Intro a C

Structs

With 💜 by @vichoeq & @KnowYourselves

Clases y Herencia

```python
class Slime(Enemy):
  def __init__(self):
    self.hit_points = 20
    self.attack_dmg = 4

  ...
```

Clases y Herencia

```python
class Slime(Enemy):
  def __init__(self):
    self.hit_points = 20
    self.attack_dmg = 4

  ...
```

struct

struct - Contenedores de variables

```c
struct perro
{
  char* nombre;
  char* raza;
  double edad;
  bool good_boy;
};
```

```python
from collections import namedtuple

perro = namedtuple(
    'nombre',
    'raza',
    'edad',
    'good_boy'
)
```

struct - Sintáxis

```
struct nombre_del_struct
{
  type_1 campo_1;
  type_2 campo_2;
  ...
  type_n campo_n;
};
```

Un *struct* es una tupla de n variables de *tipos* distintos, cada una con su propio nombre.

Cada una de estas variables es un campo del *struct*.

struct - Contenedores de variables

```
struct perro
{
  char* nombre;
  char* raza;
  double edad;
  bool good_boy = true;
};
```

No se pueden definir valores default para los campos

struct y el STACK

struct y el STACK - Inicialización

```c
struct point
{
  double x;
  double y;
};
```

```c
struct point p = {5.12, 2.78};
struct point q = {.x = 5.12, .y = 2.78};
struct point r = {
  .x = 5.12,
  .y = 2.78
};
```

Los campos de un *struct* están contiguos en memoria.

La sintaxis de inicialización es igual que en un arreglo.

Se puede especificar el valor a asignar a cada campo, por nombre.

struct y el STACK - Asignando un literal

```c
struct point p;
p = {.x = 7.18, .y = 2.78};
```

```
$ gcc main.c -o main
error: expected expression before ‘{’ token
```

```c
struct point p;
p = (struct point){.x = 7.18, .y = 2.78};
```

```
$ gcc main.c -o main
$ ./main
```

struct y el STACK - acceso

```c
struct point
{
  double x;
  double y;
};
```

```c
struct point p = {.x = 7.18, .y = 2.52};

if(p.x < 10)
{
  p.y *= 2;
}
```

Para acceder a cada campo se usa un punto.

struct y el STACK - asignación

```c
struct point
{
  double x;
  double y;
};
```

```c
struct point p;

p.x = 7.18;
p.y = 2.52;
```

Podemos asignar el struct campo por campo usando el punto.

struct y typedef

```c
struct point
{
  double x;
  double y;
};

typedef struct point Point;
```

```c
Point A[2];
A[0] = (Point){.x = 1.26, .y = 25.3};
A[1] = (Point){.x = 0.54, .y = 1.55};
```

Podemos utilizar typedef para definir un alias sin *struct*, así nos ahorramos esos preciosos 7 caracteres.

Para los siguientes ejemplos usaremos Point aquí definido.

struct y typedef

```c
typedef struct point
{
  double x;
  double y;
} Point;
```

También podemos usar typedef junto con la definición del struct

Esto es posible ya que el struct entero es un tipo

struct y typedef

```c
typedef struct point
{
  double x;
  double y;
} Point;
```

También podemos usar typedef junto con la definición del struct

Esto es posible ya que el struct entero es un tipo

```
struct*
```

*struct** y el HEAP - Inicialización

```c
Point* a = malloc(sizeof(Point));
*a = (Point){.x = 0.25, .y = 0.56 };
```

Hay que pedir memoria para el *struct* mediante malloc y sizeof.

*struct** - acceso

```c
Point* a = malloc(sizeof(Point));
*a = (Point){.x = 0.25, .y = 0.56 };

if(p->x < 10)
{
  p->y *= 2;
}
```

Para acceder a cada campo se usa la flecha "->".

*struct** - asignación

```c
struct point
{
  double x;
  double y;
};
```

```c
struct point p = malloc(sizeof(Point));

p->x = 7.18;
p->y = 2.52;
```

Podemos asignar el *struct* campo por campo usando la flecha.

struct.struct

struct.struct

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct kid
{
  char* name;
  struct dog dog;
};
```

