If you are using a jupyter notebook (recommended), then keep all your programs in a single notebook. A good programming style is to define a function for one task with clearly defined input (arguments) and output. For plots you may use matplotlib (if you are using python) or gnuplot (if you are using c or fortran) or LsqFit module if you are using Julia.

If you are planning to submit separate programs, then please follow the guideline below:

- Keep all files of a worksheet in a single folder.

- Follow a systematic naming convention. You may name the program files as Q1.py or Q1a.py, Q1b.py for question 1 (if you have created multiple files for a single question). The data file should be named as Q1-data-a.dat and so on.

- Finally compress the entire folder as a single .zip or .tgz (using tar cvfz archive.tgz folder-name/, and submit the file in WeLearn.

1. (4 points) Use FFT to calculate the Fourier Transform of the following functions
   (a) (2 points) A square function.
   (b) (2 points) A double slit (difference of two square functions of unequal widths).

2. (16 points) Consider a Gaussian wavepacket $\frac{1}{\sigma\sqrt{2\pi}}\exp(-(x-x_\circ)^2/2\sigma^2)$. It is given that $\sigma = 0.04$ and $x_\circ = -5$. Solve the time dependent Schrödinger equation for $-20 \leq x \leq 20$ for the following potentials.
   (a) (8 points)
   $$V(x) = \begin{cases} 0, & \text{for } x < 5.0 \text{ or } x > 7 \\ V_\circ, & \text{for } 5 \leq x \leq 7 \end{cases}$$
   where, $V_\circ = 40$
   (b) (8 points)
   $$V(x) = 0.1 \times x^2.$$