PHYS:5905 Homework 7

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1. Problem (g)

   The plot is shown in Figure 1.

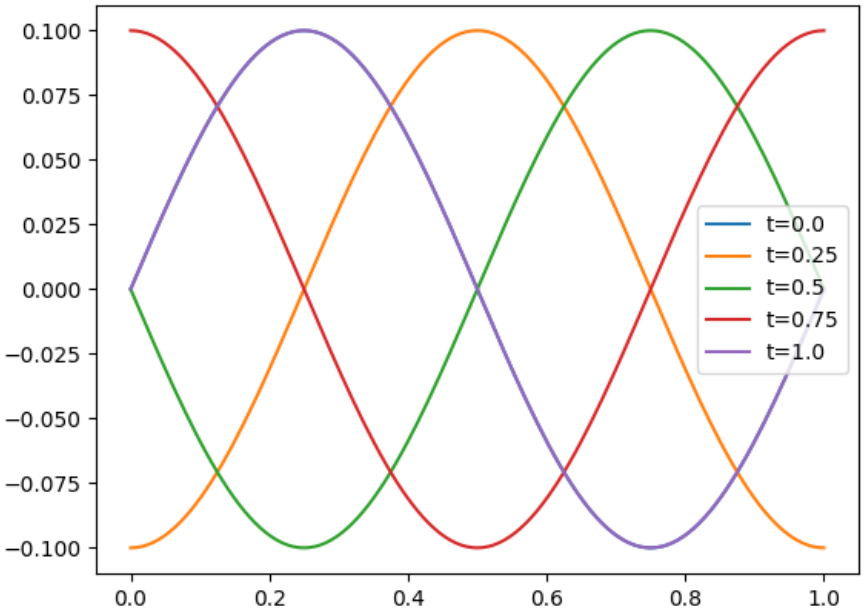

   Figure 1: $u(x)$ at $t = 0, 0.25, 0.5, 0.75, 1.0$ with $n_x = 128$, $\Delta t = \frac{1}{128}$.

2. Problem (h)

   The plot is shown in Figure 2.

   I'm not sure where does the damp in the solution come from.

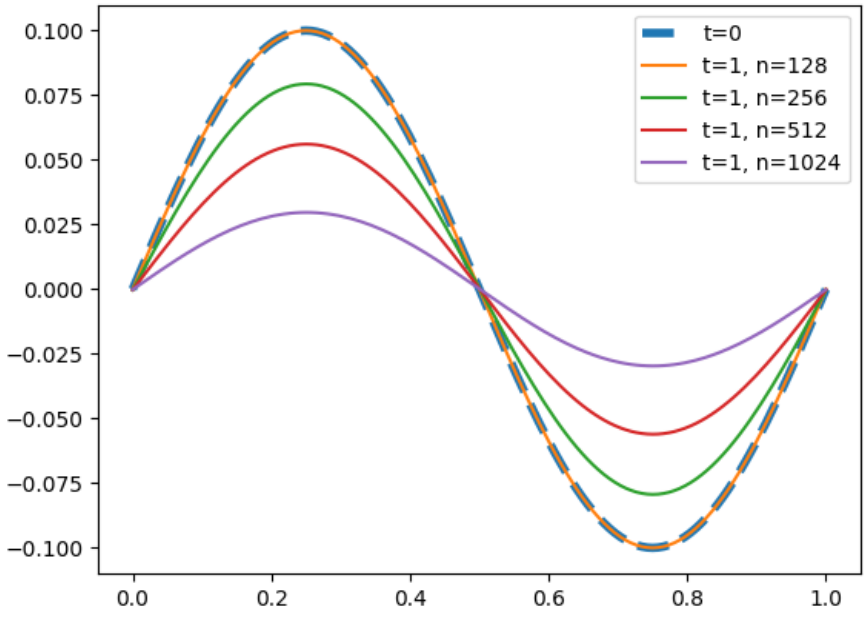

Figure 2: $u(x)$ at $t = 0$, and at $t = 1$ with $\Delta t = \frac{1}{128}, \frac{1}{256}, \frac{1}{512}, \frac{1}{1024}$, while $n_x = 128$.

3. Problem (i)

   The plot is shown in Figure 3.

   The result comes from the CFL condition:

$$C = \frac{\Delta t}{\Delta x} = 2 > 1,$$

   so the numerical scheme is not stable.

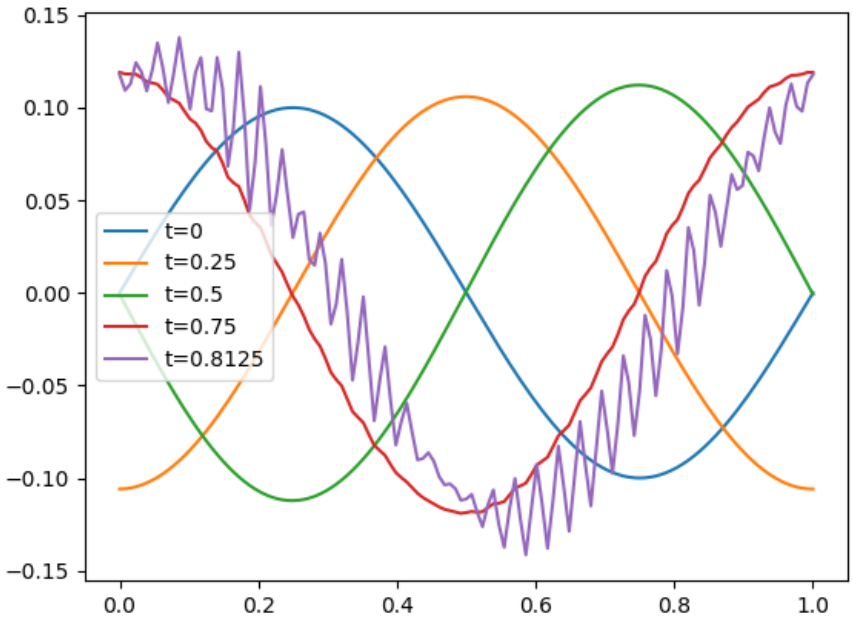

Figure 3: $u(x)$ at $t = 0, 0.25, 0.5, 0.75, 0.8125$ with $\Delta t = \frac{1}{64}$ and $n_x = 128$.