F29LP Language Processors

COURSE DETAILS
Course Code: F29LP
Full Course Title: Language Processors
SCQF Level: 9
SCAF Credits: 15
Available as Elective: No

DELIVERY LEVEL
Undergraduate: No
Postgraduate Taught: No
Postgraduate Research: No

COURSE AIMS
To develop skills in programming language definition
To develop skills in programming language implementation

LEARNING OUTCOMES – SUBJECT MASTERY
- Ability to construct & manipulate lexical & syntactic definitions
- Understanding of relationship between grammars & automata
- Ability to construct lexical & syntactic analysers from definitions
- Familiarity with static & dynamic semantics, and associated formalisms
- Ability to generate & traverse ASTs
- Ability to construct AST-based analysers, interpreters & code generators for simple languages
- Understanding of run-time environments
- Ability to use compiler construction tools

LEARNING OUTCOMES – PERSONAL ABILITIES
- Appreciation of problem solving as language definition & implementation
- Ability to apply appropriate language oriented formalisms, tools & techniques in solving problems
- Skills in engineering complex software artefacts

SYLLABUS
Language definition:
- lexicon: non-terminal & terminal symbols, type 3 grammars, regular expressions, finite state automata, Moore & Mealey machines, left & right recursion
- concrete syntax: type 2 grammars & BNF, factoring grammars, converting left to right recursion, LL(K) & LR(K) grammars, push down automata, parsing
- abstract syntax: abstract syntax from concrete syntax
F29LP Language Processors

- static semantics: types
- dynamic semantics: overviews of axiomatic, denotational & operational semantics; introduction to structural operational semantics (SOS) for declarations, expressions, statements

Language implementation:

- lexical analysis
- syntax analysis: recursive descent for LL(1)
- abstract syntax tree (AST) construction
- AST pretty printing
- overview of interpreter/abstract machine
- AST interpretation
- static analysis of AST: e.g. type checking, identifier resolution
- code generation e.g.: register/memory allocation, structured constructs as test/jump, structured data as structured memory sequences, stack discipline for blocks/subroutines, parameter passing
- run time environment: e.g. heap allocation, garbage collection, debugging support
- compiler construction tools e.g. Lex, Yacc, JavaCC

Based on simple imperative language

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<tr>
<th>COURSE RELATIONSHIPS</th>
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<td>Course Code</td>
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