Structures (1B)

p1.c

```
#include <stdio.h>

struct aaa {
  int i;
  double x;
} ;


int main(void) {
  double     x = 3.14;
  int        i = 1000;
  struct aaa b;
  struct aaa c;

  b.x = 3.14;
  b.i = 1000;

  c.x = 2.18;
  c.i = 2000;


  printf("x= %f \n", x);
  printf("i= %d \n", i);
  printf("b.x= %f \n", b.x);
  printf("b.i= %d \n", b.i);
  printf("c.x= %f \n", c.x);
  printf("c.i= %d \n", c.i);

  printf("sizeof(b.x)=%ld \n", sizeof(b.x));
  printf("sizeof(b.i)=%ld \n", sizeof(b.i));
  printf("sizeof(b) = %ld \n", sizeof(b));

  printf("&b.x=%p \n", &b.x);
  printf("&b.i=%p \n", &b.i);

 }
```

p2.c

```
#include <stdio.h>
struct aaa { double x; int i; } ;

double Sum( struct aaa A)      { return (A.i + A.x); }
double Sum2( int m, double a ) { return (m + a); }
double Sum3( struct aaa *P )   { return ((*P).i + (*P).x); }
double Sum4( struct aaa *P )   { double tmp = ((*P).i + (*P).x);
 (*P).i *= 2; (*P).x *= 2; return tmp; }

int main(void) {
  struct aaa S;  S.i = 100;    S.x = 3.1;

  printf("S.i=%d \n", S.i);
  printf("S.x=%f \n", S.x);
  printf("Sum(S)        = %f \n", Sum( S ) );
  printf("Sum2(S.i,S.x) = %f \n", Sum2(S.i, S.x) );
  printf("Sum3( &S )    = %f \n", Sum3( &S ) );
  printf("Sum4( &S )    = %f \n", Sum4( &S ) );
  printf("S.i=%d \n", S.i);
  printf("S.x=%f \n", S.x);
}
```

p3.c

```
#include <stdio.h>
struct aaa { double x; int i; } ;

double Sum( struct aaa A)      { return (A.i + A.x); }
double Sum2( int m, double a ) { return (m + a); }
double Sum3( struct aaa *P )   { return ((*P).i + (*P).x); }
double Sum4( struct aaa *P )   { double tmp = ((*P).i + (*P).x);
 (*P).i *= 2; (*P).x *= 2; return tmp; }

int main(void) {
  struct aaa S;  S.i = 100;    S.x = 3.1;

  printf("S.i=%d \n", S.i);
  printf("S.x=%f \n", S.x);
  printf("Sum(S)        = %f \n", Sum( S ) );
  printf("Sum2(S.i,S.x) = %f \n", Sum2(S.i, S.x) );
  printf("Sum3( &S )    = %f \n", Sum3( &S ) );
  printf("Sum4( &S )    = %f \n", Sum4( &S ) );
  printf("S.i=%d \n", S.i);
  printf("S.x=%f \n", S.x);
}
```

p3.c

```
#include <stdio.h>

int main(void) {

  // method 1
  struct aaa { int i; double x; } ;
  struct aaa a_var;

  // method 2
  struct bbb { int i; double x; } b_var;

  // method 3
  struct ccc { int i; double x; } ;
  typedef struct ccc ctype ;
  ctype c_var;

  // method 4
  typedef struct ddd { int i; double x; } dtype;
  dtype d_var;

  a_var.i = 11;
  a_var.x = 0.11;

  b_var.i = 22;
  b_var.x = 0.22;

  c_var.i = 33;
  c_var.x = 0.33;

  d_var.i = 44;
  d_var.x = 0.44;

  // all 4 methods gives the same result
  printf("a_var.i = %d \n", a_var.i);
  printf("a_var.x = %f \n", a_var.x);

  printf("b_var.i = %d \n", b_var.i);
  printf("b_var.x = %f \n", b_var.x);

  printf("c_var.i = %d \n", c_var.i);
  printf("c_var.x = %f \n", c_var.x);

  printf("d_var.i = %d \n", d_var.i);
  printf("d_var.x = %f \n", d_var.x);
```

```
}
```

