the classic example: Ada

rather more non-standard than his first 3; but then, as he notes that he means fourth generation programming languages;

- "fourth-generation language" is sometimes used "to refer to application generator programs, which might or might not be programming languages in the technical sense discussed in the first two pages of the Introduction."

Sometimes I've seen 4GL's characterized as languages where you indicate what you want, and not how to get it -- that's another different "direction";
• some characteristics are just a consolidation and correction of certain third generation characteristics;

• others are important new facilities;

• most important contribution: in name structures
  – MacLennan's fourth generation is essentially synonymous with data abstraction language!

• primary characteristic: provision of an encapsulation facility supporting:
  – the separation of specification and definition
  – information hiding
  – name access by mutual consent
"Most of these languages allow encapsulated modules to be generic (or polymorphic)" which can lead to operator identification issues;

control structures: "It is characteristic of this generation to provide for concurrent programming"

  "Most ... use some form of message-passing as a means of synchronization and communication among concurrent tasks"

  "Protected data structures ... are also typical."

  "On the other hand, the basic framework of these languages is still sequential."

"typically also have a dynamically-scoped exception mechanism for handling both system- and user-defined errors"
• **data structure constructors**: similar to those of the third generation, except some problems *(array parameters!)* have been corrected;

• "**primitive data structures** tend to be more **complicated** than the third generation, because of the desire to control accuracy and precision in numeric types"

• "**syntactic structures** ... are largely those of the second and third [generations]... in the Algol/Pascal tradition.
  
  – The major exception is a preference for **fully-bracketed structures.**"

  – ^ ...which, for example, are another solution to the dangling-else problem!