LECTURE ASSIGNMENT 2

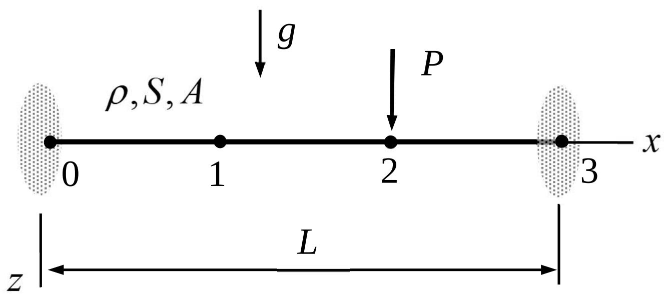
The continuum model for the string shown is given by equations

$$S\frac{d^2w}{dx^2}+\rho Ag=0 \quad x\in]0,\frac{2}{3}L] \ \text{ or } \ x\in]\frac{2}{3}L,L]$$

$$[\![S\frac{dw}{dx}]\!]+P=0 \quad x=\frac{2}{3}L\,, \quad w=0 \quad x=0\,, \ \text{and} \ \ w=0 \quad x=L\,.$$

Write the equations according to the Finite Difference Method using a regular grid $i\in\{0,1,2,3\}$, if the backward and forward difference approximations to the first derivative and the central difference approximation to the second derivative are given by

$$w_i'=\frac{1}{\Delta x}(w_i-w_{i-1})\,, \quad w_i'=\frac{1}{\Delta x}(w_{i+1}-w_i)\,, \ \text{and} \ \ w_i''=\frac{1}{\Delta x^2}(w_{i-1}-2w_i+w_{i+1})\,.$$



Name_______________________________ Student number_______________

Finite Difference Method uses the continuum model and difference approximations to derivatives at the grid points to discretize with respect to the spatial coordinate. Proper outcome requires a correct representation of the continuum model (obviously). Let us write the equations by considering the points one by one:

At point $i=0$, one uses the boundary condition

$w=0$: ____________________________ .

At the regular point $i=1$, one uses the differential equation

$S\dfrac{d^2w}{dx^2}+\rho Ag=0$: ____________________________ .

At the non-regular point $i=2$ of the point force, one uses the jump condition

$\left[\!\left[S\dfrac{dw}{dx} \right]\!\right]+P=0$: ____________________________ .

At point $i=3$, one uses the boundary condition

$w=0$: ____________________________ .