

CS2262 Spring 2007

Assignment 2: Floating Point Numbers and Taylor Polynomials

1. Work through the exercise on Floating Point Arithmetic with MATLAB (either 2.3.4 or section MATLAB 1.7 in Leader). There is nothing to hand in for this question.
2. Derive the binary double precision IEEE floating-point expressions for the following numbers and confirm their values using MATLAB and the `format hex` statement: (a) 8, (b) 1.5, (c) 1.25
3. Predict the output of the following section of code if it run on a binary computer that uses chopping. More precisely, estimate the number of times the programmer probably intended for this loop to be executed, and state whether this intended behaviour is what actually occurs. Would the outcome be any different if the statement `X=X+H` was replaced by `X=X*H`

```
I = 0
X = 0.0
H = 0.1
while X < 1.0
    I = I + 1
    X = X + H
    disp([I,X])
end
```

4. Produce a general formula for the degree n Taylor polynomials for the following functions, all using $a = 0$ as the point of approximation: (a) $1/(1 - x)$, (b) $\sin x$, (c) $(1 + x)^{1/2}$.
5. Use the Taylor polynomials of degrees 1, 2, 3 for the function $f(x) = \sqrt{1 + x}$ obtained in the last question to compute approximate values of $\sqrt{0.9}$, $\sqrt{1.1}$, $\sqrt{1.5}$, $\sqrt{2.0}$ and compare them with the exact values to 8 or more digits.
6. The quotient

$$g(x) = \frac{\log(1 + x)}{x}$$

is undefined for $x = 0$. Approximate $\log(1 + x)$ using Taylor polynomials of degrees 1, 2, and 3, in turn to determine a natural definition of $g(0)$.

Due February 1st 2007

Email completed assignments to cs2262_assignments@cct.lsu.edu