



Compilers

Error Handling

- Purpose of the compiler is
 - To detect non-valid programs
 - To translate the valid ones
- Many kinds of possible errors (e.g. in C)

Error kind	Example	Detected by ...
Lexical	... \$...	Lexer
Syntax	... x *% ...	Parser
Semantic	... int x; y = x(3); ...	Type checker
Correctness	your favorite program	Tester/User

- Error handler should
 - Report errors accurately and clearly
 - Recover from an error quickly
 - Not slow down compilation of valid code

- Panic mode
- Error productions
- Automatic local or global correction

- Panic mode is simplest, most popular method
- When an error is detected:
 - Discard tokens until one with a clear role is found
 - Continue from there
- Looking for synchronizing tokens
 - Typically the statement or expression terminators

- Consider the erroneous expression
 $(1 + + 2) + 3$
- Panic-mode recovery:
 - Skip ahead to next integer and then continue
- Bison: use the special terminal **error** to describe how much input to skip

$$E \rightarrow \text{int} \mid E + E \mid (E) \mid \text{error int} \mid (\text{error})$$

- Error productions
 - specify known common mistakes in the grammar
- Example:
 - Write $5x$ instead of $5 * x$
 - Add the production $E \rightarrow \dots \mid EE$
- Disadvantage
 - Complicates the grammar

- Idea: find a correct “nearby” program
 - Try token insertions and deletions
 - Exhaustive search
- Disadvantages:
 - Hard to implement
 - Slows down parsing of correct programs
 - “Nearby” is not necessarily “the intended” program

- Past
 - Slow recompilation cycle (even once a day)
 - Find as many errors in one cycle as possible
- Present
 - Quick recompilation cycle
 - Users tend to correct one error/cycle
 - Complex error recovery is less compelling