



# Prolog

報告者: 陳兆炫



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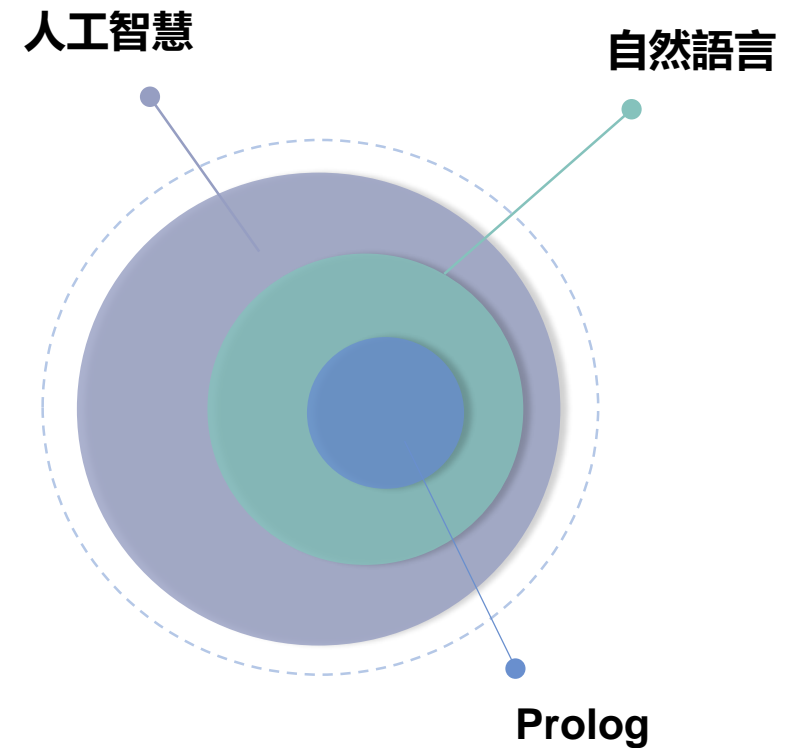
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以範例實際執行程式

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## What's the Prolog ?

- Programming in Logic 的縮寫
- 邏輯程式語言
- 廣泛應用於人工智慧領域
- 建造專家系統



## Prolog 的特性

- 基於謂詞邏輯理論的程式
- If ... else ...
- and、or、not ...
- >、<、= ...

Sentence	→	AtomicSentence   Sentence Connective Sentence   $\neg$ Sentence   (Sentence)   Quantifier Variable, ... Sentence
AtomicSentence	→	Predicate(Term,...)   Term=Term
Term	→	Function(Term,...)   Constant   Variable
Connective	→	$\rightarrow$   $\wedge$   $\vee$   $\leftrightarrow$
Quantifier	→	$\forall$   $\exists$
Constant	→	X   John   ...
Variable	→	a   x   s   ...
Predicate	→	HasColour   Before   Raining   ...
Function	→	Mother   LeftLegOf   ...

