b(i,j) + 2                              (8)
S2          b(i,j) = a(i-1,j+1) + 1
         end do
      end do


      do i=1,n
S1          a(i,i)=a(i-1,i+1)+1                              (9)
S2          b(i)=a(2i,i+5)+7
      end do


      do i=1,n
S1          if (a(i) > b(i)) then
S2                  a(i+1) = c(i) + 1                        (10)
S3                  d(i) = a(i) + x(i)
            end if
      end do
```