```c
struct kid matias = {
  .name = "matías",
  .dog = {
    .name = "bruno",
    .age = 3,
    .good_boy = true
  }
};
```

C nos permite definir *struct* que contienen *struct*.

La inicialización de un *struct* dentro de un *struct* es igual.

struct.struct

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct kid
{
  char* name;
  struct dog dog;
};
```

```c
struct kid matias = {
  .name = "matías",
  .dog = {
    .name = "bruno",
    .age = 3,
    .good_boy = true
  }
};
```

struct.struct

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct kid
{
  char* name;
  struct dog dog;
};
```

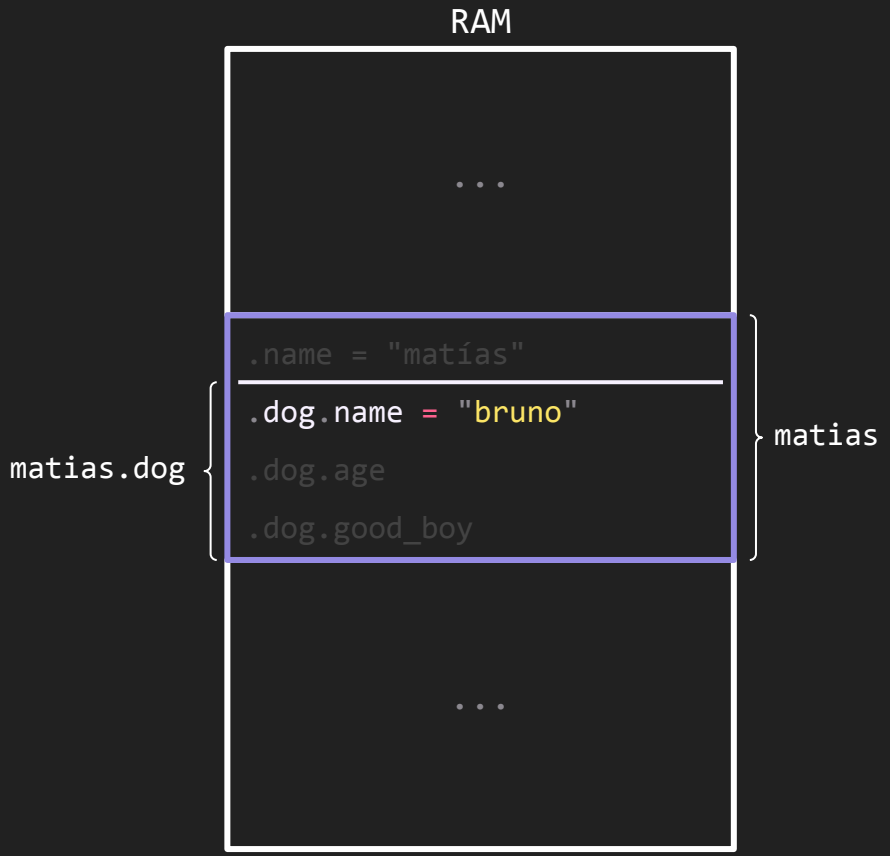
```c
struct kid matias = {
  .name = "matías",
  .dog = {
    .name = "bruno",
    .age = 3,
    .good_boy = true
  }
};
```

struct.struct

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct kid
{
  char* name;
  struct dog dog;
};
```

```c
struct kid matias = {
  .name = "matías",
  .dog = {
    .name = "bruno",
    .age = 3,
    .good_boy = true
  }
};
```

