# IT Entrepreneurship and Management

## Day 5 Software Implementation

**Source code with readability and understandability**

**Charoen Vongchumyen**

**Email : charoen.vo@kmitl.ac.th**

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**Thank to Tsuneo Yamaura**

# Software Implementation

- Implementation phase (Coding Phase)
  - The process to convert the detailed design to source code
    - → Do no change the contents of the detailed design.

Understand by human being → Understand by Machine

| Func. Spec. | Design | Coding Debug | Test | Maintenance |
|---|---|---|---|---|

# Software Implementation

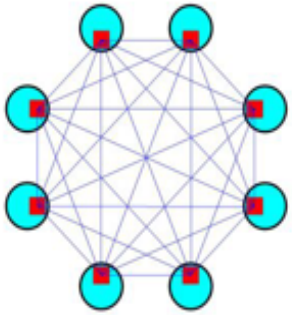
- Implementation phase ( Coding phase )
  - Theoretically, coding by a single person is ideal.

    → A single person will be able to code 20KLOC/Person-year

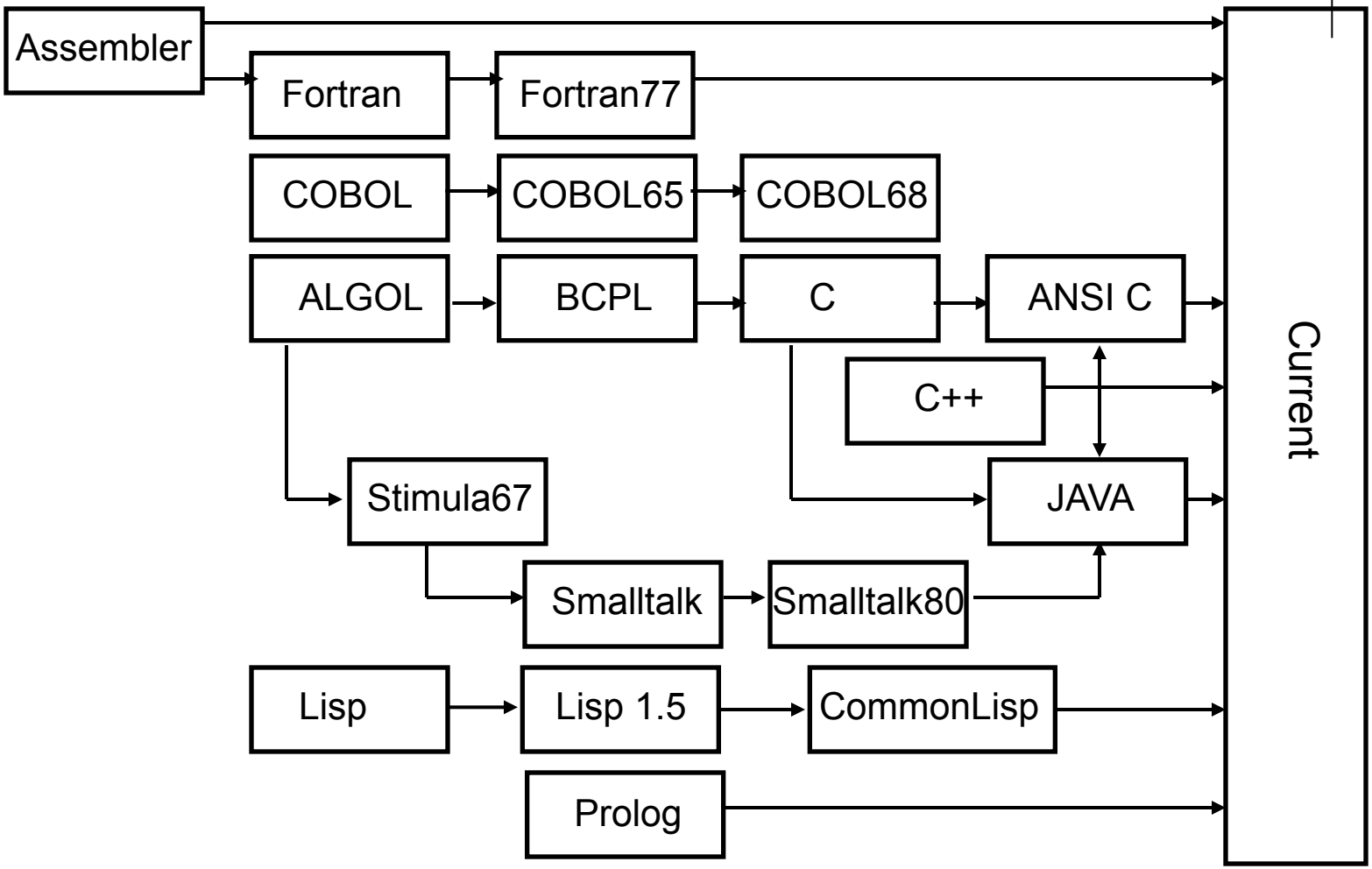
    → In a project, his coding will be reduce to 10KLOC/person-year due to overhead including communication among members.

