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1. Theoretical Question on Ridge Regression:

Grouping 1:

1st cluster: m samples at $x = -2 \rightarrow J_1 = -2$

2nd cluster: m samples at $x = 0$ and 1 at $x = a \rightarrow J_2 = \frac{a}{m+1}$

$$J = m * (-2 - (-2))^2 + m * (0 - \frac{a}{m+1})^2 + (a - \frac{a}{m+1})^2 = \frac{m}{m+1}a^2$$

Grouping 2:

1st cluster: m samples at $x = -2$ and m samples at $x = 0 \rightarrow J_1 = \frac{-2m+0m}{2m} = 1$

2nd cluster: 1 sample at $x = a \rightarrow J_2 = a$

$$J' = m * (-2 - (-1))^2 + m * (0 - (-1))^2 + (a - a)^2 = 2m$$

Since $J < J`$:

$$\frac{m}{m+1}a^2 < 2m$$

$$a^2 < 2m(m+1)$$

$$f(m) = 2m + 2$$

2. On Regularization in Logistic Regression

A)

I. Yes.
I. No, since it does not pass through (0,0).
II. No, since more optimal solution available, where soft-margin crossover happens.

B)

II. No, since it does not pass through (0,0).
III. Yes.
IV. No, since it does not pass through (0,0).

C)

I. No, since soft margin is not allowed.
II. No, since soft margin is not allowed.
III. Yes.