Q=7) Let's assume two sets of vectors as below

$$S_1 = x_1, x_2, x_3 \ldots$$

$$S_2 = y_1, y_2, y_3 \ldots$$

& coefficients for S_1 as $\alpha_1, \alpha_2, \alpha_3 \ldots$ where $\alpha_1 + \alpha_2 + \ldots + \alpha_n = 1$

& Coefficients for S_2 as $\beta_1, \beta_2, \beta_3 \ldots$ where $\beta_1 + \beta_2 \ldots \beta_n = 1$

Assuming both the given statements are true

i.e. (1) above two sets are linearly separable

(2) their convex hulls intersect.

from (1), If these two sets are linearly separable then there must be linear equation of below form:-

$$g_i(x_i) > 0 \quad \& \quad g_j(y_j) < 0$$

Using formula of precewise linear machines

$$w_i^t x_i + w_i 0 > 0 \quad \& \quad w_i^t y_j + w_i 0 < 0 \quad \text{--- (a)}$$

from (2)
Assuming that convex hulls intersect, there must be a point which satisfies

$$Z = \sum_{i=1}^{n} x_i \alpha_i = \sum_{j=1}^{n} \beta_j y_j$$

but for that to be true

$$w_i^t Z + w_i 0 = w_i^t y_j + w_i 0 \quad \text{--- (b)}$$

which contradicts equation (a) above. Hence two sets could either be linearly separable or their convex hulls intersect but NOT both.