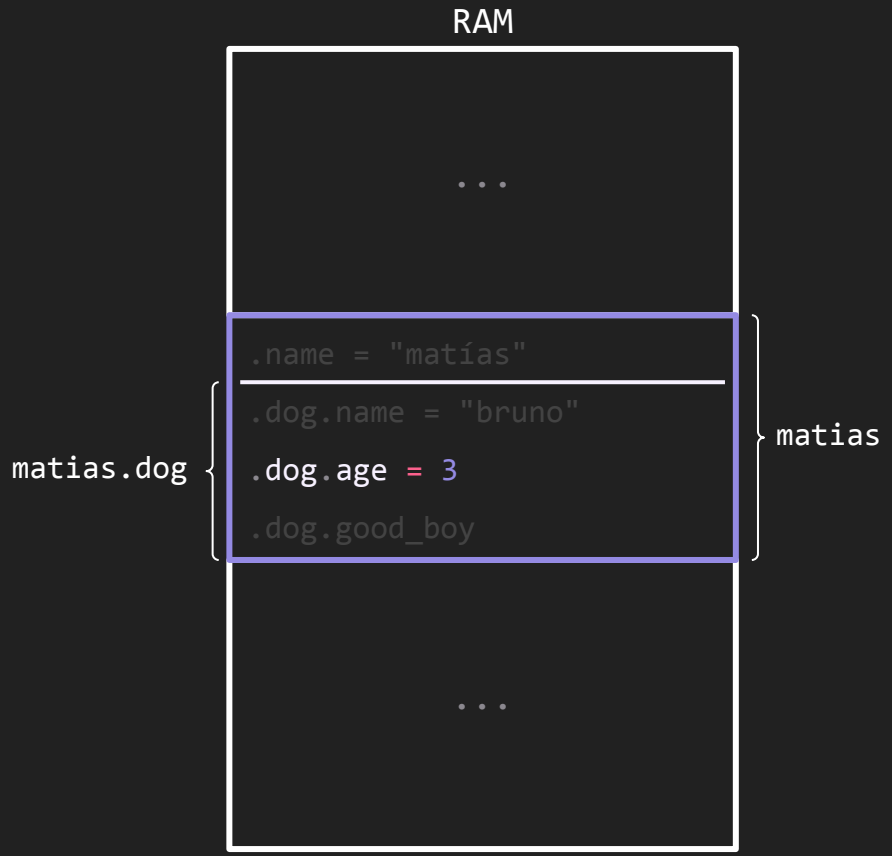


struct.struct

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct kid
{
  char* name;
  struct dog dog;
};
```

```c
struct kid matias = {
  .name = "matías",
  .dog = {
    .name = "bruno",
    .age = 3,
    .good_boy = true
  }
};
```

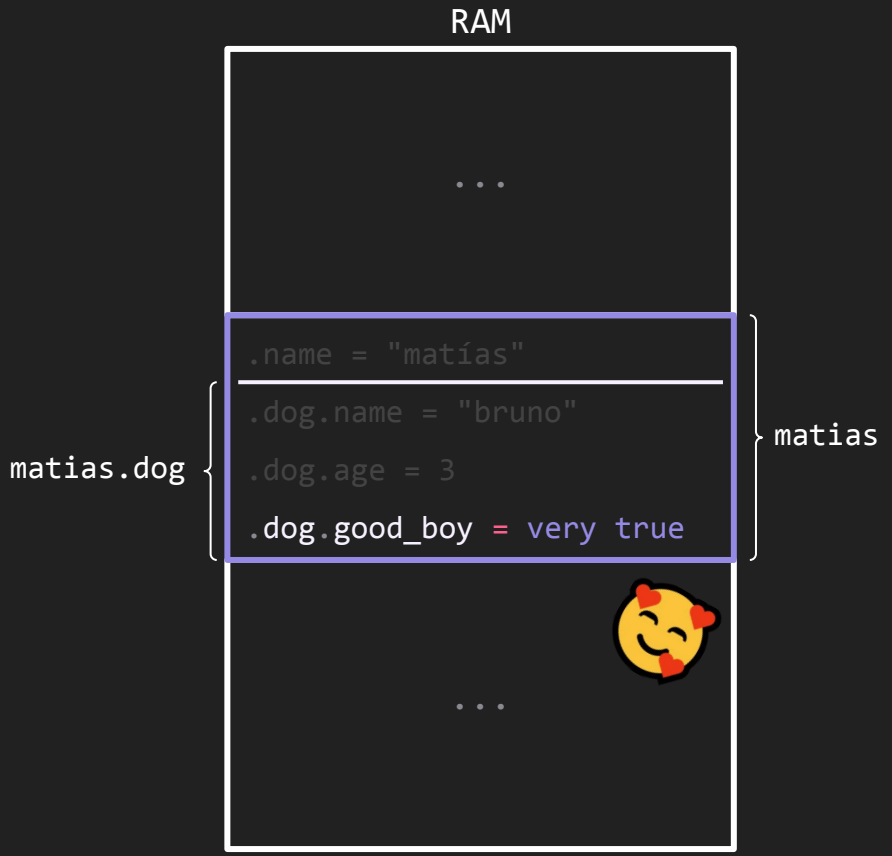


struct.struct

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct kid
{
  char* name;
  struct dog dog;
};
```

```c
struct kid matias = {
  .name = "matías",
  .dog = {
    .name = "bruno",
    .age = 3,
    .good_boy = true
  }
};
```



*struct.struct**

*struct.struct**

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct adult
{
  char* name;
  struct dog* dogs;
  int dog_count;
};
```

