

Name: \_\_\_\_\_

1. (12 pts) How would you T<sub>E</sub>X the following?

$$X = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1p} \\ X_{21} & X_{22} & \cdots & X_{2p} \\ \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots \\ X_{n1} & X_{n2} & \cdots & X_{np} \end{bmatrix}$$

2. (12 pts) How is  $-73.4236$  represented as a `real*4`? How about  $7,532$  as an `integer*2`?
3. (12 pts) What would be the new values in the array  $(6,4,10,2,3,9,5,8,7,11,1)$  after the first splitting in the quicksort algorithm?
4. (12 pts) Given a starting value  $x_0$ , how would you use Newton's root finding method to find the roots of the function

$$f(x) = (1 - x^2) \sin(2\pi x), \quad x \in [0, 1]?$$

When you get a root, how do you check to be sure that it corresponds to a relative minimum of  $f$ ?

5. (12 pts) Find the (2,2) element of the upper left hand (2 by 2) matrix in

$$A = \begin{bmatrix} 6 & 4 & 3 \\ 4 & 5 & 3 \\ 3 & 3 & 4 \end{bmatrix}$$

using the SWEEP algorithm.

6. (12 pts) What number would be printed by the following program?

```

double precision x(8,8),trace
do 10 i=1,8
do 10 j=1,8
10 x(i,j)=10*(i-1)+j
write(*,*) trace(x,3)
stop
end
double precision trace(a,n)
double precision a(n,n)
trace=0.0
do 10 i=1,n
10 trace=trace+a(i,i)
return
end

```

7. (12 pts) Find the quantile function of the logistic distribution having cdf

$$F(x; \mu, \beta) = \frac{1}{1 + e^{-(x-\mu)/\beta}}, \quad x > 0.$$

8. (12 pts) If a computer can perform 1,000,000 multiplications and additions in a second, how many minutes does it take to multiply a (300 by 200) matrix times a (200 by 100) matrix 500 times?

9. (4 pts) Given data  $y$  and  $X$  satisfying the multiple linear regression model  $y = X\beta + \epsilon$ , what is the formula for the least squares estimator  $\hat{\beta}$  of  $\beta$ ?