# Assignment of Data Mining (5) May 17, 2022

**Name:** 階戸弾          **Student Number:** **1224525046**

For parameter $p \in (0,1)$, an object function to be maximized is defined as

$$f(p) = -p \log p - (1-p)\log(1-p).$$

1. Find the update rule by Newton-Raphson algorithm to optimize the parameter $p$.

$$f'(p) = -logp - 1 - \{-lop(1-p) - 1\}$$

$$= \log\left(\frac{1-p}{p}\right)$$

$$f''(p) = \frac{1}{\frac{1}{p}-1}\left(-\frac{1}{p^2}\right)$$

$$= -\frac{1}{p-p^2}$$

よって

$$d = -\frac{f'(p)}{f''(p)} = (p-p^2)\log\left(\frac{1-p}{p}\right)$$

以上より update rule は

$$p_{k+1} = p_k + d = p_k + (p_k - p_k{}^2)\log\left(\frac{1-p_k}{p_k}\right)$$

2. Compute 5 updated values $p^1, p^2, \ldots, p^5$ by Newton-Raphson method, from initial value $p^0 = 0.1$.

$$p^1 = p^0 + \left(p^0 - p^{0^2}\right)\log\left(\frac{1-p^0}{p^0}\right) = 0.29775$$

$$p^2 = p^1 + \left(p^1 - p^{1^2}\right)\log\left(\frac{1-p^1}{p^1}\right) = 0.477161$$

$$p^3 = p^2 + \left(p^2 - p^{2^2}\right)\log\left(\frac{1-p^2}{p^2}\right) = 0.499968$$

$$p^4 = p^3 + \left(p^3 - p^{3^2}\right)\log\left(\frac{1-p^3}{p^3}\right) = 0.5$$

$$p^5 = p^4 + \left(p^4 - p^{4^2}\right)\log\left(\frac{1-p^4}{p^4}\right) = 0.5$$