17.

Consider the primal question

$$\min_{b,w} \frac{1}{2}w^T w$$

$$\text{s.t. } y_n(\underbrace{w^T z_n}_{\phi(x_n)} + b) \geq 1$$

~~Suppose~~ Let w_i is the weight for constant feature (z_i).

suppose $w_i^* \neq 0$ is the optimal solution. b^*

we can consider another $\tilde{w}^*$ with $w_i = 0$

$\tilde{b} = b^* + \sum w_i z_i$

the $\frac{1}{2}\tilde{w}^T\tilde{w} < \frac{1}{2}w^{*T}w^*$

and every constraint $y_n(\tilde{w} z_n + \tilde{b}) \geq 0$ still holds

$\Rightarrow$ w^* is $w_i \neq 0$ is not an optimal

$\Rightarrow$ In optimal w, w_i for constant features must be 0.

18 Suppose $g_{SVM}(x) = \text{sign}\left(\sum_{SV_n} \alpha_n y_n K(x_n, x) + y_s - \sum_{SV_n} \alpha_n y_n K(x_n, x_s)\right)$

new $\tilde{g}_{SVM}(x) = \text{sign}\left(\sum_{SV_n} \alpha_n y_n K(x_n, x) + y_s - \sum \alpha_n y_n (\cancel{K(x_n, x_s + q)}) + \cancel{\sum_{SV_n} \alpha_n y_n} q\right.$

$= \text{sign}\left(\sum \alpha_n y_n K(x_n, x) + y_s - \sum_{SV_n} \alpha_n y_n K(x_n, x_s)\right)$

$= g_{SVM}(x) \Rightarrow$ equivalent!