Course: CS208 - Algorithm Design and Analysis

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Assignment 1

(1) False. it is not always the case.

Counter Example: $m = \{m_1, m_2\}$, $w = \{w_1, w_2\}$

men's preference list:

	1	2
m_1	w_2	w_1
m_2	w_1	w_2

women's preference list

	1	2
w_1	m_1	m_2
w_2	m_2	m_1

inverse

	m_1	m_2
w_1	1	2
w_2	2	1

in this example, m_1 prefers w_2 the most, this two pair (m_1, w_2). But w_2 prefers m_2 the most, however cannot be in pair with m_2.

Thus, not every instance of stable matching, contain a pair (m, w) such that m is ranked first on the preference list of w

② - True

w and m prefer each other the most. This stable matching, m will choose w as his first proposal, w accept m since she is free. Based on algorithm this couple will not be changed.

③.

Network A

scheme	win	lose
S	T	T'
S'	T'	T

Network B

Schema	win	lose
T	S'	S
T'	S	S'

in forming the pair of calender (S, T), we have the schedule T' in which network B gain more audian T. it can be concluded that there is not always a stable pair of schedules.

④. yes, it is possible

Suppose we have 3 men and 3 women.

	1	2	3
m_1	w_3	w_1	w_2
m_2	w_1	w_3	w_2
m_3	w_3	w_1	w_2

	1	2	3
w_1	m_1	m_2	m_3
w_2	m_1	m_2	m_3
w_3	m_2	m_1	m_3

in addition, w_3 has a false preference w_3'

w_3' m_2 m_3 m_1

* First run of Gale-Shapley algorithm with true preference of w_3

- in the first iteration :

m_1 proposes to w_3

m_2 proposes to w_1

m_3 propose to w_3.

Finally, Gale-Shapley algorithm with true preferences

(m_1, w_3), (w_2, w), (m_3, w_2).

* if we run Gale-Shapley with false reference of w_3', results

(m_1, w_1), (m_2, w_3), (m_1, w_2).

Conclusion, it is possible if w_3 false her preference list to get her desired partner.