Homework 09

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STAT 608-720

1)

a)

$$
\begin{aligned}
log(\frac{\theta(x)}{1-\theta(x)}) &= \beta_0 + \beta_1 x \\
(\frac{\theta(x)}{1-\theta(x)}) &= exp(\beta_0 + \beta_1 x) \\
\theta(x) &= \frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)}
\end{aligned}
$$

b)

$$
\begin{aligned}
\theta(x) &= \frac{exp(\beta_0 + \beta_1 x)}{1 + exp(\beta_0 + \beta_1 x)} \\
\theta(x) &= \frac{1}{1 + exp(-(\beta_0 + \beta_1 x))}
\end{aligned}
$$

2) We might be interested in tranforming the predictor variables in a logistic regression in order get a linear relationship between the predictor variables and log(odds). using log on the predictor variables would enable the interpretation of percent changes.

3)

a) & b)

$$
\begin{aligned}
Z = Bin(n,p) = P(Z=z) &= \binom{n}{z} p^z (1-p)^{n-z} \\
n = 1 : P(Z=z) &= p^z (1-p)^{n-z} \\
z = 0 : P(Z=0) &= (1-p) \\
z = 1 : P(Z=1) &= p(1-p)^{1-z}
\end{aligned}
$$

$$
\begin{aligned}
log(\frac{\theta(x)}{1-\theta(x)}) &= log(\frac{P(Y=1)}{P(Y=0)}) + log(\frac{P(X=x|Y=1)}{P(X=x|Y=0)}) \\
&= log(\frac{p_1}{p_0}) + log(\frac{p_1(1-p_1)^{1-z}}{(1-p_0)}) \\
&= \beta_0 + \beta_1 x
\end{aligned}
$$