Computational Physics **Problem Set 2** **Due 2019/10/1**

Your solutions should include your source codes (without *.exe files), results, and discussions, all in a gzipped tar file. Please send your homework from your NTU email account to twchiu@phys.ntu.edu.tw before 24:00 of the due date.

1. **Numerical integration with Trapezoidal, Simpson, and 5-point formulas**

   Evaluate the integral $\int_0^{\pi} dx \sin x$

   using approximations to the integrand that are piecewise linear, quadratic, and quartic. With *N* intervals, and hence *N*+1 points, evaluate the integral for *N* = 4, 8, 16, 32, 64, …, 1024, and compare the accuracy of the methods.

2. **Romberg Integration**

   The intensity of light after the diffraction at a knife's edge varies as we move away from the edge according to

   $$I = \frac{I_0}{2}\left\{\left[C(v)+0.5\right]^2 + \left[S(v)+0.5\right]^2\right\}$$

   where I_0 is the intensity of the incident light, v is proportional to the distance moved, and $C(v)$ and $S(v)$ are Fresnel integrals

   $$C(v) = \int_0^v dw \cos\left(\pi w^2/2\right), \quad S(v) = \int_0^v dw \sin\left(\pi w^2/2\right)$$

   Write a C/C++ program to calculate the Fresnel integrals, and evaluate I/I_0 as a function of v, and plot your results.