Homework 1

Name: Chiao Lu

UID: 204848946

# Problem 1

Resource: <https://cs.stackexchange.com/questions/38386/computer-program-vs-algorithm>

An algorithm is a systematic approach to solving a specific problem.

A program is a set of instructions for a computer/human to follow.

# Problem 2

Really sad. The below statement is FALSE.

|  |
| --- |
| *There is an algorithm that solves the Stable Matching Problems for every instance of this problem.* |

Why? We can come up with a counter example!

Consider the following Yupi, men and women set:

Now, let’s create a super artificial (and unfortunate) love preference table below.

|  |  |  |
| --- | --- | --- |
|  | Rank high ☺ | Rank low ☹ |
|  |  |  |
|  |  |  |

Quick explanation of my notation above: prefers to , and prefers to . All tables below follow the same notation.

|  |  |  |
| --- | --- | --- |
|  | Rank high ☺ | Rank low ☹ |
|  |  |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
|  | Rank high ☺ | Rank low ☹ |
|  |  |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
|  | Rank high ☺ | Rank low ☹ |
|  |  |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
|  | Rank high ☺ | Rank low ☹ |
|  |  |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
|  | Rank high ☺ | Rank low ☹ |
|  |  |  |
|  |  |  |

Below, we will show that with the above love preference, there is no way to find a perfect match with no instabilities. In other words, no matter how you match people, someone will cheat on its partner.

To show this, let’s enumerate all possible perfect matches , and .

Now, if you refer to the love preference tables defined earlier, you will find out that:

1. In , will hook up.
2. In , will hook up.
3. In , will hook up.
4. In , will hook up.

We just found an instance of the problem where no stable matching exists. This tells us that the statement below is false.

|  |
| --- |
| *There is an algorithm that solves the Stable Matching Problems for every instance of this problem.* |