STAT 604 Exam 1 **Fall, 1995 Dr. Newton**

1. (20 points) Given regression data y and X where X is $(n \times m)$ and least squares estimates $\hat{\beta}$, write a Fortran double precision function called `SSR` that calculates the sum of squares of residuals. You are not allowed to use any arrays other than `y`, `X`, and `betah`.

2. (10 points) What is the smallest number of multiplications and additions needed to multiply a lower triangular matrix L times an upper triangular matrix U?

3. (10 points) Express 735 as an `integer*2` and -537 as a `real*4`

4. (15 points) What would be printed by the following Fortran program?

```
      dimension x(20,5),xtx(5,5)

      n=10
      m=2

      do 5 i=1,20
      do 5 j=1,5
 5    x(i,j)=0.

      do 10 i=1,n
      x(i,1)=1
 10   x(i,2)=i

      call xtx(x,n,m,xtx)

      do 20 i=1,m
 20   write(*,30) (xtx(i,j),j=1,m)

      stop
      end
      subroutine xtx(x,n,m,xtx)
      dimension x(n,m),xtx(m,m)

      do 10 i=1,m
      do 10 j=1,i
         c=0.0
         do 20 k=1,n
 20      c=c+x(k,i)*x(k,j)
      xtx(i,j)=c
 10   xtx(j,i)=c

      return
      end
```

5. (20 points) Show that sweeping an $(n \times n)$ matrix A twice in a row on its kth diagonal gives A back again.

6. (10 points) Given a N(0,1) random number generator, how would you generate a random sample of size n from a χ^2_m population? How about from an F_{m_1,m_2}?

7. (15 points) What is the probability that a random point in the unit square is also in the unit circle? Use this to design a simulation that estimates π by generating points in the unit square. How many points would you have to generate to be 95% sure that your estimate is within 0.01 of the true value?