## Prolog 的特性

- 根據已知事實(fact)與規則(rule)推論出新的事實
  - 事實：今天太陽很大
  - 規則：假如今天下雨我就會帶傘
  - 推理：今天沒有帶傘



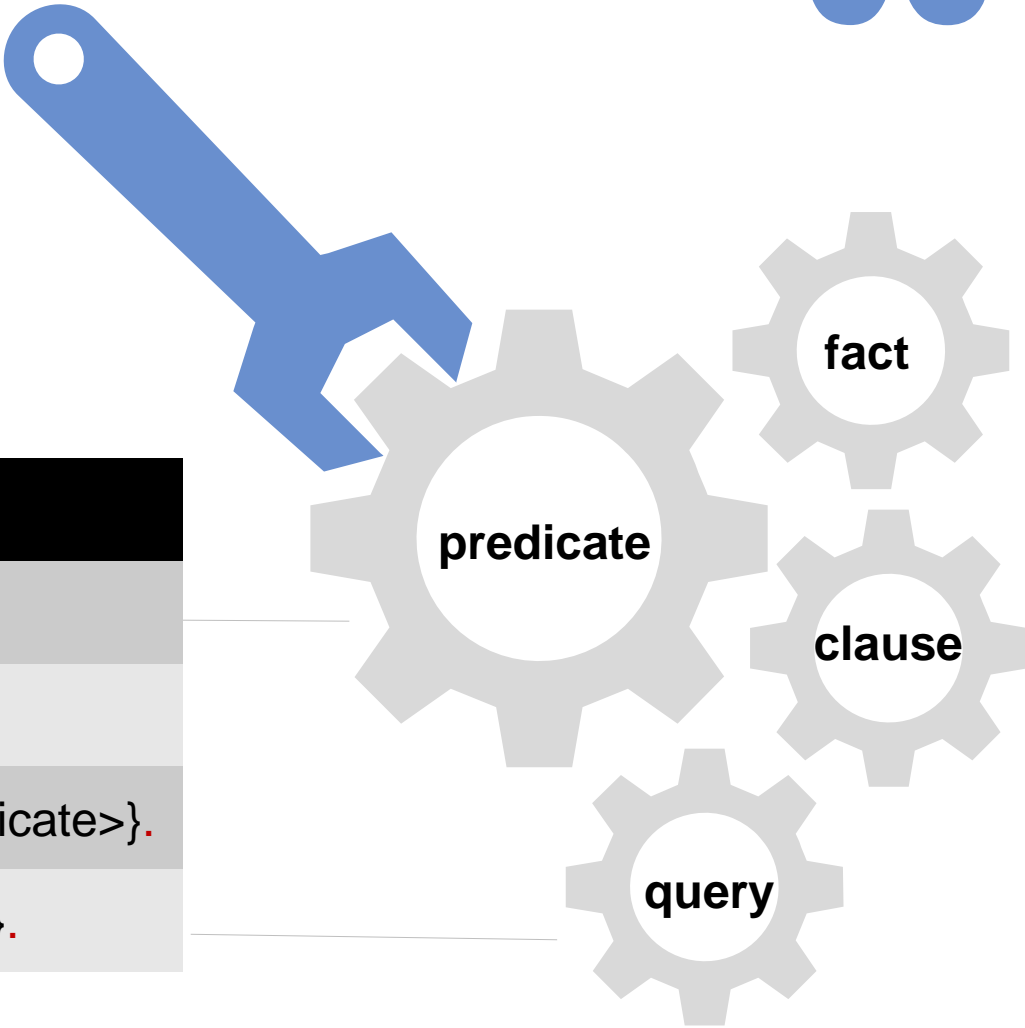
## fact

- <predicate>.
- 表示 true

## clause

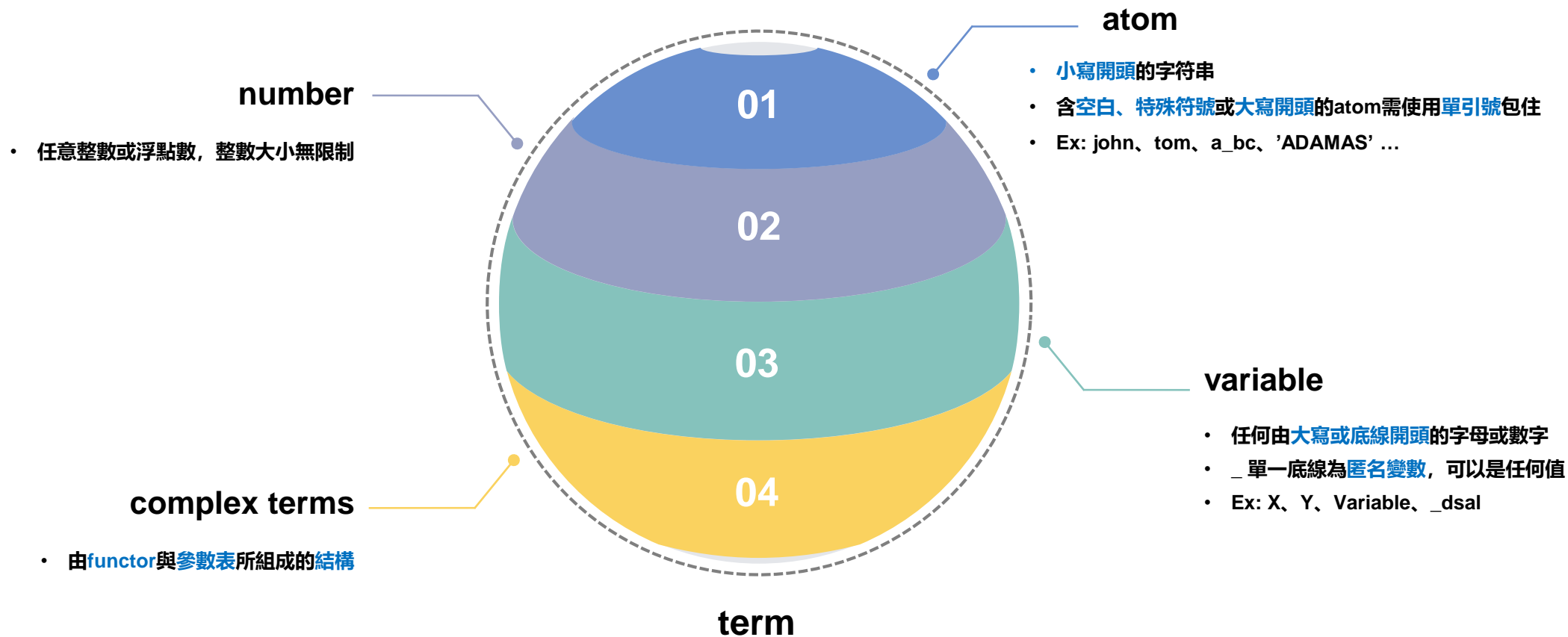
- 可以是多個 <predicate>
- 「, 」表示 and
- 「;」表示 or

Type	BNF
predicate	<predicate> ::= <P>(<ARGS>)
fact	<fact> ::= <predicate>.
clause	<clause> ::= <predicate> :- <predicate> {(,   ;) <predicate>}.
query	<query> ::= ?- <predicate> {(,   ;) <predicate>}.



# 基本語法

## 03



## 基本語法 - compound term

- 一個由functor與參數表組成的結構。
- Ex: 'Student'('ChenZhaoXuan', '1105410022', 'NPU')

Type	BNF
predicate	<predicate> ::= <P>(<ARGS>)

- <P> as functor , predicate 本身就是 compound term
- 操作:
  - `arg(N, Term, Arg).`
  - `functor(Term, Functor, NumberOfArgs).`
  - `=..`



