Stages of compilation

There are six stages of compiling a program:

* Lexical analysis
* Symbol table construction
* Syntax analysis
* Semantic analysis
* Code generation
* Optimization

## Lexical analysis

* Comments and unnecessary spaces are removed.
* Keywords, **constants** and **identifiers** are replaced by 'tokens', which are symbolic **strings** to identify what the elements are.

## Symbol table construction

* A table stores the names and addresses of all **variables**, constants and **arrays**.
* Variables are checked to make sure they have been **declared** and to determine the **data types** used.

## Syntax analysis

* Tokens are checked to see if they match the syntax of the **programming language**.
* If syntax errors are found, error messages are produced.

## Semantic analysis

* Variables are checked to make sure they have been correctly declared and contain the correct data type.
* Operations are checked to ensure that they are appropriate for the type of variable being used.

## Code generation

* **Machine code** is generated in this stage.

## Optimization

* Code optimization makes the program more efficient so it runs faster and uses fewer resources.

Levels of programming

Introductory

Content is designed for psychologists who may have little to no background in a specialized skill or content area. Through this level of programming, the learner can become acquainted with the theoretical underpinnings, principles, methods, and perspectives of a content area. An introductory level program also may serve as the foundation for subsequent intermediate and advanced learning. Introductory level programing may also be related to an emerging area of knowledge or practice. Although this content can be used as a foundation for more advanced learning, an introductory level program may simply focus on breadth, enrichment or general knowledge.

Intermediate

Intermediate level programming builds upon the learners’ foundational knowledge in a content area. Programming at the intermediate level includes more depth than that which is associated with a beginning level program. The program of instruction can build on the learners’ familiarity with the literature and/or experience. Programming can help the learner understand applications and limitations of theories and applied skill sets. Intermediate level programming may also focus on an integration of skills. This programming could also serve as a refresher course for individuals who have background in a content area and are interested in learning more contemporary applications.

Advanced

CE program content at an advanced level builds upon established experience, knowledge and skills in the content area. This may include more diverse applications to specific populations or a novel application of the skill presented. Advanced level programming allows learners to refine their knowledge and skills in a content area and learn to effectively utilize them across challenging contexts. The content and instructional flow is consistent with the needs or a learner who has knowledge, experience, and skills in the content area. Advanced level programming tends to be more specialized in nature and allows the learner to integrate and enhance knowledge and skills into their practice or other professional domains.

*Stages of compilation.* Program Construction. BBC.

[Stages of compilation - Program construction - Eduqas - GCSE Computer Science Revision - Eduqas - BBC Bitesize](https://www.bbc.co.uk/bitesize/guides/zmthsrd/revision/3#:~:text=Stages%20of%20compilation.%20There%20are%20six%20stages%20of,construction.%20syntax%20analysis.%20semantic%20analysis.%20code%20generation.%20optimisation.)

*Levels of programming.* American Psychological Association.

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