CS480

Compilers
Semantic Actions One

March 20, 2009

Less Code, More Design

Design

- Manage attributes
  - synthesized/inherited

- Quad File Generation
  - back patch

- Semantic Error Checking

Source to Quad

```
int a;

int b(c,d)
int c,d;
{
   int h,i;
}


int e()
{
}


main()
{
   int f;
   int g[5];
}
```
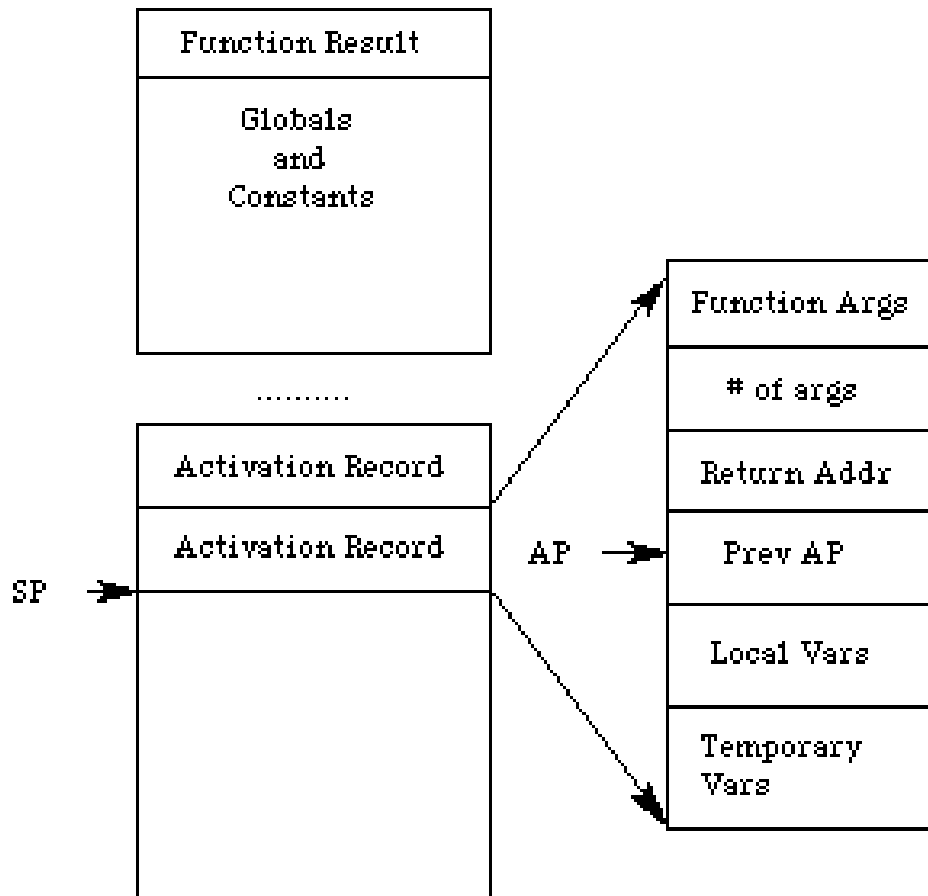
```
Quad File
---------

1 27 0      0 0      0 0      0
2 22 0      3 0      0 0      0
2 23 0      0 0      0 0      0
2 22 0      0 0      0 0      0
2 23 0      0 0      0 0      0
2 22 0      7 0      0 0      0
2 23 0      0 0      0 0      0
1 28 0      0 0      0 0      0
3
0
0
5
```

	Runtime Stack
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

Activation Record

Function Result
Globals and Constants

....

Activation Record
Activation Record

SP →

AP →

Function Args
# of args
Return Addr
Prev AP
Local Vars
Temporary Vars

```
int b(c,d)
int c,d;
{
    int h,i;
}


main()
{
    int f;
    int g[5];
}
```

Symbol Table

```
int a;

int b(c,d)
int c,d;
{
   int h,i;
}
```

Deleting a level - ST before leaving function b:

```
     S Y M B O L    T A B L E
Identifier   Level       Type       Address           Other
----------------------------------------------------------------
         a     1          1            1                 -1
         b     1          5            1                  2
         c     2          1           -3                 -1
         d     2          1           -4                 -1
      else     0          0            4                 -1
       for     0          0            6                 -1
         h     2          1            1                 -1
         i     2          1            2                 -1
        if     0          0            3                 -1
     input     0          0            7                 -1
       int     0          0            2                 -1
      main     0          0            1                 -1
    output     0          0            8                 -1
    return     0          0            5                 -1
```

Quads

OpCode	Instruction	Operands			Functionality
20	load parameter	op1			push op1 on runtime stack
21	function call	op1		label	op1 = # of parameters already pushed push op1 push PC push AP AP <- SP PC <- label
22	function begin	op1			op1 = size of local data area SP = SP + op1
23	function return				pop activation record off stack and update AP, SP, and PC. Also, put function result in location 0.