LAPORAN PRAKTIKUM
ANALISIS ALGORITMA

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Kelas A

Program Studi S-1 Teknik Informatika

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Selesaikan worksheet 1, program c++, dan bagian analisis di modul praktikum.

Worksheet 1

Worksheet 01

Dengan Algoritma Gale-Shapley, cari himpunan stable-matching yang sesuai dengan preference-lists berikut ini. Gunakan processor terhebat yang Anda miliki (otak) untuk mengikuti algoritma G-S dan output tidak perlu diuraikan per-looping tetapi Anda harus memahami hasil setiap looping.

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

```
Initially all m ∈ M and w ∈ W are free
While there is a man m who is free and hasn't proposed to
every woman
    Choose such a man m
    Let w be the highest-ranked woman in m's preference list
        to whom m has not yet proposed
    If w is free then
        (m, w) become engaged
    Else w is currently engaged to m'
        If w prefers m' to m then
            m remains free
        Else w prefers m to m'
            (m, w) become engaged
            m' becomes free
        Endif
    Endif
Endwhile
Return the set S of engaged pairs
```

Iterasi 1

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 2

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 3

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 4

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 5

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 6

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 7

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 8

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 9

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 10

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 11

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 12

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 13

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 14

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Iterasi 15

Men's Preferences Profile

	0th	1st	2nd	3rd	4th
Victor	Bertha	Amy	Diane	Erika	Clare
Wyatt	Diane	Bertha	Amy	Clare	Erika
Xavier	Bertha	Erika	Clare	Diane	Amy
Yancey	Amy	Diane	Clare	Bertha	Erika
Zeus	Bertha	Diane	Amy	Erika	Clare

Women's Preferences Profile

	0th	1st	2nd	3rd	4th
Amy	Zeus	Victor	Wyatt	Yancey	Xavier
Bertha	Xavier	Wyatt	Yancey	Victor	Zeus
Clare	Wyatt	Xavier	Yancey	Zeus	Victor
Diane	Victor	Zeus	Yancey	Xavier	Wyatt
Erika	Yancey	Wyatt	Zeus	Xavier	Victor

Program C++

Tugas Praktikum

- Ubahlah pseudocode algoritma G-S pada worksheet 01 ke dalam program menggunakan bahasa C++
- Gunakan table pria sebagai table acuan untuk memudahkan Anda menentukan pasangannya.
- Cocokkan jawaban Anda pada worksheet 01 dengan hasil program yang Anda buat
- Jika ada yang berbeda tuliskan bagian mana yang berbeda dan analisalah (Poin ini disampaikan pada bagian Analisis Algoritma) yang sudah disiapkan.

```
/*
Nama        : Alfari Sidnan Ghilmana
NPM         : 140810180011
Kelas       : A
Deskripsi   : Gale-Shapley Algorithm
```

```cpp
*/

#include <algorithm>
#include <iostream>
#include <map>
#include <queue>
#include <string>
#include <vector>
using namespace std;
const char *men_data[][6] = {
    { "victor", "bertha", "amy", "diane", "erika", "clare" },
    { "wyatt",  "diane", "bertha", "amy", "clare", "erika" },
    { "xavier", "bertha", "erika", "clare", "diane", "amy" },
    { "yancey", "amy", "diane", "clare", "bertha", "erika" },
    { "zeus",   "bertha", "diane", "amy", "erika", "clare" }
};

const char *women_data[][6] = {
    { "amy",    "zeus", "victor", "wyatt", "yancey", "xavier" },
    { "bertha", "xavier", "wyatt", "yancey", "victor", "zeus" },
    { "clare",  "wyatt", "xavier", "yancey", "zeus", "victor" },
    { "diane",  "victor", "zeus", "yancey", "xavier", "wyatt" },
    { "erika",  "yancey", "wyatt", "zeus", "xavier", "victor" }
};

typedef vector<string> PrefList;
typedef map<string, PrefList> PrefMap;
typedef map<string, string> Couples;

bool prefers(const PrefList &prefer, const string &first, const string &second){
    for (PrefList::const_iterator it = prefer.begin(); it != prefer.end(); ++it){
        if (*it == first) return true;
        if (*it == second) return false;
    }
    return false;
}

void check_stability(const Couples &engaged, const PrefMap &men_pref, const PrefMap &women_pref){
    cout << "Stablility:\n";
    bool stable = true;
    for (Couples::const_iterator it = engaged.begin(); it != engaged.end(); ++it)
    {
        const string &bride = it->first;
        const string &groom = it->second;
```

```cpp
        const PrefList &preflist = men_pref.at(groom);

        for (PrefList::const_iterator it = preflist.begin(); it != preflist.end()
; ++it){
            if (*it == bride)
                break;

            if (prefers(preflist, *it, bride) && prefers(women_pref.at(*it), groo
m, engaged.at(*it))){
                cout << "\t" << *it <<
                    " prefers " << groom <<
                    " over " << engaged.at(*it) <<
                    " and " << groom <<
                    " prefers " << *it <<
                    " over " << bride << "\n";
                stable = false;
            }
        }
    }
    if (stable) cout << "\t(all marriages stable)\n";
}

int main(){
    PrefMap men_pref, women_pref;
    queue<string> bachelors;

    for (int i = 0; i < 5; ++i){
        for (int j = 1; j < 6; ++j){
        men_pref[men_data[i][0]].push_back(men_data[i][j]);
            women_pref[women_data[i][0]].push_back(women_data[i][j]);
        }
        bachelors.push(men_data[i][0]);
    }

    Couples engaged;

    cout << "Matchmaking:\n";
    while (!bachelors.empty()){
        const string &suitor = bachelors.front();
        const PrefList &preflist = men_pref[suitor];

        for (PrefList::const_iterator it = preflist.begin(); it != preflist.end()
; ++it){
            const string &bride = *it;
                if (engaged.find(bride) == engaged.end()){
```

```cpp
                cout << "\t" << bride << " and " << suitor << "\n";
                engaged[bride] = suitor;
                break;
            }

            const string &groom = engaged[bride];

            if (prefers(women_pref[bride], suitor, groom)){
                cout << "\t" << bride << " dumped " << groom << " for " << suitor
   << "\n";
                bachelors.push(groom);
                engaged[bride] = suitor;
                break;
            }
        }
        bachelors.pop();
    }

    cout << "Engagements:\n";
    for (Couples::const_iterator it = engaged.begin(); it != engaged.end(); ++it)
    {
        cout << "\t" << it->first << " and " << it->second << "\n";
    }

    check_stability(engaged, men_pref, women_pref);
}
```

```
Matchmaking:
        bertha and victor
        diane and wyatt
        bertha dumped victor for xavier
        amy and yancey
        diane dumped wyatt for zeus
        amy dumped yancey for victor
        clare and wyatt
        erika and yancey
Engagements:
        amy and victor
        bertha and xavier
        clare and wyatt
        diane and zeus
        erika and yancey
Stablility:
        (all marriages stable)
```

