CSE 401
Intro Compilers

Final Review

(post-Midterm)

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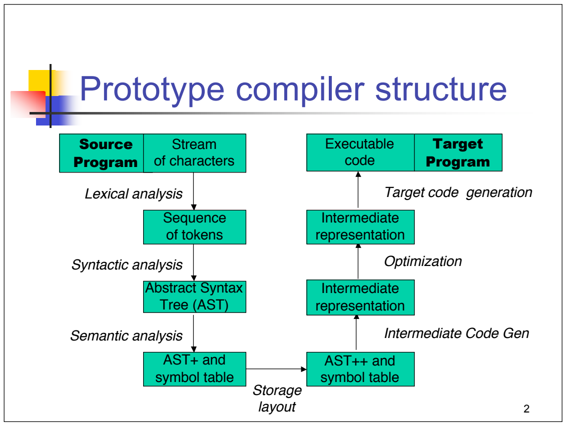

Prototype compiler structure

Source Program | Stream of characters

Lexical analysis

Sequence of tokens

Syntactic analysis

Abstract Syntax Tree (AST)

Semantic analysis

AST+ and symbol table

Storage layout

AST++ and symbol table

Intermediate Code Gen

Intermediate representation

Optimization

Intermediate representation

Target code generation

Executable code | **Target Program**

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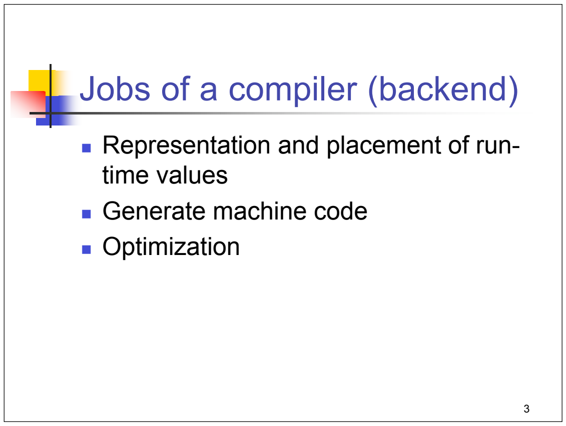

Jobs of a compiler (backend)

- Representation and placement of run-time values
- Generate machine code
- Optimization

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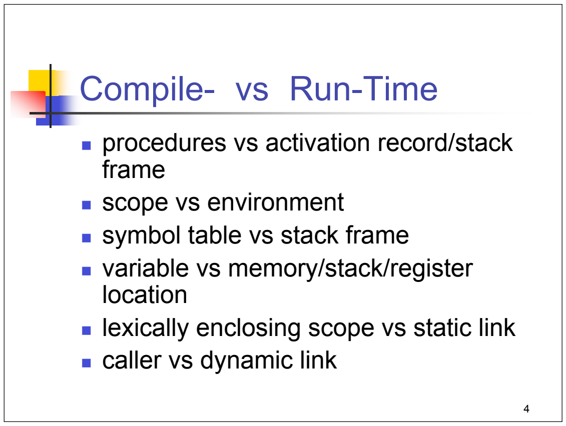

Compile- vs Run-Time

- procedures vs activation record/stack frame
- scope vs environment
- symbol table vs stack frame
- variable vs memory/stack/register location
- lexically enclosing scope vs static link
- caller vs dynamic link

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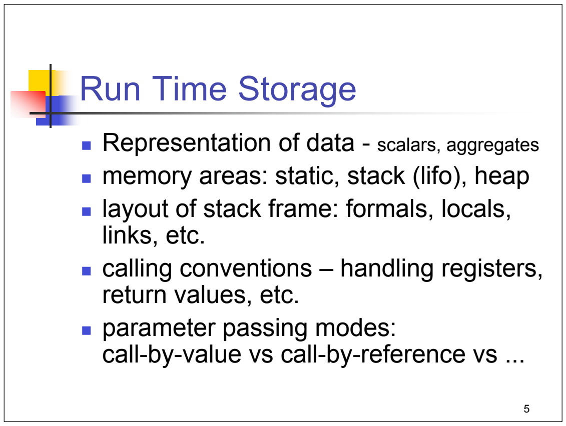

Run Time Storage

- Representation of data - scalars, aggregates
- memory areas: static, stack (lifo), heap
- layout of stack frame: formals, locals, links, etc.
- calling conventions – handling registers, return values, etc.
- parameter passing modes: call-by-value vs call-by-reference vs ...

