

Ans - 2 - (a) $\text{avg}(\alpha x + \beta \cdot 1_n)$

$$= \text{avg}(\alpha x) + \text{avg}(\beta \cdot 1_n)$$

$$= \alpha \text{avg}(x) + \beta \text{avg}(1_n)$$

$$= \alpha \text{avg}(x) + \beta$$

(b) $\text{std}(\alpha x + \beta \cdot 1_n)$

$$= \frac{\|(\alpha x + \beta \cdot 1_n) - \text{avg}(\alpha x + \beta \cdot 1_n) \cdot 1_n\|_2}{\sqrt{n}}$$

$$= \frac{\|(\alpha x + \beta \cdot 1_n) - (\alpha \text{avg}(x) + \beta) \cdot 1_n\|_2}{\sqrt{n}}$$

$$= \frac{\|(\alpha x + \beta \cdot 1_n) - \alpha \text{avg}(x) \cdot 1_n - \beta \cdot 1_n\|_2}{\sqrt{n}}$$

$$= \frac{\|\alpha x - \alpha \text{avg}(x) \cdot 1_n\|_2}{\sqrt{n}} = |\alpha| \frac{\|x - \text{avg}(x) \cdot 1_n\|_2}{\sqrt{n}}$$

$$= |\alpha| \text{std}(x)$$

1) $\text{avg}(x+Y)$
 $= \text{avg}(x) + \text{avg}(Y)$

2) $\text{avg}(\alpha x)$
 $= \alpha \text{avg}(x)$

3) $\text{avg}(1_n) =$
 $\frac{1+1+\dots+1}{n}$
 $= n/n = 1$

(3)