Analisis Algoritma

Jawablah pertanyaan berikut:

1. Apakah jawaban Anda di Worksheet 01 dan Program sama persis? Jika Tidak? Kenapa?

= Ya

Anda diminta untuk membuktikan algoritma G-S benar dengan menjawab pertanyaan berikut:

Fakta (1.1):

Seorang wanita tetap bertunangan dari titik di mana dia menerima proposal pertamanya; dan

urutan mitra yang bertunangan dengannya menjadi lebih baik dan lebih baik lagi (hal ini sesuai

dengan daftar preferensi wanita). =>tidak perlu dipertanyakan

Fakta (1.2):

Urutan wanita yang dilamar pria lebih buruk dan lebih buruk lagi (hal ini sesuai dengan daftar

preferensi pria). => tidak perlu dipertanyakan

Teorema (1.3):

Algoritma G-S berakhir setelah paling banyak n^2 iterasi menggunakan While Loop.

Buktikan!

= Jika ada n laki laki dan n perempuan, dengan greedy method(try & error) maka worst case nya adalah setiap laki-laki di pasangkan ke semua perempuan dengan maksimal iterasi yaitu n^2 iterasi

Teorema (1.4):

Jika seorang pria bebas di beberapa titik dalam eksekusi algoritma, maka ada seorang wanita

yang belum dia ajak bertunangan.

Buktikan!

= Jika terdapat n laki-laki dan n perempuan, maka terdapat maksimal iterasi yaitu n^2 iterasi . Jika iterasi yang dilakukan < n^2 maka bias saja terdapat wanita yang belum diajak bertunangan

Teorema (1.5):

Himpunan S yang dikembalikan saat terminasi adalah perfect matching

Buktikan!

= Algortma G-S akan menghasilkan pasangan dengan kemungkinan referensi pria maupun wanita paling tinggi yang mungkin,sehingga pasangan pasangan tersebut dapat di katakana perfect matching

Teorema (1.6):

Sebuah eksekusi algoritma G-S mengembalikan satu set pasangan S. Set S adalah pasangan yang

stabil.

Buktikan!

= Terbukti karena algoritma G-S merupakan algoritma "mencoba dan gagal" untuk mencari pasangan untuk setiap n laki-laki ke n perempuan dengan acuan list referensi laki-laki dan perempuan