AMSC/CMSC460 Section 2.

Homework Set 2. Due: Th March 17, 2011. 10:45am
By the end of the class

1.
a) Derive the formula for piecewise linear interpolation for 2 dimensions, in (x,y), for equi-distance point.

$$x_i = x_0 + i\Delta x: \qquad i = 0,...,I-1$$

$$y_j = y_0 + j\Delta y: \qquad j = 0,...,J-1$$

b) For MATLAB
(i) Write a general MATLAB code for the piecewise linear interpolation for (I,J).
(ii) For (I,J)=(11, 21) for x over [0, pi], y over [0, pi], evaluate the function
f(x,y)= sin(x) * cos (y)
on the grid and make a conter plot.
(iii) Evaluate the linear interpolation at the 1/3 of the interval width for (x,y) and make a contour plot.

2.
Repeat 1 for Lagrange interpolation.
Note) Not piecewise. Formula was discussed in the class.

3.
Prove that if a function is concave downward, then the trapezoidal rule always underestimate the integral.

4.
Consider $f(x)=(x^2+1)^{-1}$.
a)
(i) Obtain the actual value of the integral for x over [0,1] (analytical).
(ii) Obtain the actual value of the integral using a trapezoidal rule (analytical)
(iii) Obtain the actual value of the integral using a composite trapezoidal rule with 2 and 4 subinterval (analytical)

b) For MATLAB
(i) Write a general MATLAB code for composite trapezoidal and Simpson's rule.
(ii) Repeat (a.ii) and (a.iii) numerically.
(iii) Compare the errors.