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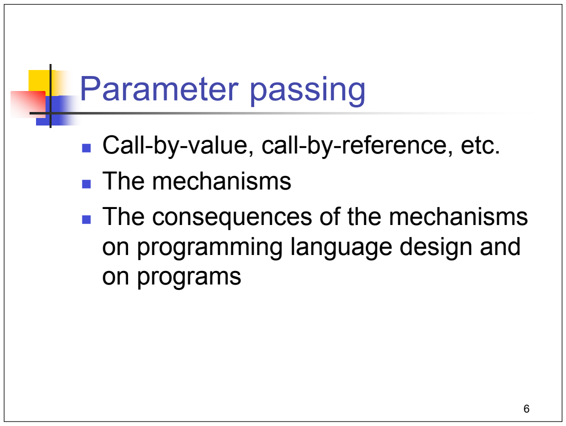

Parameter passing

- Call-by-value, call-by-reference, etc.
- The mechanisms
- The consequences of the mechanisms on programming language design and on programs

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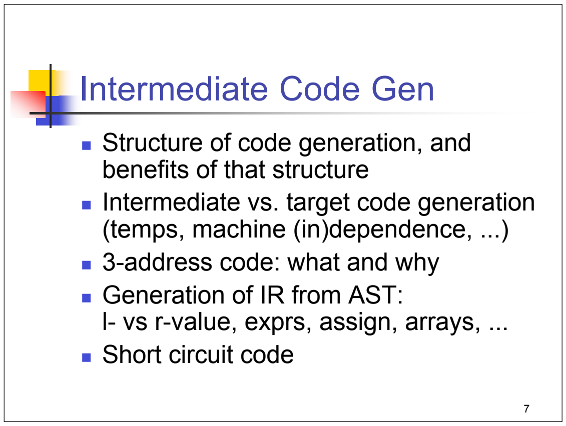
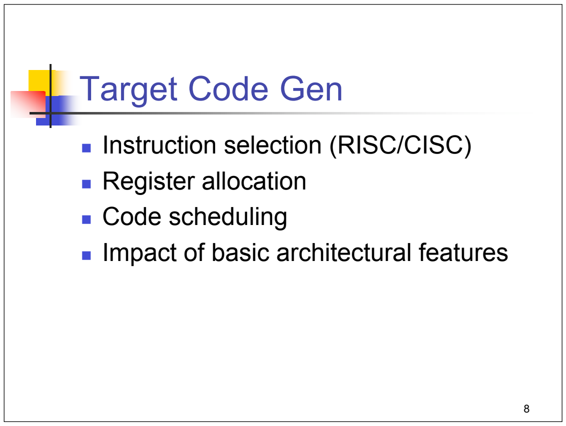


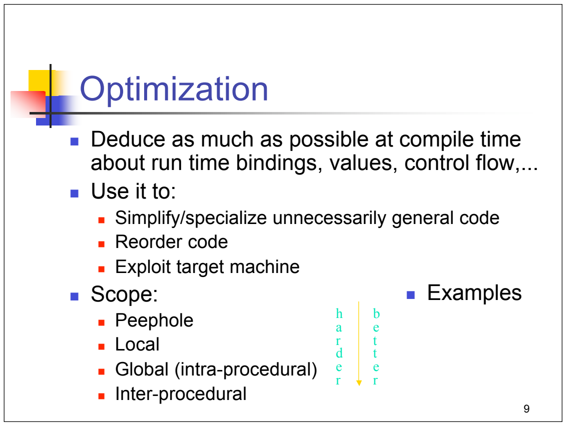
Intermediate Code Gen

- Structure of code generation, and benefits of that structure
- Intermediate vs. target code generation (temps, machine (in)dependence, ...)
- 3-address code: what and why
- Generation of IR from AST:
  l- vs r-value, exprs, assign, arrays, ...
- Short circuit code



Target Code Gen

- Instruction selection (RISC/CISC)
- Register allocation
- Code scheduling
- Impact of basic architectural features



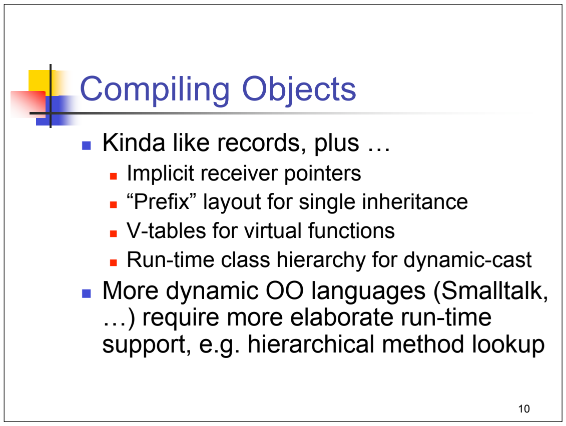
Optimization

- Deduce as much as possible at compile time about run time bindings, values, control flow,...
- Use it to:
  - Simplify/specialize unnecessarily general code
  - Reorder code
  - Exploit target machine
- Scope:
  - Peephole
  - Local
  - Global (intra-procedural)
  - Inter-procedural

harder

better

- Examples



Compiling Objects

- Kinda like records, plus …
  - Implicit receiver pointers
  - “Prefix” layout for single inheritance
  - V-tables for virtual functions
  - Run-time class hierarchy for dynamic-cast
- More dynamic OO languages (Smalltalk, …) require more elaborate run-time support, e.g. hierarchical method lookup