Problems from Burden and Faires:

Section 1.1: #12, #24
Section 1.2: #10, #12, #15, #19, #20, #25
Section 1.3: #8, #12, #17

Problems from Dr. Pounds:

1. Some compilers implement an extended double precision format (typically “REAL*10” in FORTRAN or “long double” in C). Documentation for a specific compiler states that the these extended precision floating point numbers are comprised of ten bytes and the largest possible finite number is $1.2 \times 10^{4932}$ and the smallest number is is $3.4 \times 10^{-4932}$. Determine the (1) number of sign bits, (2) number of bits in the exponent, and (3) number of bits in the mantissa.

2. Some compilers implement “short floats” to save memory. One such compiler utilizes binary numbers with 1 sign bit, a five digit exponent, and a ten digit mantissa. Using these data:

(a.) determine the value of $\beta$ needed to give the widest possible range of numeric values for IEEE data types given by equation 1.

$$(-1)^s 2^{e-\beta}(1+f)$$

(b.) determine the largest and smallest numbers possible with this representation. You may assume that the numbers follow the IEEE floating point semantics.

(c.) provide the best “short float” machine number for the representation of $\pi$.

3. The $n^{th}$ term of the Fibonacci sequence can be computed with the equation

$$F_n = \frac{1}{\sqrt{5}} \left[ \left( \frac{1 + \sqrt{5}}{2} \right)^n - \left( \frac{1 - \sqrt{5}}{2} \right)^n \right]$$

(a.) Write a Maple procedure to calculate $F_n$. Set digits to 100 so results will be accurate to 100 decimal places and, using your Maple routine, calculate the values of $F_5$, $F_{10}$, $F_{20}$, $F_{50}$, $F_{100}$, $F_{150}$, $F_{500}$, and $F_{1450}$.

(b.) Using a high level computer language (C, Fortran, JAVA, etc.) write a single precision algorithm to calculate the same Fibonacci numbers found in part (a.).

(c.) Using a high level computer language (C, Fortran, JAVA, etc.) write a double precision algorithm to calculate the same Fibonacci numbers found in part (a.).

(d.) Using your Maple results as your standard, prepare a table listing the results from Maple and your single and double precision results as well as the relative error from both the single and double precision results.