**2011 Spring Semester Numerical Analysis Mid-term Examination**

1. Please explain the IEEE 754 representation for floating numbers.
   1. What is the scientific notation of floating point used in the IEEE 754 standard? (科學表示法)
   2. Please draw a graph to show the layout and lengths (in bits) of all parts.(劃出各部分)
   3. Please explain the meanings of all parts. How to store the exponent? How to store the mantissa?(解釋各部分含意)
   4. What is the largest relative round-off error? (15)
2. What is truncation error? What is round-off error? (10)
3. Let .
   1. Compute the root by using bi-section method. Assume the initial interval is [1, 3]. Please modify and list the interval at the first 3 iterations.
   2. Compute the root by using Newton’s method. Let x0=5. Compute xi, i=1,2, and 3. (15)
4. The input data of an interpolation computation are (xi, fi) = {(0, 2), (1, 1), (2, 4), (3, 17)}.
   1. Deduce the Lagrange polynomial for this data set.
   2. Deduce the Newton’s polynomial for this data set.
   3. Compute f(1.5)=? by using the Newton’s polynomial. (15)
5. What is Horner’s algorithm for evaluating polynomial? Assume p(x)=anxn + an-1xn-1 + … + a1x + a0. (a) Write down the pseudo-code of Horner’s algorithm. (b) What is the time complexity of this algorithm? Please deduce it. (15)
6. The sample points of an integration computation are (xi, fi) = {(-2, 10), (-1, 5), (0, 2), (1, 1), (2, 4), (3, 8), (4, 10)}.
   1. Compute the integration by using trapezoid rule.
   2. Compute the integration by using Simpson’s rule. (15)
7. Use the data of Problem 6 to compute the following derivatives:
   1. The first derivative f’(x=2) by using the central difference method.
   2. The second derivative f”(x=2).
   3. The first derivative f’(x=4). (15)