嵌入式技术

函数式程序设计

邢超

<EC.1>

1 函数式语言介绍

命令式语言 imperative language

- 结果与运算次序有关
- 副作用 side effect

```
int a;
int f(int x){
a=x;
return x;
}
int main(int argc, char ** argv){
f(0);
f(1);
return 0;
}
```

<EC.2>

函数式语言

- immutable data
- Pure function
- First class function
- Recursion

<EC.3>

Tail Recursion

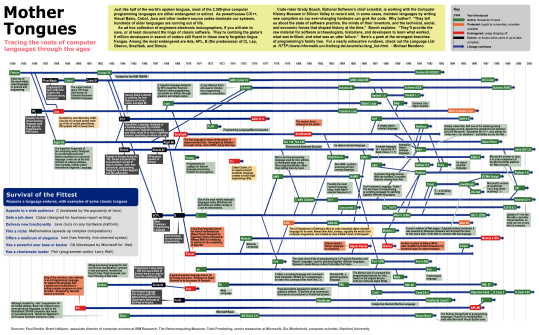
```
#include <sys/time.h>
#include <stdio.h>
#include <stdlib.h>

long long fib0(long long n, long long
    fib_n){
  if(n>2) return fib0(n-1)+fib0(n-2);
  else return 1;
}

long long fib(long long n, long long
   N,
              long long fib_ns1, long
                  long fib_n){
  if(n<N) return fib(n+1,N,fib_n,
      fib_ns1+fib_n);
  else return fib_n;
}
int main(int argc, char **argv){
   fib0(atoi(argv[1]));
   fib(2,atoi(argv[1]),1,1);
return 0;
}
```

<EC.4>

函数式语言列表



<EC.5>

2 Lisp

3 Scheme

4 Ocaml

curry

```
# let rec fact n = if n<2 then 1 else
    n*fact(n-1) ;;
val fact : int -> int = <fun>
# fact 8 ;;
- : int = 40320
# let next x = x+1;;
val next : int -> int = <fun>
```

```
# let compose f g x = f(g(x));;
val compose : ('a -> 'b) -> ('c -> 'a
    ) -> 'c -> 'b = <fun>
# let weird = compose fact next;;
val weird : int -> int = <fun>
# weird 7;;
- : int = 40320
# compose fact next 7;;
- : int = 40320
```

<EC.6>

pattern matching

```
$ ledit ocaml
        Objective Caml version 3.06
# let rec sum lst =
    match lst with
      [] -> 0
    | head :: tail -> head + sum tail
        ;;
val sum : int list -> int = <fun>
# sum [ 1; 2; 3 ] ;;
- : int = 6
```

<EC.7>

List

```
# List.map ((+) 2)  [1 ; 2 ; 3];;
- : int list = [3; 4; 5]
# List.fold_left (+) 0 [1 ;2; 3] /
    3;;
- : int = 2
# List.filter ((>) 5) [1;2;9;10];;
- : int list = [1; 2]

let rec fold_right f a lst = match
    lst with
  | [] -> a
  | x :: xs -> f x (fold_right f a xs
      );;
(* fold_right f 0 [1;2;3] = f 1 (f 2
    (f 3 0)) *)
let rec fold_left f a lst = match lst
     with
  | [] -> a
  | x :: xs -> fold_left f (f a x) xs
(* fold_left f 0 [1;2;3] = f (f (f 0
    1) 2) 3 *)
```

<EC.8>

5 Haskell

6 思考

思考

- 常见的函数式程序设计语言有哪些？特点是什么？
- 如何利用函数式语言的优点更好地设计 C/C++ 程序？

<EC.9>