

# NTIN090 – Introduction to Complexity and Computability

Exam test (year 2015/16)

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Version V

1. Show that the following problem is not algorithmically decidable:

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| DISJOINTNESS   |
| <b>Instance :</b> Codes of Turing machines $M_x$ and $M_y$ .         |
| <b>Question :</b> Is it true that $L(M_x) \cap L(M_y) = \emptyset$ ? |

Decide whether this problem is partially decidable, give reasons for your decision.

2. Decide, whether

$$\text{NSPACE}(n^2) \subseteq \text{TIME}(2^{n^3}).$$

Possible answers are (yes/no/not known). Give reasons to your answer.

3. With help of one of problems Tiling, Satisfiability, 3-Satisfiability, Vertex Cover, 3-Dimensional Matching, Hamiltonian cycle, Travelling salesperson, or Partition show that the following problem is NP-complete:

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| DOMINATING SET   |
| <b>Instance :</b> Graph $G = (V, E)$ , natural number $k > 0$  |
| <b>Question :</b> Is there a set of vertices $S \subseteq V$ of size at most $k$ which satisfies that any vertex $v$ in $V$ has a neighbour in $S$ |