# Handout 09: Logistic Regression (Supplement)

On the original handout I gave you the following two formulas:

$$p_i = \frac{e^{x_i^t b}}{e^{x_i^t b} + 1}$$
$$1 - p_i = \frac{1}{1 + e^{x_i^t b}}$$

I should have noted that if you multiple both of these by:

$$1 = \frac{e^{-x_i^t b}}{e^{-x_i^t b}}$$

You will get the alternative forms:

$$p_i = \frac{1}{1 + e^{-x_i^t b}}$$
$$1 - p_i = \frac{e^{-x_i^t b}}{e^{-x_i^t b} + 1}$$

So if you multiply $x_i^t b$ by negative one, you flip the equations for $p_i$ and $(1 - p_i)$. This is what I meant by logistic regression being *symmetric* between $0$ and $1$. If you flip the signs of the regression vector $\beta$ you will have the logistic model with the two classes flipped.

Beyond the demonstration that show this kind of symmetry, the alternative forms are also useful for deriving the Hessian matrix on the problems from the handout.