```c
struct adult diego = {
  .name = "diego",
  .dogs = calloc(2, sizeof(struct dog)),
  .dog_count = 2
};
diego.dogs[0] = (struct dog) {"alan", 9, true};
diego.dogs[1] = (struct dog) {"casi", 5, true};
```

C nos permite definir *struct* que contienen *struct**.

La inicialización de un *struct** dentro de un *struct* requiere el uso de malloc/calloc.

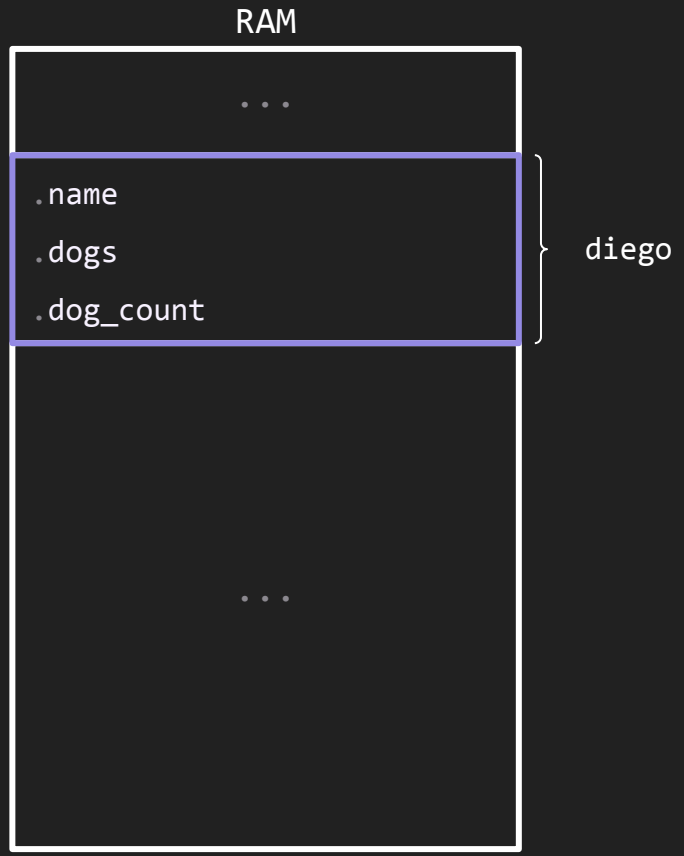
Se podría en el STACK, pero no es recomendado.

*struct.struct**

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct adult
{
  char* name;
  struct dog* dogs;
  int dog_count;
};
```

```c
struct adult diego = {
  .name = "diego",
  .dogs = calloc(2, sizeof(struct dog)),
  .dog_count = 2
};
diego.dogs[0] = (struct dog) {"alan", 9, true};
diego.dogs[1] = (struct dog) {"casi", 5, true};
```



*struct.struct**

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct adult
{
  char* name;
  struct dog* dogs;
  int dog_count;
};
```

```c
struct adult diego = {
  .name = "diego",
  .dogs = calloc(2, sizeof(struct dog)),
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};
diego.dogs[0] = (struct dog) {"alan", 9, true};
diego.dogs[1] = (struct dog) {"casi", 5, true};
```

*struct.struct**

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct adult
{
  char* name;
  struct dog* dogs;
  int dog_count;
};
```

```c
struct adult diego = {
  .name = "diego",
  .dogs = calloc(2, sizeof(struct dog)),
  .dog_count = 2
};
diego.dogs[0] = (struct dog) {"alan", 9, true};
diego.dogs[1] = (struct dog) {"casi", 5, true};
```

