Ans-8- a) Input: $x_1, x_2, \dots x_N \in \mathbb{R}^n$

$k \in \mathbb{R}$, cluster rep: $z_1, z_2, \dots, z_K \in \mathbb{R}^n$.

For each x_i, we have to find $\min_{j=1..k} \|x_i - z_j\|_2^2$

and then assign x_i to z_j (C_j).

- calculate $x_i - z_j \longrightarrow n$ operations
- calculate $\|x_i - z_j\|_2^2 \longrightarrow n$ multiplications + $(n-1)$ additions.

$= 2n - 1$ operations.

(*) total $\longrightarrow 3n-1$ operation for $\|x_i - z_j\|_2^2$

Now to repeat above for k-clusters

$k(3n-1) + (k-1)$

Eqn (*) calculation for k-cluster rep.

comparison (to assign to C_j)

$= \boxed{3nK - 1} \longrightarrow$ For N points: $\boxed{N(3nK-1)}$

b) Updating cluster representatives

let Cluster C_i has $|G_i|$ points assigned to it

to calculate $\dfrac{\sum_{x_j \in C_i} x_j}{|G_i|}$ for each $i = 1..k$

(-1) because 1 point was initially z_j and assumption is $z_i \notin \{x_1 \dots x_N\}$?

This involves $(|G_i| - 1)$ add. + 1 division

$= |G_i|$ operations —(**)

Now summation of x_j will be n-operations i.e. eqn (**) is when $x_j \in \mathbb{R}^1$; then (**) will be modified to $n|G_i|$ operations

Thus total operations $= n \sum_{i=1}^{k} |G_i| = \boxed{nN}$

c) With 10 iterations, computation

$= \boxed{10 * (N(3nk-1) + nN)}$