**2017 Numerical Analysis Computer Project #2**

**Interpolation**

1. Generate N+1 sample points in a circle of radius equal to r (r=10.0, for example.)
   1. *for i= 0 to N do {t[i]=i\*Δθ, x[i]= r\*cos(t[i]), y[i]=r\*sin(t[i]).}*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| T[i] | t0 | t1 | t2 | … | tn-1 | tn |
| X[i] | X0 | X1 | X2 | … | Xn-1 | Xn |
| Y[i] | Y0 | Y1 | Y2 | … | Yn-1 | Yn |

1. Produce 360 interpolation points by using the following two methods
   1. Lagrange polynomial or Newton polynomial and keep the interpolation points in qx[i] and qy[i].
2. Compute the distances between the interpolation points calculated by these two methods:
   1. ∞ norm =
3. Try N=12, 24, and 36. (40%)
   1. Print out the 2- and infinite norms for each N value.
   2. Find the interpolation point which produces the infinite norm for each case.
4. Please answer the following questions (40%)
   1. As N increases, will the norms decreases? Why?
   2. Are the infinite norms always come from the 1st or the last interval? Why?
5. A piecewise cubic spline method (40%)
   1. Use a cubic polynomial (Lagrange or Newton polynomial) to compute the interpolation points for .
   2. To do so, use the sample points of to construct the cubic polynomial for this interval. Remember to circulate the sample points if the indices are less than 0 or greater than n ((i-1+n)%n, (i+1)%n, (i+2)%n.)
   3. Generate 360 interpolation points by using this method.
   4. Compute the norms as we do in III.
   5. Compare the results with those of the normal Lagrange or Newton polynomial.
   6. Are the piecewise cubic splines enjoy C1-continuity at the sample points?
   7. Give explanation, discussion, and analysis about the comparison results.
6. You can draw the results by using tools or designing programs. (2 weeks to go)