# 基本語法 - compound term

- **arg(N, Term, Arg):**

對compound term的第N個參數進行操作。

- **functor(Term, Functor, NumberOfArgs):**

獲取 compound term 的名稱與參數數量,  
或建構一個具特定名稱且擁有特定數目個  
自由變數的 compound term。

- **=.. : 建構或解構一個 compound term。**

```
SWI-Prolog -- c:/Users/KAO/Desktop/Prolog_data/example/Demo.pl
File Edit Settings Run Debug Help
Welcome to SWI-Prolog (threaded, 64 bits, version 7.6.4)
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.
Please run ?- license. for legal details.

For online help and background, visit http://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- arg(1, 'Student'('ChenZhaoXuan', '1105410022', 'NPU'), X).
X = 'ChenZhaoXuan'.

?- arg(2, 'Student'('ChenZhaoXuan', X, 'NPU'), 1105410022).
X = 1105410022.

?- functor('Student'('ChenZhaoXuan', X, 'NPU'), Name, Variable).
Name = 'Student',
Variable = 3.

?- functor(X, 'Student', 3).
X = 'Student'(_3214, _3216, _3218).

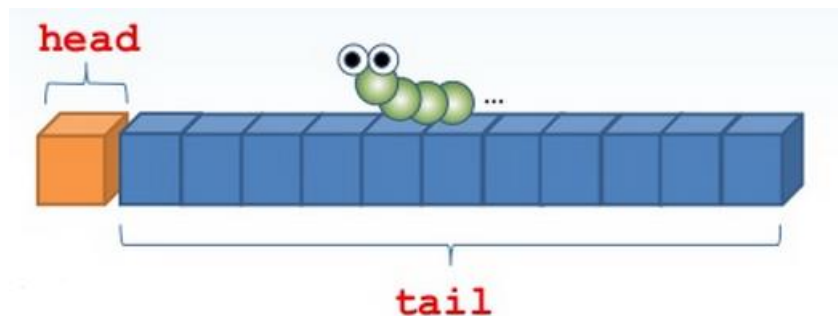
?- 'Student'('ChenZhaoXuan', X, 'NPU') =.. X.
X = ['Student', 'ChenZhaoXuan', X, 'NPU'].

?- X = ['Student', 'ChenZhaoXuan', X, 'NPU'].
X = ['Student', 'ChenZhaoXuan', X, 'NPU'].

?-
```

# 基本語法 - compound term

- 列表list
  - 由 head(元素) 和 Tail(清單) 組成



- 一個空的list 寫作 [ ]
- [a, b, c, d]
- list的操作:
  - member
  - append
  - reverse
- String字串: 一個整數的list (對應ASCII/UTF-8 code)  
Ex: "KuoE0" 相當 [75, 117, 111, 69, 48]

```

SWI-Prolog -- c:/Users/KAO/Desktop/Prolog_data/example/Demo.pl
File Edit Settings Run Debug Help
Welcome to SWI-Prolog (threaded, 64 bits, version 7.6.4)
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For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- [Head|Tail] = [1, 2, 3, 4, 5].
Head = 1,
Tail = [2, 3, 4, 5].

?- [X, Y|Z] = [1, 2, 3, 4, 5].
X = 1,
Y = 2,
Z = [3, 4, 5].

?- [A, B, _, C, D|E] = [1, 2, 3, 4, 5].
A = 1,
B = 2,
C = 4,
D = 5,
E = [].

?- member(3, [1, 2, 3, 4, 5]).
true.

?- append([1, 2, 3], [4, 5, 6], X).
X = [1, 2, 3, 4, 5, 6].

?- reverse([1, 2, 3, 4], Result).
Result = [4, 3, 2, 1].

?-
  
```



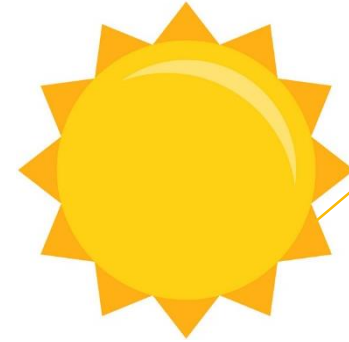
## Demo example

以範例實際執行程式

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# Demo example1

today:



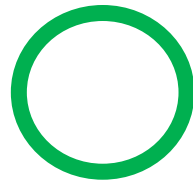
fact

rule

如果今天下雨我就會帶傘



take umbrella:



inference



## Demo example2

fact: Minato 是 Naruto 的爸爸  
Naruto 是 Boruto 的爸爸  
Naruto 是 Himawari 的爸爸  
Hinata 是 Boruto 的媽媽  
Hinata 是 Himawari 的媽媽  
Boruto 是 Himawari 的哥哥  
Himawari 是 Boruto 的妹妹

rule: 如果 A 是 B 的爸爸則 A 是 B 的父母  
如果 A 是 B 的媽媽則 A 是 B 的父母

如果 A 是 B 的哥哥或 A 是 B 的妹妹  
或 B 是 A 的哥哥或 B 是 A 的妹妹  
則是 A B 是兄妹

如果 A 是 B 的爸爸且 B 是 C 的爸爸則 A 是 C 的爺爺



Minato

父子



Naruto



Hinata

夫妻



Boruto



Himawari

兄妹



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# Thanks.



Prolog 語言介紹與基礎理論實作

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