Therefore the total amount of mass at $t=0$ is:

$$Q(0) = u_l \cdot 1 + u_r \cdot x \quad ①$$

the total amount of mass at $t=T$ is:

$$Q(T) = u_l \cdot (1+sT) + u_r \cdot (x-sT) \quad ②$$

② − ① $\quad Q(T) - Q(0) = sT(u_l - u_r)$.

(L) $\quad Q(T) - Q(0) = \int_0^T \frac{u_l^2}{2} - \frac{u_r^2}{2}\, dt$.

$$= \int_0^T (u_l - u_r) \frac{u_l + u_r}{2}\, dt$$

$$= (u_l - u_r) \frac{u_l + u_r}{2} \cdot T$$

So $s = \frac{u_l + u_r}{2}$