Ideal prj

Communication
Path = n(n-1)/2



# History of programming language



# Programming manner (guide lines)

- The basic rules and styles for better coding like dining manners.
  (1) Easy to understand by the person who wrote the code.
    - When coding, easy to write and read.
    - When coding, not to make bugs.
    - When debugging, easy to detect bugs in the code.

# Programming manner (guide lines)

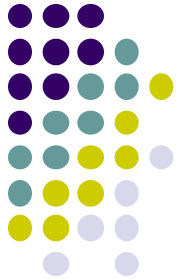
- The basic rules and styles for better coding like dining manners.

(2) Easy to understand by others

- When maintaining (by others), easy to pinpoint the code that should be changed.

  (Most likely, the person who maintains the code is not the person developed the source)

# Basic ideas of programming style



- Four basic rules for better understanding

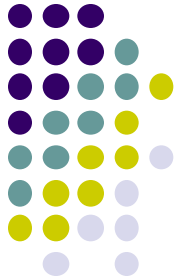
  (1) KISS (Keep It Simple and Stupid) coding.

  (2) Use a simple control structure.

  (3) Coding that does not target a particular language.

  (4) Add comments for better understandability

# Basic ideas of programming style



(4) Add comments for better understandability

- As a header, add comments that describe:
  - Function of the module
  - Input data
  - Output data
- If you use complex algorithm, use formula and charts for better understanding.

# Structured programming

- Basic of the programming style
- The most famous and used programming methods.
- History of ‘Structured programming’
  - (1) 1966 : Mathematical Theory
  - (2) 1968 : Letter from Dijkstra
  - (3) 1974 : Paper by Knuth

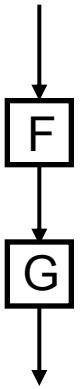
# Structured programming

- History of the Structured Programming

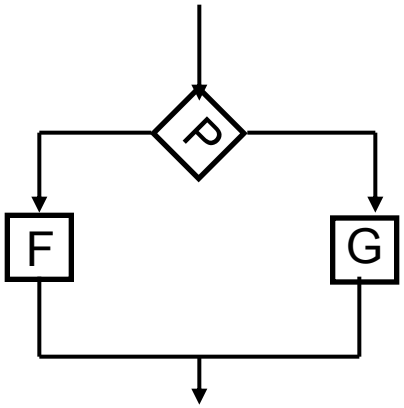
  (1) 1966 : Mathematical Theory (by Barry Boehem)

  → All the programs can be described with Concatenation, Selection and Iteration.

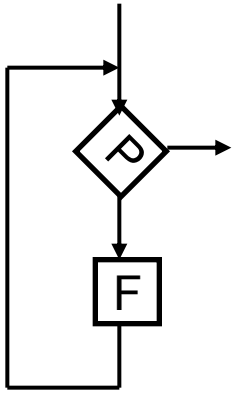
# Structured programming




Concatenation
F follow by G




Selection
If P, then F else G

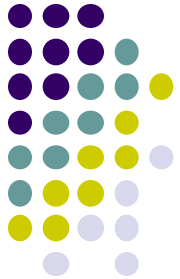



Iteration
While P do F

# Structured programming

- Forty years ago, COBOL, Fortran and assembler were the major computer languages, which provided unconditional GOTO statement (they only had GOTO statement)
- The mathematical theory of programming without GOTO statement did not draw attention of computer engineers and scientists

# History of the Structured programming



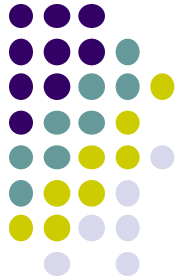
(2) 1968 : A letter from Dijkstra to ACM (Association for Computing Machinery )

'GOTO statement considered harmful'

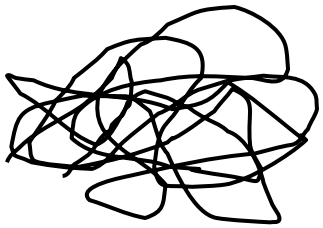
- Forty year ago, There were no computer language that provided Concatenation, Selection and Iteration.

