CAS10 Assignment 1

Institute of Computing Technology,
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- Due Nov. 5, 2010.
- Please send your answer to wangchao1987@ict.ac.cn, shaomingfu@gmail.com, huangchunlin@ict.ac.cn, zhanghaicang@ict.ac.cn
- You can choose one problem from Problem 1-4, and one problem from Problem 5-6.

1 True or False (10 marks)

Decide whether you think the following statement is true or false. If it is true, give a short explanation. If it is false, give a counterexample.

True or false? In every instance of the Stable Matching Problem, there is a stable matching containing a pair (m, w) such that m is ranked first on the preference list of w and w is ranked first on the preference list of m.

2 True or False (10 marks)

Decide whether you think the following statement is true or false. If it is true, give a short explanation. If it is false, give a counterexample.

True or false? Consider an instance of the Stable Matching Problem in which there exits a man m and a woman w such that m is ranked first on the preference list of w and w is ranked first on the preference list of m. Then in every stable matching S for this instance, the pair (m, w) belongs to S.

3 Time Analysis (10 marks)

Can you give another analysis method to prove that the algorithm of Stable Matching Problem must be stopped in $O(n^2)$ time?

4 Programming (5 marks)

Please write a program to implement the algorithm of the Stable Matching Problem in C/C++ or Java.

You can refer to the algorithm of Page 21 of the book **Algorithm Design**.

5 Potential Method (10 marks)

Suppose that a counter begins at a number with b 1's in its binary representation, rather than at 0. Show that the cost of performing n **INCREMENT** operations is $O(n)$ if $n = \Omega(b)$. (Do not assume that b is constant.)

6 Aggregate Analysis (10 marks)

If the set of stack operation included a **MULTIPUSH** operation, which pushes k items onto the stack, would the $O(1)$ bound on the amortized cost of stack operations continue to hold?