AMSC/CMCS 466 – Introduction to Numerical Analysis I

Spring Term 2006

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Homework set #1

Problem 1: a) Consider the following MATLAB program:

```
x=1000;
y=1;
z=x+1;
while z>x
  yold=y;
  y=y/2;
  z=x+y;
end
yold
eps(x)
yold/x
```

Run this program on your computer with various choices of x, for example $x = .0078125$, $x = 1000$, $x = 123456789$. Explain why the program stops. Find the output, explain its meaning, and compare with the built-in constant eps. Read the online information available for eps in MATLAB by using the command `help eps`.

b) Write a MATLAB program that computes the underflow limit.

Problem 2: [Atkinson 1.10.e] Convert the number $(.00011001100110011...)_2$ into its decimal equivalent.

Problem 3: [Atkinson 1.12] To convert a positive decimal fraction $x < 1$ to its binary equivalent $x = (.a_1a_2a_3\ldots)_2$ begin by writing

$$x = a_1 2^{-1} + a_2 2^{-2} + a_3 2^{-3} + \ldots$$

Based on this, use the following algorithm.

(i) $x_1 := x; j := 1$

(ii) *While* $x_j \neq 0$, *Do the following:*

$a_j :=$ integer part of $2x_j$;

$x_{j+1} :=$ fractional part of $2x_j$

$j := j + 1$

End While

Apply this algorithm to convert the decimal number .2 to its binary equivalent.

Problem 4: [Atkinson 1.4] Assuming $g \in C([a, b])$, show that

$$\int_0^h x^2(x-h)^2 g\big((1-x/h)a + xb/h\big)\,\mathrm{d}x = \frac{h^5}{30}\,g(\zeta) \qquad \text{for some } \zeta \in [a, b].$$