3450:427/527 Applied Numerical Methods I, Kreider, Fall 2012

Homework Set 6, chapter 7

Each problem is worth 10 points.

Due date: Thursday 6 Dec

For problems 1 through 6, build a MATLAB function to evaluate the appropriate quadrature rule. Specify the integrand, limits of integration and number of subintervals (if appropriate) as inputs. For each of the problems, apply the rule to the following 2 integrals. Report answers to at least 8 digits after the decimal. Note that integral (b) gives you an indication of the degree of accuracy of each quadrature rule – if d is high enough, you'll get the exact answer.

(a) $\displaystyle\int_{-2}^{4} e^{2x}\,dx = \frac{e^8 - e^{-4}}{2} = 1490.4698357014$

(b) $\displaystyle\int_{1}^{4} x^3 - 3x^2 + 2\,dx = 27/4 = 6.75$

1. Implement the trapezoid rule by writing a function of the form trap(f,a,b).
2. Implement Simpson's rule by writing a function of the form simp(f,a,b).
3. Implement Boole's rule by writing a function of the form boole(f,a,b).
4. Implement the composite trapezoid rule (use $n = 40$ subintervals for the 2 integrals) by writing a function of the form ctrap(f,a,b,n).
5. Implement the composite Simpson rule (use $n = 40$ subintervals, $m = 20$ pairs for the 2 integrals) by writing a function of the form csimp(f,a,b,n). Input the number of subintervals so it is easier to compare with other composite methods. Be careful with the n versus m notation – n is the number of subintervals, while m is the number of pairs.
6. Implement the 3 point Gaussian rule, which has nodes and weights

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   x = [ -sqrt(3/5) 0 sqrt(3/5) ];
   w = [ 5/9 8/9 5/9 ];
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   by writing a function of the form G3(f,a,b).
7. Compute the error estimates for composite trapezoid and composite Simpson, both with $n = 40$, for integral (a). Compare the estimates with the actual errors.