NTIN090 — Introduction to complexity and computability theory

Exam questions, academic year 2019/20

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Two questions will be asked during the oral part of the exam according to one of the following two schemes:

- One question of group A and one question of group D.
- One question of group B and one question of group C.

A

(A1) Rice's theorem.

(A2) Post correspondence problem.

(A3) Savitch's theorem.

(A4) Deterministic space hierarchy.

(A5) Deterministic time hierarchy.

(A6) NP-completeness of Tiling.

(A7) Fully polynomial time approximation scheme for the Knapsack problem.

B

(B1) Gödel number, universal Turing machine, undecidability of the language of universal Turing machine (acceptance) and Halting problem.

(B2) RAM and its equivalence with Turing machines.

(B3) Enumerators of partially decidable and decidable languages.

(B4) Polynomial reduction of Tiling to Satisfiability.

(B5) Polynomial reduction of Satisfiability to 3-Satisfiability.

(B6) Polynomial reduction of 3-Dimensional Matching to Partition.

(B7) Pseudopolynomial algorithm for the Knapsack problem. Pseudopolynomial algorithms and strong NP-completeness (definitions).

C

(C1) Definition of m-reducibility and completeness, m-completeness of the language of a universal Turing machine, the Halting problem and their diagonals (languages L_u, HALT, DIAG, and HALT-DIAG).

(C2) Basic complexity classes and their relations.

(C3) Approximation algorithms, example (Bin Packing).

D

(D1) (Turing) decidable and partially decidable languages and their basic properties (closedness properties, Post's theorem).

(D2) The (two) definitions of class NP and their equivalence.

(D3) Inapproximability of Travelling Salesperson.

(D4) Pseudopolynomial algorithms and strong NP-completeness (definitions). Strong NP-completeness of Travelling Salesperson.

(D5) Approximation schemes (definition), connection to strong NP-completeness.

(D6) Class co-NP and co-NP-completeness.