Q 3-1)

a) Each list takes $O(k^2)$ & there are $\frac{n}{k}$ sublist

$\therefore O(\frac{n}{k} \cdot k^2) = O(nk)$

b) We have $\frac{n}{k}$ sublist, since we merge 2 sublists together, there is a total of $\log_2(\frac{n}{k})$ merges with each merge taking $O(n)$ time

$\therefore$ we have $O(n \cdot \log(\frac{n}{k}))$

c) $nk + n\log(\frac{n}{k}) = n\log n$

$nk + n\log n - n\log k$

$= n(k + \log n - \underbrace{\log k}_{const})$

so the max value ea for k to keep the time complexity would be $k = \log n$

$\Rightarrow n(\log n + \log n - \log k) = n(2\log n - \log k)$

$\Rightarrow O(n \log n)$