Name: Shuo Wu wustl key: wushuo Student ID: 452666

Qn2,

A,

Let $X = \{x_i, x_{i+1}, \ldots, x_j\}$, we sort and re-label the points so that $x_i \le x_{i+1} \le \cdots \le x_j$.

Let S_{ij} be the smallest set of intervals we build (the solution), contains some intervals $I_k = [x_k , x_k + 1]$, where $i \le k \le j$.

Same definition for S_{jk} and S_{jk}.

$X_{ik} = S_{jk} \cap X$

$X_{kj} = S_{jk} \cap X$

1, S_{ik} is the optimal solution for sub-problem X_{ik}

2, S_{kj} is the optimal solution for sub-problem X_{kj}

B,

Consider any nonempty sub-problem X_k, and let x_1 be a point in X_k with the smallest position. Then interval $I_1 = [x_1, x_1+1]$ is included in some of smallest set of intervals of X_k.

C,

Let S_k be the smallest set of unit-length closed intervals of X_k, and let $I'_1 = [x'_1,x'_1+1]$be the first interval in S_k. If $I'_1 = I_1$, then we are done, since we have shown that I_1 is in some smallest set of intervals of X_k.

$I'_1=[x'_1,x'_1+1]$, and $I_1 = [x_1, x_1+1]$.

If $x'_1 != x_1$:

If $x'_1 > x_1$, we can say S_k is not a solution for the question since the first point x_1 isn't included in S_k.

If $x'_1 < x_1$, as x_1 is the leftmost point, there are no points from X_k contained in the interval $[x'_1,x_1]$. Therefore, we could simply replace the interval $[x'_1,x'_1+1]$ in S_k (which is S_{opt}) with the interval $[x_1, x_1+1]$ such that the new set of intervals $S_{k\text{-revise}}$ is still optimal (as $| S_k | = | S_{k\_revise} |$ and all points are covered).

Name: Shuo Wu wustl key: wushuo Student ID: 452666

D,

Recursive:

s= set of intervals (solution)

X = set of the given points

initial s = Φ

Unit-length-closed-intervals_ Recursive (s, X):

1, if X = Φ

2, return s

3,else:

4, sort(X)

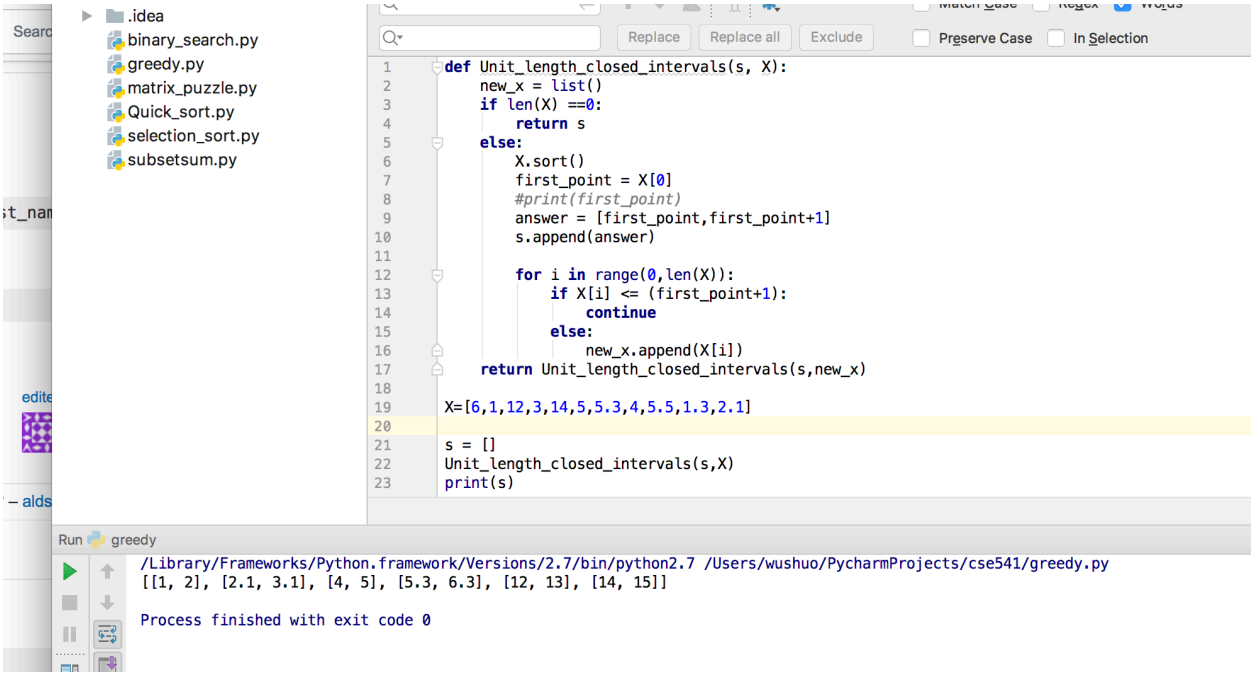
5, first_point <- X[0]

6, I_k = [first_point, first_point +1]

7, s <- (s U {I_k})

8, new_X <- (X - {points: points $\in I_k$}

9, return Unit-length-closed-intervals(s,new_X)



Name: Shuo Wu wustl key: wushuo Student ID: 452666

E,

Iterative:

s= set of intervals (solution)

X = set of the given points

initial s = Φ

Unit-length-closed-intervals_ Iterative(s, X):

1, sort(X)

2, while X != Φ:

3, for each point p_t in X:

4, first_point <- X[0]

5, l_k = [first_point, first_point +1]

6, s = (s U {l_k})

7, X = (X - {points: points $\in l_k$}

8, return s