p3.c

```
#include <stdio.h>

struct aaa { int i; double x; } ;

double sum(struct aaa *q) {
  // return (*q).i + (*q).x;
  return q->i + q->x;
}


int main(void) {

  struct aaa a;

  a.i = 11;
  a.x = 0.11;

  printf("a.i = %d \n", a.i);
  printf("a.x = %f \n", a.x);
  printf("sum(a)=%f    \n", sum(&a));

}
```

p3.c

```
#include <stdio.h>

struct srec {
  char * name;
  int    stid;
  int    eng;
  int    math;
  double gpa;
} ;


int main(void) {
  struct srec S = { "John", 2016111, 87, 90 } ;

  printf("sizeof(struct srec)= %ld \n", sizeof(struct srec));
  printf("sizeof(S)= %ld \n", sizeof(S));


  printf("sizeof(S.name)= %ld \n", sizeof(S.name));
  printf("sizeof(S.stid)= %ld \n", sizeof(S.stid));
  printf("sizeof(S.eng )= %ld \n", sizeof(S.eng ));
  printf("sizeof(S.math)= %ld \n", sizeof(S.math));
  printf("sizeof(S.gpa )= %ld \n", sizeof(S.gpa ));


  printf("&S.name=%p S.name= %s\n", &S.name, S.name);
  printf("&S.stid=%p S.stid= %d\n", &S.stid, S.stid);
  printf("&S.eng =%p S.eng = %d\n", &S.eng , S.eng );
  printf("&S.math=%p S.math= %d\n", &S.math, S.math);
  printf("&S.gpa =%p S.gpa = %f\n", &S.gpa , S.gpa );

}
```

p3.c

```
#include <stdio.h>

struct srec {
  char * name;
  int    stid;
  int    eng;
  int    math;
  double gpa;
} ;


int main(void) {
  struct srec S[3] = { { "John", 2016111, 87, 91 } ,
                       { "Mary", 2016112, 77, 93 } ,
                       { "Bill", 2016113, 57, 97 } } ;

  struct srec *p;

  p = S;

  printf("sizeof(struct srec)= %ld \n", sizeof(struct srec));
  printf("sizeof(S)= %ld \n", sizeof(S));
  printf("----------------------------\n");


  printf("&S[0].name=%p S[0].name= %s\n", &S[0].name, S[0].name);
  printf("&S[0].stid=%p S[0].stid= %d\n", &S[0].stid, S[0].stid);
  printf("&S[0].eng =%p S[0].eng = %d\n", &S[0].eng , S[0].eng );
  printf("&S[0].math=%p S[0].math= %d\n", &S[0].math, S[0].math);
  printf("&S[0].gpa =%p S[0].gpa = %f\n", &S[0].gpa , S[0].gpa );
  printf("----------------------------\n");


  printf("&p[1].name=%p p[1].name= %s\n", &p[1].name, p[1].name);
  printf("&p[1].stid=%p p[1].stid= %d\n", &p[1].stid, p[1].stid);
  printf("&p[1].eng =%p p[1].eng = %d\n", &p[1].eng , p[1].eng );
  printf("&p[1].math=%p p[1].math= %d\n", &p[1].math, p[1].math);
  printf("&p[1].gpa =%p p[1].gpa = %f\n", &p[1].gpa , p[1].gpa );
  printf("----------------------------\n");

  printf("&(p+2)->name=%p (p+2)->name= %s\n", &(p+2)->name, (p+2)-
>name);
  printf("&(p+2)->stid=%p (p+2)->stid= %d\n", &(p+2)->stid, (p+2)-
>stid);
```

```
  printf("&(p+2)->eng =%p (p+2)->eng = %d\n", &(p+2)->eng , (p+2)-
>eng );
  printf("&(p+2)->math=%p (p+2)->math= %d\n", &(p+2)->math, (p+2)-
>math);
  printf("&(p+2)->gpa =%p (p+2)->gpa = %f\n", &(p+2)->gpa , (p+2)-
>gpa );
  printf("----------------------------\n");

}
```

