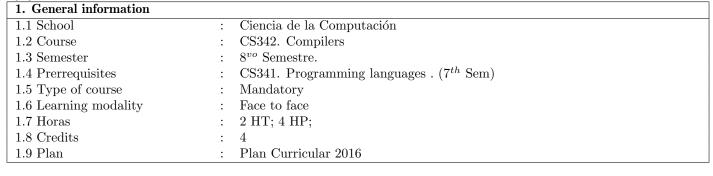
San Pablo Catholic University (UCSP) Undergraduate Program in Computer Science SILABO

CS342. Compilers (Mandatory)



2. Professors

Universidad Católica San Pablo

Lecturer

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3. Course foundation

That the student knows and understands the concepts and fundamental principles of the theory of compilation to realize the construction of a compiler

4. Summary

1. Program Representation 2. Language Translation and Execution 3. Syntax Analysis 4. Compiler Semantic Analysis 5. Code Generation

5. Generales Goals

- Know the basic techniques used during the process of intermediate generation, optimization and code generation.
- Learning to implement small compilers.

6. Contribution to Outcomes

This discipline contributes to the achievement of the following outcomes:

- 1) Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. (Assessment)
- 6) Apply computer science theory and software development fundamentals to produce computing-based solutions. (Assessment)

7. Content

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 Competences: Content Programs that take (other) programs as input such as interpreters, compilers, type-checkers, documentation generators Abstract syntax trees; contrast with concrete syntax Data structures to represent code for execution, translation, or transmission Just-in-time compilation and dynamic recompilation 	 Generales Goals Explain how programs that process other program treat the other programs as their input data [Familiarity] Describe an abstract syntax tree for a small languag [Familiarity] Describe the benefits of having program representations other than strings of source code [Familiarity] Write a program to process some representation of the string of the s
• Other common features of virtual machines, such as class loading, threads, and security.	 code for some purpose, such as an interpreter, a expression optimizer, or a documentation generate [Familiarity] Explain the use of metadata in run-time representations of objects and activation records, such as claspointers, array lengths, return addresses, and frampointers [Familiarity] Discuss advantages, disadvantages, and difficulties of just-in-time and dynamic recompilation [Familiarity] Identify the services provided by modern language run-time systems [Familiarity]

Competences:	
Content	Generales Goals
 Interpretation vs. compilation to native code vs. compilation to portable intermediate representation Language translation pipeline: parsing, optional type-checking, translation, linking, execution Execution as native code or within a virtual machine Alternatives like dynamic loading and dynamic (or "just-in-time") code generation Run-time representation of core language constructs such as objects (method tables) and first-class functions (closures) Run-time layout of memory: call-stack, heap, static data Implementing loops, recursion, and tail calls Memory management Manual memory management: allocating, deallocating, and reusing heap memory Automated memory management: garbage collection as an automated technique using the notion of reachability 	 Distinguish a language definition (what construct mean) from a particular language implementatio (compiler vs interpreter, run-time representation of data objects, etc) [Assessment] Distinguish syntax and parsing from semantics an evaluation [Assessment] Sketch a low-level run-time representation of cor language constructs, such as objects or closures [As sessment] Explain how programming language implementations typically organize memory into global data text, heap, and stack sections and how features suc as recursion and memory management map to this memory model [Assessment] Identify and fix memory leaks and dangling-pointed dereferences [Assessment] Discuss the benefits and limitations of garbage collection, including the notion of reachability [Assessment]

Readings: Aho et al. (2011), Louden (2004a), Appel (2002), Teufel and Schmidt (1998)

UNIT 3: Syntax Analysis (10)		
Competences:		
Content	Generales Goals	
 Scanning (lexical analysis) using regular expressions Parsing strategies including top-down (e.g., recursive descent, Earley parsing, or LL) and bottom-up (e.g., backtracking or LR) techniques; role of context-free grammars Generating scanners and parsers from declarative specifications 	 Use formal grammars to specify the syntax of languages [Assessment] Use declarative tools to generate parsers and scanners [Assessment] Identify key issues in syntax definitions: ambiguity, associativity, precedence [Assessment] 	
Readings: Aho et al. (2011), Louden (2004a), Appel (2002)), Teufel and Schmidt (1998)	

Competences:		
Content	Generales Goals	
 High-level program representations such as abstract syntax trees Scope and binding resolution Type checking Declarative specifications such as attribute grammars 	 Implement context-sensitive, source-level static analyses such as type-checkers or resolving identifiers to identify their binding occurrences [Assessment] Describe semantic analyses using an attribute grammar [Assessment] 	

Competences:		
Content	Generales Goals	
 Procedure calls and method dispatching Separate compilation; linking Instruction selection Instruction scheduling Register allocation Peephole optimization 	 Identify all essential steps for automatically conversing source code into assembly or other low-level larguages [Assessment] Generate the low-level code for calling functions/methods in modern languages [Assessment] Discuss why separate compilation requires uniform calling conventions [Assessment] Discuss why separate compilation limits optimization because of unknown effects of calls [Assessment] Discuss opportunities for optimization introduced be naive translation and approaches for achieving optimization, such as instruction selection, instruction scheduling, register allocation, and peephole optimization [Assessment] 	

8. Methodology

- 1. El profesor del curso presentará clases teóricas de los temas señalados en el programa propiciando la intervención de los alumnos.
- 2. El profesor del curso presentará demostraciones para fundamentar clases teóricas.
- 3. El profesor y los alumnos realizarán prácticas

4. Los alumnos deberán asistir a clase habiendo leído lo que el profesor va a presentar. De esta manera se facilitará la comprensión y los estudiantes estarán en mejores condiciones de hacer consultas en clase.

9. Assessment Theory Sessions:

The theory sessions are held in master classes with activities including active learning and roleplay to allow students to internalize the concepts.

Practical Sessions:

The practical sessions are held in class where a series of exercises and/or practical concepts are developed through problem solving, problem solving, specific exercises and/or in application contexts.

Evaluation System:

The final grade is obtained through of:

CONTINUOUS ASSESMENT	EVALUATIONS
Continuous assessment 1 : 30 %	Midterm Exam : 20 %
Continuous assessment 2 : 30 $\%$	Final Exam : 20 %
60%	40%

Where:

Continuous Assessment: It includes group work, active participation in class, exercise test.

- Continuos assessment 1 (weeks 1 9)
- Continuos assessment 2 (weeks 10 17)

To pass the course you must obtain 11.5 or more in the final grade .

References

Aho, Alfred et al. (2011). Compilers Principles Techniques And Tools. 2nd. ISBN:10-970-26-1133-4. Pearson.
Appel, A. W. (2002). Modern compiler implementation in Java. 2.a edición. Cambridge University Press.
Louden, Kenneth C. (2004a). Compiler Construction: Principles and Practice. Thomson.
Louden, Kenneth C. (2004b). Lenguajes de Programacion. Thomson.
Teufel, Bernard and Stephanie Schmidt (1998). Fundamentos de Compiladores. Addison Wesley Iberoamericana.