*struct.struct**

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct adult
{
  char* name;
  struct dog* dogs;
  int dog_count;
};
```

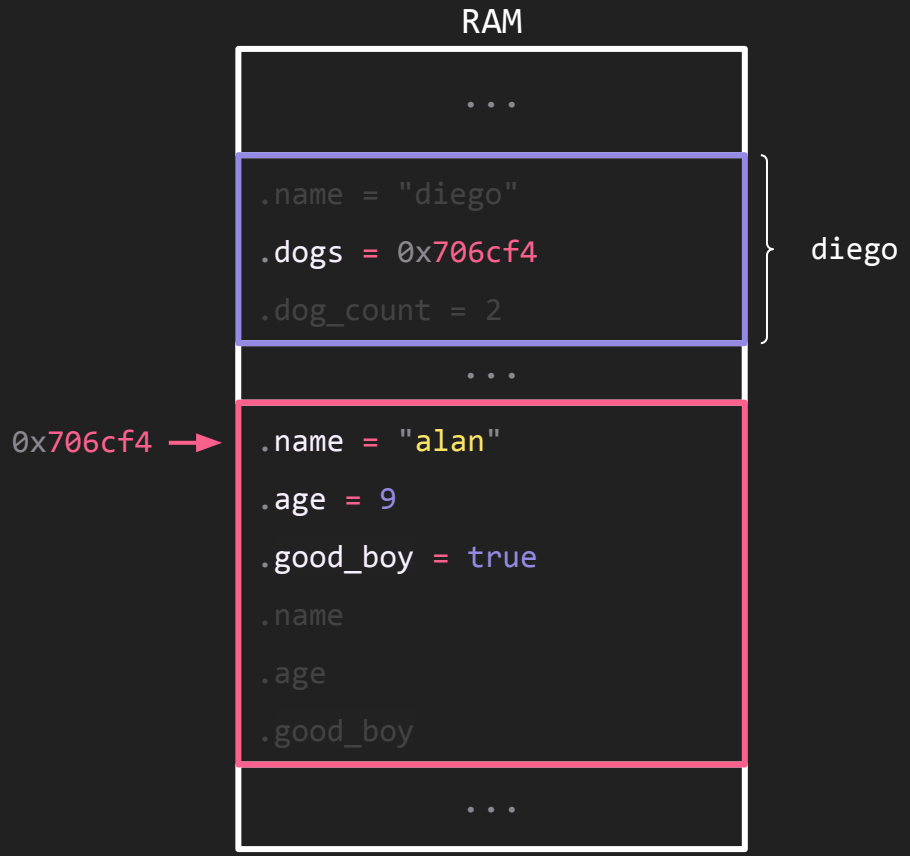
```c
struct adult diego = {
  .name = "diego",
  .dogs = calloc(2, sizeof(struct dog)),
  .dog_count = 2
};
diego.dogs[0] = (struct dog) {"alan", 9, true};
diego.dogs[1] = (struct dog) {"casi", 5, true};
```

struct.struct*

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct adult
{
  char* name;
  struct dog* dogs;
  int dog_count;
};
```

```c
struct adult diego = {
  .name = "diego",
  .dogs = calloc(2, sizeof(struct dog)),
  .dog_count = 2
};
diego.dogs[0] = (struct dog) {"alan", 9, true};
diego.dogs[1] = (struct dog) {"casi", 5, true};
```