p3.c

```
#include <stdio.h>

struct srec {
  char * name;
  int    stid;
  int    eng;
  int    math;
  double gpa;
} ;

double compute_gpa( struct srec R ) {
  return (R.eng + R.math) / 2.0;
}

int main(void) {
  // struct srec S = { "John", 2016111, 87, 91, (87+91)/2.0 } ;
  struct srec S = { "John", 2016111, 87, 91 } ;


  printf("S.name = %s \n", S.name);
  printf("S.stid = %d \n", S.stid);
  printf("S.eng  = %d \n", S.eng );
  printf("S.math = %d \n", S.math);
  printf("S.gpa  = %f \n", S.gpa );

  S.gpa = compute_gpa( S );

  printf("S.gpa  = %f \n", S.gpa );

}
```

p3.c

```
#include <stdio.h>

struct srec {
  char * name;
  int    stid;
  int    eng;
  int    math;
  double gpa;
} ;

struct srec compute_gpa( struct srec R ) {
/*
   struct srec T;
   R.gpa = (R.eng + R.math) / 2.0;
   T = R;
   return T;
*/
   R.gpa = (R.eng + R.math) / 2.0;
   return (R);
}

int main(void) {
  // struct srec S = { "John", 2016111, 87, 91, (87+91)/2.0 } ;
  struct srec S = { "John", 2016111, 87, 91 } ;


  printf("S.name = %s \n", S.name);
  printf("S.stid = %d \n", S.stid);
  printf("S.eng  = %d \n", S.eng );
  printf("S.math = %d \n", S.math);
  printf("S.gpa  = %f \n", S.gpa );

  S = compute_gpa( S );

  printf("S.name = %s \n", S.name);
  printf("S.stid = %d \n", S.stid);
  printf("S.eng  = %d \n", S.eng );
  printf("S.math = %d \n", S.math);
  printf("S.gpa  = %f \n", S.gpa );

}
```

p3.c

```
#include <stdio.h>

struct srec {
  char * name;
  int    stid;
  int    eng;
  int    math;
  double gpa;
} ;

void compute_gpa( struct srec *p ) {
   p->gpa = (p->eng + p->math) / 2.0;
}

int main(void) {
  // struct srec S = { "John", 2016111, 87, 91, (87+91)/2.0 } ;
  struct srec S = { "John", 2016111, 87, 91 } ;


  printf("S.name = %s \n", S.name);
  printf("S.stid = %d \n", S.stid);
  printf("S.eng  = %d \n", S.eng );
  printf("S.math = %d \n", S.math);
  printf("S.gpa  = %f \n", S.gpa );

  compute_gpa( &S );

  printf("S.name = %s \n", S.name);
  printf("S.stid = %d \n", S.stid);
  printf("S.eng  = %d \n", S.eng );
  printf("S.math = %d \n", S.math);
  printf("S.gpa  = %f \n", S.gpa );

}
```

p3.c

```
#include <stdio.h>

struct srec {
  char * name;
  int    stid;
  int    eng;
  int    math;
  double gpa;
} ;

void compute_gpa( struct srec *p ) {
   p->gpa = (p->eng + p->math) / 2.0;
}

int main(void) {
  // struct srec S = { "John", 2016111, 87, 91, (87+91)/2.0 } ;
  struct srec S = { "John", 2016111, 87, 91 } ;


  printf("S.name = %s \n", S.name);
  printf("S.stid = %d \n", S.stid);
  printf("S.eng  = %d \n", S.eng );
  printf("S.math = %d \n", S.math);
  printf("S.gpa  = %f \n", S.gpa );

  compute_gpa( &S );

  printf("S.name = %s \n", S.name);
  printf("S.stid = %d \n", S.stid);
  printf("S.eng  = %d \n", S.eng );
  printf("S.math = %d \n", S.math);
  printf("S.gpa  = %f \n", S.gpa );

}
```

p3.c

p3.c
