Exercises for Chapter 9, Part 1

9.1 Consider the data set $X = \{-6, -5, 0, 4, 7\}$.

a) Draw the single linkage dendrogram.

$\{-6, -5, 0, 4, 7\}$: merge clusters 1 and 2 at distance 1
$\{\{-6, -5\}, 0, 4, 7\}$: merge clusters 3 and 4 at distance 3
$\{\{-6, -5\}, 0, \{4, 7\}\}$: merge clusters 2 and 3 at distance 4
$\{\{-6, -5\}, \{0, \{4, 7\}\}\}$: merge clusters 1 and 2 at distance 5

b) Draw the complete linkage dendrogram.

$\{-6, -5, 0, 4, 7\}$: merge clusters 1 and 2 at distance 1
$\{\{-6, -5\}, 0, 4, 7\}$: merge clusters 3 and 4 at distance 3
$\{\{-6, -5\}, 0, \{4, 7\}\}$: merge clusters 1 and 2 at distance 6
$\{\{\{-6, -5\}, 0\}, \{4, 7\}\}$: merge clusters 1 and 2 at distance 13

c) Compute the sequence of cluster centers that c-means produces with initialization $V = \{5, 6\}$.

$\{\{-6, -5, 0, 4\}, \{7\}\}$ yields $V = \left\{-\frac{7}{4}, 7\right\}$
$\{\{\{-6, -5, 0\}, \{4, 7\}\}$ yields $V = \left\{-\frac{11}{3}, \frac{11}{2}\right\}$
$\{\{\{-6, -5, 0\}, \{4, 7\}\}$ terminates

d) Find an initialization for which c-means yields a different result for X.

for example $V = \left\{-\frac{11}{2}, \frac{11}{3}\right\}$:
$\{\{-6, -5\}, \{0, 4, 7\}\}$ yields $V = \left\{-\frac{11}{2}, \frac{11}{3}\right\}$ and terminates