Q1.

(i)

Definition:

Stable Marriage Problem is defined as given two sets of the same length named as set A and set B, in which the set members specify their preference lists of set members from the other set, the set members must be matched by a “stable” way. The matching is stable if there are no two set members (Ai, Bi) which would both rather have each other than their current matching.

If we define this problem as a computational problem, we get this.

Input:

Two sets of items S1 = {a1, a2, …, an} S2 = {b1, b2, … bn}

For each item in S1 and S2:

A preference list that consists of the elements of the other set such as P.L for a1 = {b(i)1, b(k)2, … b(l)n}

Output:

A set of length n that consists of pairings (A, B) in which there does not exist any pair (A, B) which would both rather have each other than their current matching.

(ii)

Example:

We can give a hypothetic undergraduate university placement system as an example. In this system, there are N many students and N many quotas for the universities in the country. In this system students join a central exam and get a score. After the exam every student lists the universities by their preferences. Also, all the universities list the students by their scores. The university placements can be made by these two preferences lists and the matchings become stable.

Q2.

(i)

(ii)

Taking N as input -> Constant time O(k0)

Creating the prefer matrix 🡪 Linear time O(N\*k1)

Creating bPartner list 🡪 Linear time O(N\*k2)

Creating aFree list 🡪 Linear time O(N\*k3)

The main while loop runs O(N) at most in every step of this loop, freeCount decrases at least 1. If we look the first while loop inside the main loop, it runs O(N^2) at most. If we look at the next while loop outside of the “do while a < N” loop this runs at most O(N^2) times. This makes the complexity of the program O(N^2).