AMSC/CMSC 660 Quiz 1 , Fall 2008

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. Suppose we have a computer that uses (single-precision) IEEE Standard floating point arithmetic: 24 digits to represent the mantissa, and exponents in the range $[-126, 127]$.

(a) (5) Consider evaluating the expression `c = a * b` on this machine. Give a machine-representable (finite) value for `a` and a machine-representable (finite) value for `b` for which the computed value `c=INF` because of overflow.

(b) (5) What is the distance between 2^{20} and the next larger floating point number?

2. (5) Consider the following MATLAB 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 double-precision floating-point arithmetic (53 bit mantissa, with exponents in the range $[-1022, 1023]$) to predict what it will actually be. Briefly explain your prediction.

3. (5) If we type `cos(pi/2)` in MATLAB, the computed answer is $6.1232e-17$. Why doesn't MATLAB return the correct value, 0?