→ Structured COBOL and Fortran came to use long afterword.

# History of the Structured programming



- There was a heating argument if ‘GOTO statement considered harmful’ was true or not.
- Some people said ‘We cannot program without GOTO statement’



GOTO statement increases spaghetti structure?

# History of the Structured programming

(3) 1974 : A paper written by Knuth completed the argument.

- 'Structured programming is not 'Programming without GOTO statement', but is programming of easy to write and understand.
- The GOTO statement may make the programming structure simple (for ex. Error handlings)
- The argument came to conclusion, and cooled down.

# History of the Structured programming

(4) 1974 : A paper written by Knuth completed the argument.

- ‘Structured programming is the one that does not use GOTO statement if possible.
- Structured programming is the one that is easy to write and understand.
- The GOTO statement should be limited only for error handling, and should be ‘Forward GOTO’
  - When you enter a house, use doors not windows.
  - In the case of fire, evacuate from the nearby window.

# History of the Structured programming

- The definition of Structured programming

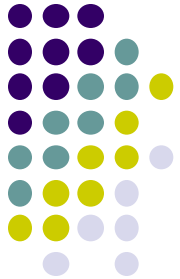
The source code is called Structured programming if

(1) The code only has concatenation, selection and iteration.

(2) Each module has only a single entry and exit.

The modern Structured programming has on more structure : ‘Call’

# Programming style guide lines



1. Variable names
   - Easy and simple to understand for Developer and the person who maintains the code.
   - Use English names : English is a universal for SW engineers.

# Basic rules of naming variables

AVERAGE_FREQ

FREQUENCY_MAXIMUM_01 → Do not use number

MINIMUM_FRQNCY

MIN_FR → Do not change orders

FRQNCY_TOTL

↓ Different var should use clearly different names

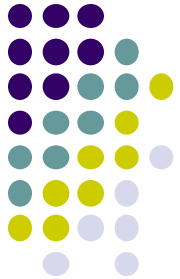
FREQ

FREQUENCY

FRQNCY

Use same word

# Programming style guide lines



- ‘Self-documenting coding’ is very detailed descripting naming, That does not require comments, For ex.

  AVERAGE_POINTS_OF_MATH_IN_CLASS_2-A

  (1) Advantages
  - You can understand the meaning without reading documents.
  - Looks like source code is written with natural language.

# Programming style guide lines

- Naming variables : self-documenting code??

  AVERAGE_POINTS_OF_MATH_IN_CLASS_2-A

  (1) Disadvantages
  - You have to be an expert programmer to come out sophisticated self-documenting code.
  - All the variable names cannot be sophisticated like that
  - The names are too long.
  - Too much depend on self-documenting code, Not be encouraged to write actual documents. (Bad maintainability)

# Programming style guide lines

2. Prologue comments
   - Programmers do not read source code to understand the function.
   - For easier understanding, Write following comments as a module header:
     - Module name
     - Brief description of module functions
     - Name of programmer, make date
     - Variable names, Formats and usage
     - Callers and callees
     - Error handling
     - Change history

**Keep update the comments!**

# Programming style guide lines

3. Maintenance comments

- When source code is changed (due to error correction or maintenance), add comments that describe the change

Source code

```
If item 01 > 100
    then
       price05 = 200
    else
       price05 = 300   #0123
End
```

change information #0123

- Why changed (if error describe the bug)
- Who changed and when
- Code before change
- Code after changed
- Test items

# Programming style guide lines

## 4. Indentation

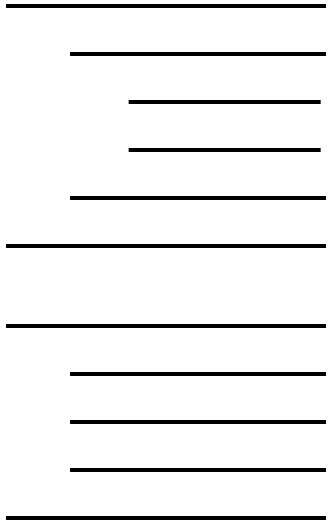
- Indentation is  a powerful method for better readability.
- Basic rules for indentation are:

  (1) Write one statement in a single line.

