AMSC/CMSC 660 Quiz 1 , Fall 2006

Show all work. You may leave arithmetic expressions in any form that a calculator could evaluate. By putting your name on this paper, you agree to abide by the university's code of academic integrity in completing the quiz. Use no books, calculators, cellphones, other electronic devices, communication with others, scratchpaper, etc.

Name _____

1. (8) For each machine-representable number `r`, define `f(r)` to be the next larger machine-representable number. Consider the following statements:

> (a) For fixed point (integer) arithmetic, the distance between `r` and `f(r)` is constant.
> (b) For floating point arithmetic, the relative distance `|(f(r)-r)/r|` is constant (for $\texttt{r} \neq 0$).

Are the statements true or false? Give examples or counterexamples to explain your reasoning.

2. (6) Consider the following code fragment:

```
x = 1;
delta = 1 / 2^(53);
for j1=1:2^(20),
  x = x + delta;
end
```

Using mathematical reasoning, we expect the final value of `x` to be $1 + 2^{-33}$. Use your knowledge of floating-point arithmetic to predict what it will actually be. Briefly explain your prediction.

3. (6) Bound the backward error in approximating the solution to

$$\begin{bmatrix} 2 & 1 \\ 3 & 6 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 5.244 \\ 21.357 \end{bmatrix} \text{ by } \mathbf{x}_c = \begin{bmatrix} 1 \\ 3 \end{bmatrix}.$$