STAT 604 Exam 1 **Fall, 1998 Dr. Newton**

Name: ____________________________

1. (20 pts) If $\Sigma = \begin{bmatrix} \sigma_1^2 & \rho\sigma_1\sigma_2 \\ \rho\sigma_1\sigma_2 & \sigma_2^2 \end{bmatrix}$ what is $\Sigma^{1/2}e$, where $e = (e_1, e_2)^T$?

2. (20 pts) How would you maximize (with respect to μ) the logarithm of the function

$$l(\mu; x) = \prod_{i=1}^{n} \frac{1}{\sqrt{2\pi}} e^{-(x_i-\mu)^2/2}$$

using Newton's method? If you use $\mu_0 = 0$, what would you get after each of the first two iterations?

3. (20 pts) Write a Fortran function called `quad` to evaluate the quadratic form $q = x^T Ax$ where A is an $(n \times n)$ matrix and x is an $(n \times 1)$ vector.

4. (20 pts) The Rayleigh distribution with parameter $\alpha > 0$ has pdf

$$f(x) = \frac{1}{\alpha^2} x e^{-x^2/(2\alpha^2)}, \qquad x > 0.$$

a. What is the cdf F of this distribution?
b. Thus what is its quantile function?
c. Thus, given a U(0,1) random number generator, how would you simulate data $X_1, \ldots, X_n$ from this distribution?

5. (20 pts) Why does the following program print `n = -10`?

```
      integer n
      n=-654321
      call prtsc(n)
      stop
      end

      subroutine prtsc(n)
      integer*2 n
      write(*,10) n
 10   format(' n = ',i10)
      return
      end
```