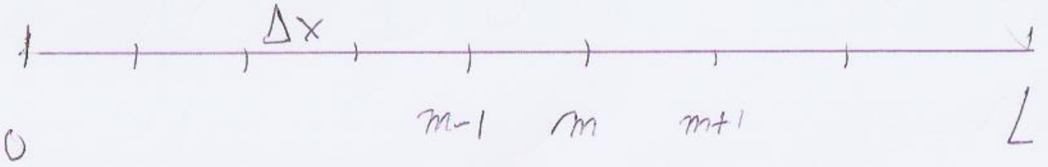
(1)

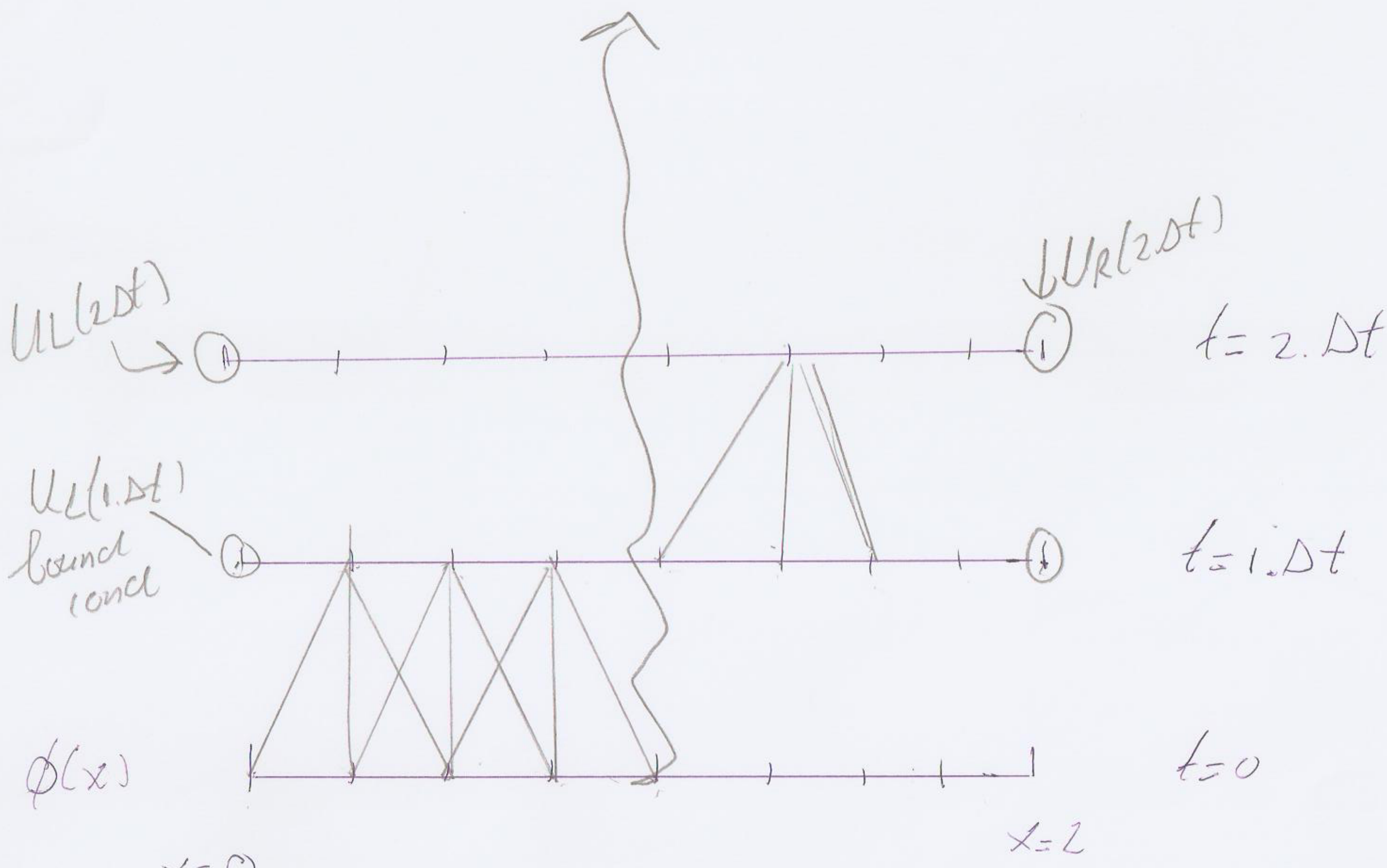
$$\frac{\partial u}{\partial t} = D \frac{\partial^2 u}{\partial x^2}$$ at location x_m and time t_n

$$\frac{\boxed{U_m^{n+1}} - U_m^n}{\Delta t} = D \frac{U_{m+1}^n - 2U_m^n + U_{m-1}^n}{(\Delta x)^2}$$



$$U_m^{n+1} = \underbrace{\frac{\Delta t\, D}{\Delta x^2}}_{= R} \left(U_{m+1}^n - 2U_m^n + U_{m-1}^n\right) + U_m^n$$

$$U_m^{n+1} = R\, U_{m-1}^n + (1-2R)\, U_m^n + R\, U_{m+1}^n$$ explicit



method of (time) lines

$$\frac{\partial u}{\partial t} = D \frac{\partial^2 u}{\partial x^2}$$ at location x_m and time t_n

$t = (n+1)\Delta t$

$t = n\Delta t$

$$\frac{\boxed{u_m^{n+1}} - u_m^n}{\Delta t} = D \, \frac{\boxed{u_{m+1}^{n+1}} - 2\boxed{u_m^{n+1}} + \boxed{u_{m-1}^{n+1}}}{(\Delta x)^2}$$

$$u_m^{n+1} - u_m^n = \underbrace{\frac{D\Delta t}{(\Delta x)^2}}_{= R} \left(u_{m+1}^{n+1} - 2u_m^{n+1} + u_{m-1}^{n+1} \right)$$

$$-R u_{m-1}^{n+1} + (1+2R) u_m^{n+1} - R u_{m+1}^{n+1} = u_m^n$$

$$-u_{m-1}^{n+1} + \left(2+\frac{1}{R}\right) u_m^{n+1} - u_{m+1}^{n+1} = \frac{1}{R} u_m^n$$ <u>implicit</u>