

Course Name	Theory of Computation		
Semester, Year	Second Semester, 2018 (Winter Term)	Number of Credits	2 credits
Course level	3000	Course Number	27099
Instructor(s) (Institution)	Thomas Zeugmann (大学院情報科学研究科)		
Course Objectives			
Course Goals			
Course Schedule	<ol style="list-style-type: none"> <li>1. Introducing Formal Languages motivation, background, relations, languages, palindromes</li> <li>2. Introducing Formal Grammars formal grammars, regular languages,</li> <li>3. Characterizations of regular languages Nerode's theorem, regular expressions, pumping lemma</li> <li>4. Context-free Languages Basic properties, transposition, reduced grammars</li> <li>5. Backus-Naur-Form, Chomsky Normal Form, pumping lemma for context-free languages</li> <li>6. Context-free Languages, Substitutions, Homomorphisms, Homomorphic Characterization</li> <li>7. Pushdown Automata Pushdown automata, modes of acceptance, pushdown automata and context-free languages</li> <li>8. Greibach Normal Form, Chomsky Hierarchy Characterization of context-free languages in terms of pushdown automata,</li> <li>9. Models of Computation Partial recursive functions, general recursive functions, pairing</li> <li>10. Turing Machines Turing computable functions, equivalence of Turing computable functions and partial recursive functions, universal Turing machines</li> <li>11. Algorithmic Unsolvability Halting problem, Post's correspondence problem</li> <li>12. Applications of Post's Correspondence Problem undecidability results for context-free languages, summary</li> <li>13. Numberings and Complexity G<sup>o</sup>del numberings, fixed point theorem, recursion theorems, Rice's theorem abstract complexity theory</li> <li>14. Multi-tape Turing Machines (deterministic, nondeterministic) Complexity classes,</li> <li>15. Immerman-Szelepcsényi Theorem Immerman-Szelepcsényi theorem, linear bounded automata, closure of context-sensitive languages under complement</li> </ol>		
Homework	Lecture slides (English・Japanese) and original text(English) can be obtained in advance. Exercise will be assigned each time.		
Grading System	Evaluation will be carried out by exercises and the final examination.		
Textbooks / Reading List	<p>英語で学ぶ計算理論 Thomas Zeugmann, 湊真一, 大久保好章 コロナ社 2009  計算理論とオートマトン言語理論 -コンピュータの原理を明かす- 丸岡 章 サイエンス社 2005  オートマトン言語理論 計算論 I J. ホップクロフト サイエンス社 1984  オートマトン言語理論 計算論 II J. ホップクロフト 1984 1984  オートマトンと計算可能性 有川節夫、宮野悟 培風館 1986</p>		
Websites			
Website of Laboratory	<a href="http://www-alg.ist.hokudai.ac.jp/index.html">http://www-alg.ist.hokudai.ac.jp/index.html</a>		
Additional Information			