COMP3121 Assignment2 - Q2

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Acknowledgement: The answer is inspired by tutorial 3 question 27 solution.

Answer

First we sort N workers based on their skill level x_i in ascending order, and P entry-level jobs based on their maximum accept skill level p_i in ascending order, and Q senior jobs based on their minimum accept skill level q_i in ascending order. This sorting process takes time $O(NlogN + PlogP + QlogQ)$ in total.
Going from the least skilled to the most skilled worker, assign each worker a entry-level job with the lowest p_i that they meet and has not been assigned, if one exists. The remaining workers, that is who has not been assigned a work, going from the least skilled to the most skilled, assign each remaining worker a senior job with the highest q_i that they meet and has not been assigned, if one exist. This assigning process takes time $O(N)$.
So the total time taken is $O(NlogN+N+PlogP+QlogQ) = O(NlogN+PlogP+QlogQ)$, which satisfies the question.