MinHash sketches

As discussed in class, for a min-wise independent family H, we can associate a sketch
$s(X) = [min\ h_1(X), min\ h_2(X), \dots, min\ h_k(X)]$ with each set X in the given data collection, where
$h_1, h_2, \dots, h_k$ are independently chosen at random from H. Consider now any two sets A and B, with their
sketches $s(A)$ and $s(B)$. Can you compute a sketch for $A \cup B$ using just s(A) and s(B) in $O(k)$ time? Can
you prove that it is equivalent to compute $s(A \cup B)$ from scratch directly from $A \cup B$?

SOLUTION