

MIDTERM EXAM I: CS321-003, Spring 2004

2:00PM-2:50PM, February 25, 2004

This is a closed book test. Please show all steps in your work. Please finish your work independently.

1. (10 points) Convert $(31)_8$ to a decimal number. Show all steps, not just the final result.
2. (10 points) Calculate $f(10^{-2})$ for the function $f(x) = e^x - 1$ in five-decimal-digit arithmetic. The answer should have five significant figures and can easily be obtained with pencil and paper. Compare it with the straightforward evaluation of $f(10^{-2})$ using $e^{0.01} \approx 1.0101$, and make some comments (why one is better than the other). The Taylor expansion of e^x is

$$e^x = 1 + x + \frac{x^2}{2} + \frac{x^3}{6} + \dots$$

3. (10 points) Design an iteration procedure to numerically compute $\sqrt{5}$ based on Newton method for root finding. Please give a reasonable initial guess and justify your choice. (You should not actually do the computation to compute $\sqrt{5}$, just work out the iteration procedure and choose a reasonable initial guess.)
4. (10 points) Find the interpolating polynomial of order less than or equal to 1 in Newton form for the following table (please show all steps)

x	1	3
y	-3	2

5. (10 points) Assume computing in 32-bit single precision arithmetic. Suppose x and y are machine numbers. Estimate the relative roundoff error in computing the result of xy .

Please remember to write down your name on the answer sheets.