6. Transform the following loop into a doacross loop using POST and WAITs, but no more than one pair of POST/WAIT per dependence cycle.

\[
\text{do } i=1,n \\
\quad a(i)=a(i)+c(i-1) \\
\quad c(i)=a(i-1)+1 \\
\quad d(i)=c(i)+f(i) \\
\quad g(i)=d(i)+g(i) \\
\text{end do}
\]

Estimate execution time assuming an unlimited number of processors and ignoring the time of all operations except for the floating point operations shown in the loop body. Each of these floating point operations take one unit of time to execute.
1. Are there any dependence cycles in the loop
   
   \[
   \text{do } i=1,n \\
   \quad a = x(i) + b(i) \\
   \quad y(i) = a + 1 + x(i-1) \\
   \text{end do}
   \]
   Can the cycles be eliminated?

2. Transform the loop
   
   \[
   \text{do } i=1,n \\
   \quad a(i) = b(i) + c(i) \\
   \quad d(i) = a(i) + d(i) \\
   \quad x = d(i) + z(i-1) \\
   \quad y(i) = x + a(i) \\
   \quad z(i) = y(i) + x \\
   \text{end do}
   \]
   into a parallel form with as much parallelism as possible, but without changing recurrences into parallel form.

3. Give an example of two loops that can be fused and an example where the loops cannot be fused. Explain why in each case.

4. Is stripmining always a valid transformation? Why or why not?

5. Make up an example where skewing enables parallelization. Prove that the resulting loop is parallel.
if a<b then
    c=1
    d=2
else
    c=2
    d=1
fi
a=c+d
if x<y then
    if x<y then
        x=2
        y=1
    else
        x=1
        y=2
    fi
z=x+y

4. Transform the following program to SSA form and determine the sets of equivalent variables.

m=0
j=1
S1
    j++
    if j>n the goto S2
    m+=j
goto S1
S2
    p=0
    k=1
    k++
S3
    if k>n the goto S2
    p=p+k
    m=m+p
goto S3
1. Compute the dependence graph with direction vectors of the following program:

```
do i=1,n
S1 a=b(i)+c(i-1)
S2 c(i-1)=a+b(i-1)
do j=1,n
S3 x(i,j)=c(j)+1
S4 y(j)=a+x(i-1,j+1)
end do
end do
```

2. Compute the dependence graph with direction vectors of the following program:

```
do i=1,n
   a=b(i)+c(i-1)
   c(i-1)=a+b(i-1)
do j=1,n
   x(i,j)=c(j)+1
   y(j)=a+x(i-1,j+1)
end do
end do
```

3. Transform the following program into SSA form and determine the equivalence of variables. Are $z$ and $a$ equivalent? If not, what could be done to make them equivalent?