

**CS 172, Spring 1999
Midterm #1
Professor Manuel Blum**

This is a CLOSED BOOK examination.
Calculators ARE permitted.
Do all your work on the pages of this examination.

Problem #1

- a) Define the number of steps taken by a NDTM on input x .
- b) Define the number of steps taken by a NDTM on inputs of length n .

Problem #2

Define two (computational) problems p_1, p_2 to be poly-time equivalent iff it is possible to solve p_1 in polynomial time using p_2 .

Are the following two problems poly-time equivalent?
If so, prove it.
If not, explain why not.

Decision:

Instance: $NDTM_i, x \in \{0,1\}^*, m$ in unary (ie $1 \dots 1 = 1$).
Question: Does $NDTM_i$ accept x in m steps? ie does there exist a $y \in \{0,1\}^*$ s.t.

Optimization:

Input: $NDTM_i, x \in \{0,1\}^*, m$ in unary
Output: $y \in \{0,1\}^*$ s.t. $NDTM_i$ accepts (y,x) in m steps, if any (ie if such y exists).
"NONE" if there is no such y .

Problem #3

Explain what problems if any you encounter in doing the above reductions in the case that m is given in binary instead of unary.

**Posted by HKN (Electrical Engineering and Computer Science Honor Society)
University of California at Berkeley
If you have any questions about these online exams
please contact examfile@hkn.eecs.berkeley.edu.**