Day17.C

Structure (1)
Defintions

Young W. Lim

December 9, 2017

0.1 Structure Definitions and Usages

```
::::::::::::::
h0.c
::::::::::::::
#include <stdio.h>

struct aaa {
  int a;
  int b;
};

struct bbb {
  double a;
  double b;
};

void pr_aaa( struct aaa X, char * s) {
  printf("------------------\n");
  printf("%s.a= %d \n", s, X.a);
  printf("%s.b= %d \n", s, X.b);
}

void pr_bbb( struct bbb X, char * s) {
  printf("------------------\n");
  printf("%s.a= %g \n", s, X.a);
  printf("%s.b= %g \n", s, X.b);
}



int main(void) {

/***
  struct bbb {
    double a;
    double b;
  };
***/

  struct aaa A = { 100,  200  };
  struct bbb B = { 11.1, 22.2 };
  struct bbb C;

  C = B;


  pr_aaa( A, "A");
  pr_bbb( B, "B");
  pr_bbb( C, "C");
```

```
}
```

```
::::::::::::::
h0.out
::::::::::::::
------------------
A.a= 100
A.b= 200
------------------
B.a= 11.1
B.b= 22.2
------------------
C.a= 11.1
C.b= 22.2
```

```
::::::::::::::
error
::::::::::::::
h0.c:21:21: warning: struct bbb declared inside parameter list
 void pr_bbb( struct bbb X, char * s) {
                     ^
h0.c:21:21: warning: its scope is only this definition or declaration, which is probably n
h0.c:21:25: error: parameter 1 (X) has incomplete type
 void pr_bbb( struct bbb X, char * s) {
                         ^
```

structure definition points

- if `struct bbb` is defined in the main function
- other functions do not see its definition

```
::::::::::::::
h1.c
::::::::::::::
#include <stdio.h>

struct aaa {
  int a;
  int b;
};

struct bbb {
  double a;
```

```
  double b;
};

typedef struct aaa AType;
typedef struct bbb BType;

// void pr_aaa( struct aaa X, char * s) {
void pr_aaa( AType X, char * s) {
  printf("------------------\n");
  printf("%s.a= %d \n", s, X.a);
  printf("%s.b= %d \n", s, X.b);
}

// void pr_bbb( struct bbb X, char * s) {
void pr_bbb( BType X, char * s) {
  printf("------------------\n");
  printf("%s.a= %g \n", s, X.a);
  printf("%s.b= %g \n", s, X.b);
}



int main(void) {

/***
  struct bbb {
    double a;
    double b;
  };
***/

/***
  struct aaa A = { 100,  200  };
  struct bbb B = { 11.1, 22.2 };
  struct bbb C;
***/

  AType A = { 100,  200  };
  BType B = { 11.1, 22.2 };
  BType C;

  C = B;


  pr_aaa( A, "A");
  pr_bbb( B, "B");
  pr_bbb( C, "C");


}
```

```
::::::::::::::
h1.out
::::::::::::::
------------------
A.a= 100
A.b= 200
------------------
B.a= 11.1
B.b= 22.2
------------------
C.a= 11.1
C.b= 22.2
```

using typedef

- replace `struct aaa` with `AType`
- replace `struct bbb` with `BType`

```
::::::::::::::
h2.c
::::::::::::::
#include <stdio.h>


struct bbb {
  double a;
  double b;
};


void pr_bbb( struct bbb X, char * s) {
  printf("------------------\n");
  printf("%s.a= %g \n", s, X.a);
  printf("%s.b= %g \n", s, X.b);
}

//----------------------------------------
// Z1 = a + bi
// Z2 = c + di
// Z1 + Z2 = (a+c) + (b+d)i
// Z1 - Z2 = (a-c) + (b-d)i
//
// Z1 * Z2 = (ac-bd) + (bc+ad)i
// Z1 / Z2 = {(ac+bd)/(c^2+d^2)}
//         + {(bc-ad)/(c^2+d^2)}i
//----------------------------------------
```

```
struct bbb ADD_bbb( struct bbb X, struct bbb Y) {
  struct bbb S;

  S.a = X.a + Y.a;
  S.b = X.b + Y.b;
  return(S);
}

struct bbb SUB_bbb( struct bbb X, struct bbb Y) {
  struct bbb S;

  S.a = X.a - Y.a;
  S.b = X.b - Y.b;
  return(S);
}

struct bbb MUL_bbb( struct bbb X, struct bbb Y) {
  struct bbb S = {0., 0.};

  S.a = X.a*Y.a - X.b*Y.b;
  S.b = X.b*Y.a + X.a*Y.b;

  return(S);
}

struct bbb DIV_bbb( struct bbb X, struct bbb Y) {
  struct bbb S = {0., 0.};
  double denom = Y.a*Y.a + Y.b*Y.b;

  S.a = X.a*Y.a + X.b*Y.b;
  S.b = X.b*Y.a - X.a*Y.b;

  S.a /= denom;
  S.b /= denom;

  return(S);
}


int main(void) {

  struct bbb B = { 11.1, 22.2 };
  struct bbb C;

  C = B;


  pr_bbb( B, "B");
  pr_bbb( C, "C");
```

```
  printf("\nADD_bbb( B, C )============\n\n");
  pr_bbb( B, "B");
  pr_bbb( C, "C");
  C = ADD_bbb( B, C );
  pr_bbb( C, "C");

  printf("\nSUB_bbb( B, C )============\n\n");
  pr_bbb( B, "B");
  pr_bbb( C, "C");
  C = SUB_bbb( B, C );
  pr_bbb( C, "C");

  printf("\nMUL_bbb( B, C )============\n\n");
  pr_bbb( B, "B");
  pr_bbb( C, "C");
  C = MUL_bbb( B, C );
  pr_bbb( C, "C");

  printf("\nDIV_bbb( B, C )============\n\n");
  pr_bbb( B, "B");
  pr_bbb( C, "C");
  C = DIV_bbb( B, C );
  pr_bbb( C, "C");


}

:::::::::::::::
h2.out
:::::::::::::::
------------------
A.a= 100
A.b= 200
------------------
B.a= 11.1
B.b= 22.2
------------------
C.a= 11.1
C.b= 22.2

ADD_bbb( B, C )============

------------------
B.a= 11.1
B.b= 22.2
------------------
C.a= 11.1
C.b= 22.2
------------------
```

```
C.a= 22.2
C.b= 44.4

SUB_bbb( B, C )============

------------------
B.a= 11.1
B.b= 22.2
------------------
C.a= 22.2
C.b= 44.4
------------------
C.a= -11.1
C.b= -22.2

MUL_bbb( B, C )============

------------------
B.a= 11.1
B.b= 22.2
------------------
C.a= -11.1
C.b= -22.2
------------------
C.a= 369.63
C.b= -492.84

DIV_bbb( B, C )============

------------------
B.a= 11.1
B.b= 22.2
------------------
C.a= 369.63
C.b= -492.84
------------------
C.a= -0.018018
C.b= 0.036036
```