Econometrics Assignment 5
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$$Pr[resp_i = 1] = \frac{exp(\beta_0 + \beta_1 male_i + \beta_2 active_i + \beta_3 age_i + \beta_4 (age_i/10)^2)}{1 + exp(\beta_0 + \beta_1 male_i + \beta_2 active_i + \beta_3 age_i + \beta_4 (age_i/10)^2)}$$

$Variable$	$Coefficient$
$Intercept$	-2.488
$Male$	0.954
$Active$	0.914
Age	0.070
$(Age/10)^2$	-0.069

(a) For a 50 year old active male customer

$$Pr[resp_i = 0] active_i \beta_2$$
$$(1 - Pr[resp_i = 1]) active_i \beta_2$$
$$\frac{1}{1 + exp(-2.488 + 0.954 + 0.914 + 0.070 * 50 - 0.069 * 25)} (0.914 * 1)$$
$$= 0.229$$

For a 50 year old inactive male customer

$$\frac{1}{1 + exp(-2.488 + 0.954 + 0.070 * 50 - 0.069 * 25)} (0.914 * 0)$$
$$= 0$$

(b) Let $Z = exp(\beta_0 + \beta_1 male_i + \beta_3 age_i + \beta_4 (age_i/10)^2)$

then $exp(\beta_2) Z = exp(\beta_0 + \beta_1 male_i + \beta_2 + \beta_3 age_i + \beta_4 (age_i/10)^2)$

$$\frac{Pr[resp_i = 1 | active_i = 1] - Pr[resp_i = 1 | active_i = 0]}{Pr[resp_i = 1 | active_i = 0]}$$
$$\frac{\frac{exp(\beta_2) Z}{1 + Z exp(\beta_2)} - \frac{Z}{1 + Z}}{\frac{Z}{1 + Z}}$$
$$(\frac{1 + Z}{Z}) \frac{exp(\beta_2) Z}{1 + Z exp(\beta_2)} - (\frac{1 + Z}{Z}) \frac{Z}{1 + Z}$$
$$\frac{(1 + Z) exp(\beta_2)}{1 + Z exp(\beta_2)} - 1$$
$$\frac{Z exp(\beta_2) + exp(\beta_2) - 1 - Z exp(\beta_2)}{1 + Z exp(\beta_2)}$$
$$\frac{exp(\beta_2) - 1}{1 + Z exp(\beta_2)}$$
$$(exp(\beta_2) - 1) \frac{1}{1 + Z exp(\beta_2)}$$

Using $Pr[resp_i = 0 | active_i = 1] = 1 - Pr[resp_i = 1 | active_i] = \frac{1}{1 + Z exp(\beta_2)}$

$$(exp(\beta_2) - 1)Pr[resp_i = 0|active_i = 1]$$

(c) $(exp(\beta_2) - 1)Pr[resp_i = 0|active_i = 1]$

$$(exp(0.914) - 1)\frac{1}{1 + exp(-2.488 + 0.954 + 0.914 + 0.070 * 50 - 0.069 * 25)}$$
$$0.365$$