$$G = \frac{1}{m} \sum_{\ell=1}^{m} x_\ell (s=1) u_i - \log(1+e^{u_i}) \longrightarrow \max_{u_i}$$

$$\frac{\partial G}{\partial u_i} = \underbrace{\frac{1}{m} \sum_{\ell=1}^{m} x_\ell (s=1)}_{A} - \frac{e^{u_i}}{1+e^{u_i}} = 0$$

$$A \cdot (1+e^{u_i}) = e^{u_i}$$
$$A = e^{u_i} - A \cdot e^{u_i}$$
$$A = e^{u_i} \cdot (1-A)$$
$$\frac{A}{1-A} = e^{u_i}$$
$$u_i = \log \frac{A}{1-A}$$

$$\frac{\partial G}{\partial u_i} = A - \frac{e^{u_i}}{1+e^{u_i}}$$

$$\frac{\partial}{\partial u_i} \frac{\partial G}{\partial u_i} = - \frac{e^{u_i} \cdot (1+e^{u_i}) - e^{u_i} \cdot e^{u_i}}{(1+e^{u_i})^2}$$

$$= - \frac{e^{u_i}}{(1+e^{u_i})^2}$$

$\rightarrow e^{u_i} > 0 \quad \forall u_i \Rightarrow -\frac{e^{u_i}}{(1+e^{u_i})^2} < 0 \Rightarrow$ concave function