Name: _____

(5) 1. Define *swamping* in floating point arithmetic.

(5) 2. Define *digit cancellation* in floating point arithmetic.

(9) 3. Let $a = 0.0123401$ and $b = 1.23601$. Using 3 decimal digit rounding arithmetic, compute the following:

(a) $\text{fl}(a)$

(b) $\text{fl}(b)$

(c) $\text{fl}(a + b)$

(3) 4. Define the machine precision μ.

(4) 5. State the fundamental axiom of floating point arithmetic.

(25) 6. On Conditioning and Stability

(a) What is a well conditioned problem?

(b) Describe what a relative condition number is.

(c) What is a backward stable computation?

(d) How can we use the ideas of conditioning and stability to evaluate the error in a computation?

(27) 7. Let $A = \begin{bmatrix} 2 & 1 & 0 \\ 18 & 12 & 1 \\ 4 & 2 & -1 \end{bmatrix}$.

(a) Give L and U from the $A = LU$ factorization of A.

(b) Explain how pivoting effects the multipliers and why pivoting is used in Gaussian elimination.

(c) Briefly describe complete pivoting.

(12) 8. Solve $Ax = b$, where $PA = LU$ and

$$P = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \quad L = \begin{bmatrix} 1 & 0 \\ 2 & 1 \end{bmatrix}, \quad U = \begin{bmatrix} 1 & 3 \\ 0 & 1 \end{bmatrix}, \quad \text{and } b = \begin{bmatrix} 3 \\ 1 \end{bmatrix}.$$

(4) 9. Define a *flop*.

(6) 10. Count the number of flops required to multiply a $n \times n$ upper triangular matrix and an n-vector.