NYU Physics I—the spacetime interval

1 Draw a spacetime diagram showing the four events $A = (c\,t_A, x_A) = 0\,\mathrm{m}, 0\,\mathrm{m})$, $B = (1\,\mathrm{m}, 1\,\mathrm{m})$, $C = (1\,\mathrm{m}, 0\,\mathrm{m})$, and $D = (0\,\mathrm{m}, 1\,\mathrm{m})$,

2 Compute all six spacetime intervals between all pairs of events.

3 Now Lorentz Transform these events to a new frame using the Lorentz Transformation

$$\begin{aligned} c\,t' &= \gamma\,c\,t - \beta\,\gamma\,x \\ x' &= \gamma\,x - \beta\,\gamma\,c\,t \quad , \end{aligned} \tag{1}$$

with $\beta = (3/5)$.

4 Draw a spacetime diagram of the four events in the new frame.

5 Re-compute all six spacetime intervals in this new frame. Which are null, which are spacelike, and which are timelike?

6 Now Lorentz Transform the events again using the opposite velocity, or

$$\begin{aligned} c\,t'' &= \gamma\,c\,t' + \beta\,\gamma\,x' \\ x'' &= \gamma\,x' + \beta\,\gamma\,c\,t' \quad . \end{aligned} \tag{2}$$

Is everything okay?