  (2) Give same spacing to the same level.

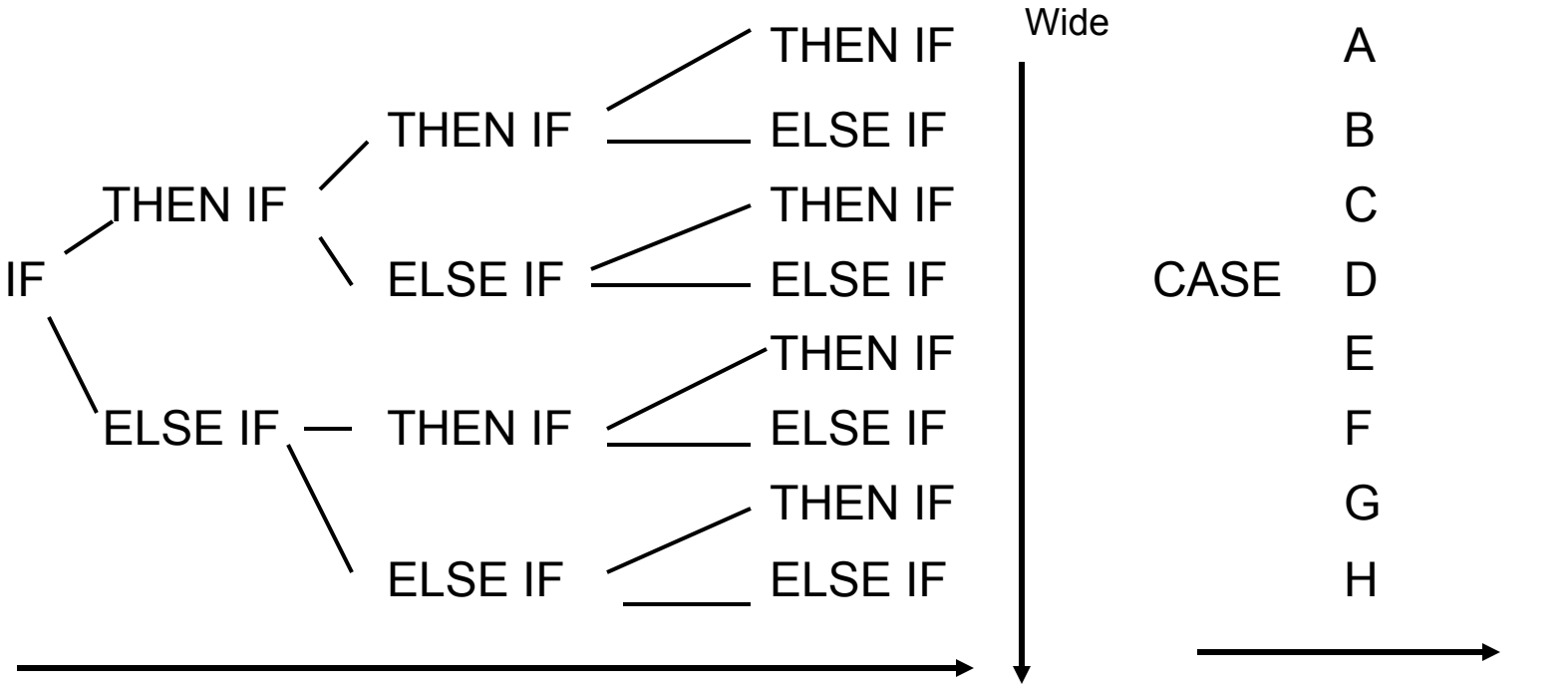
  (3) Use a text editor for automatic indentation.

  (4) Use a blank line for separation blocks.



# Programming style guide lines

## 5. Nesting of IF statement




Nesting is too deep, Not > 4 levels

Nesting is not deep

# Programming style guide lines

## 6. Coding standards

- Coding standards are the rules that are applies to all the projects, eg. LOC of each module < 50
- The enforcement of standards will brings better readability.
- If applied too strict, you may have disadvantages
  - Needs time to learn the standards and check the code
  - Programmer unintentionally follow the standard.
  - So just guide line not law.