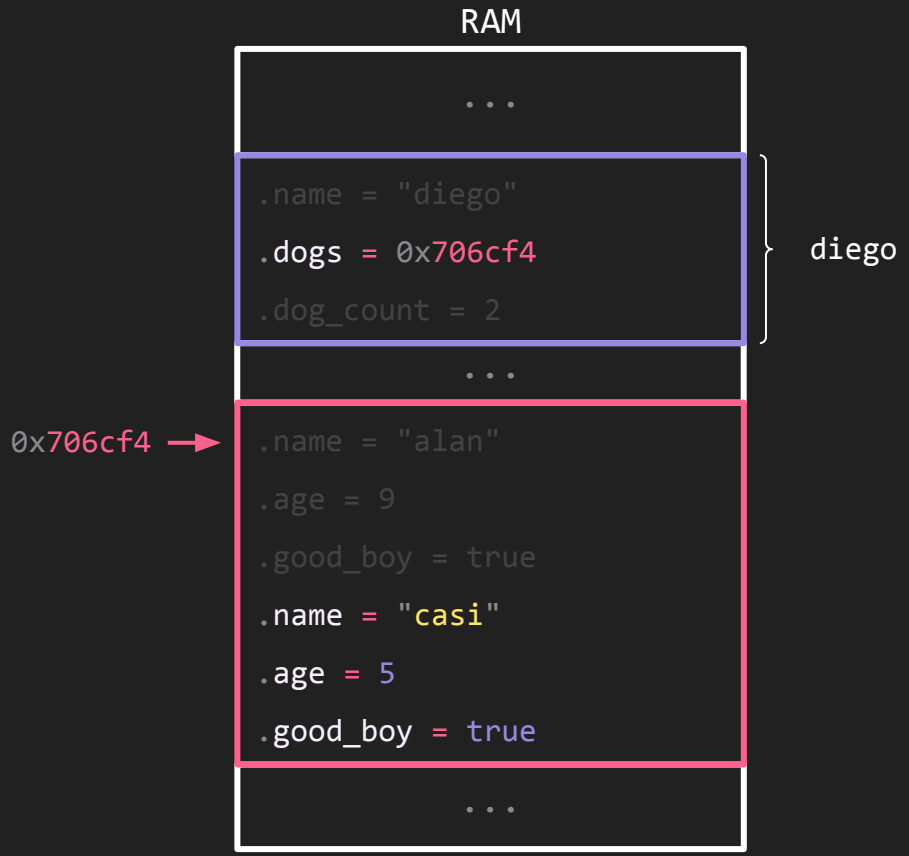


*struct.struct**

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
};
```

```c
struct adult
{
  char* name;
  struct dog* dogs;
  int dog_count;
};
```

```c
struct adult diego = {
  .name = "diego",
  .dogs = calloc(2, sizeof(struct dog)),
  .dog_count = 2
};
diego.dogs[0] = (struct dog) {"alan", 9, true};
diego.dogs[1] = (struct dog) {"casi", 5, true};
```



struct recursivo

struct recursivo

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog friend;
};
```

struct recursivo

```
struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog friend;
};
```

RAM

...

.name
.age
.good_boy
.friend.name
.friend.age
.friend.good_boy
.friend.friend.name
.friend.friend.age
.friend.friend.good_boy
.friend.friend.friend.name
.friend.friend.friend.age

struct recursivo

```c
struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog* friend;
};
```

```c
struct dog A = {"bruno", 3, true, NULL};
struct dog B = {"catalina", 4, true, NULL};

A.friend = &B;
B.friend = &A;
```

struct recursivo - typedef

```c
typedef struct dog
{
  char* name;
  double age;
  bool good_boy;
  Dog* friend;
} Dog;
```

```c
struct dog;
typedef struct dog Dog;

struct dog
{
  char* name;
  double age;
  bool good_boy;
  Dog* friend;
};
```

Programar con *struct*

Modelación orientada a objetos

Modelación orientada a *objetos*

```c
typedef struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog* friend;
} Dog;

Dog* dog_init(char* name){ ... }

void dog_bark(Dog* dog){ ... }

void dog_meet(Dog* dog, Dog* friend){ ... }

void dog_destroy(Dog* dog){ ... }
```

Es lo más cercano a **clases** que podemos hacer en **C**.

Modelación orientada a *objetos*

```c
typedef struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog* friend;
} Dog;

Dog* dog_init(char* name){ ... }

void dog_bark(Dog* dog){ ... }

void dog_meet(Dog* dog, Dog* friend){ ... }

void dog_destroy(Dog* dog){ ... }
```

Definimos el *struct*.

Modelación orientada a *objetos*

```c
typedef struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog* friend;
} Dog;

Dog* dog_init(char* name){ ... }

void dog_bark(Dog* dog){ ... }

void dog_meet(Dog* dog, Dog* friend){ ... }

void dog_destroy(Dog* dog){ ... }
```

Definimos la función que inicializa un nuevo *struct* en el HEAP con malloc/calloc.

Modelación orientada a *objetos*

```c
typedef struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog* friend;
} Dog;

Dog* dog_init(char* name){ ... }

void dog_bark(Dog* dog){ ... }

void dog_meet(Dog* dog, Dog* friend){ ... }

void dog_destroy(Dog* dog){ ... }
```

Definimos las funciones que usan o procesan el *struct*.

Modelación orientada a *objetos*

```c
typedef struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog* friend;
} Dog;

Dog* dog_init(char* name){ ... }

void dog_bark(Dog* dog){ ... }

void dog_meet(Dog* dog, Dog* friend){ ... }

void dog_destroy(Dog* dog){ ... }
```

Las funciones definen el comportamiento del objeto.

Modelación orientada a *objetos*

```c
typedef struct dog
{
  char* name;
  double age;
  bool good_boy;
  struct dog* friend;
} Dog;

Dog* dog_init(char* name){ ... }

void dog_bark(Dog* dog){ ... }

void dog_meet(Dog* dog, Dog* friend){ ... }

void dog_destroy(Dog* dog){ ... }
```

Definimos la función que hace free de la memoria usada por una instancia del *struct*.

Estructuras de datos

Estructuras de datos

```c
struct list
{
  int value;
  struct list* next;
};

typedef struct list List;

List* list_init(){ ... }

List* list_append(List* list){ ... }

List* list_at_index(List* list, int index){ ... }

void  list_destroy(List* list){ ... }
```

Sirven para organizar datos en la memoria del programa.

Estructuras de datos

```c
struct list
{
  int value;
  struct list* next;
};

typedef struct list List;

List* list_init(){ ... }

List* list_append(List* list){ ... }

List* list_at_index(List* list, int index){ ... }

void  list_destroy(List* list){ ... }
```

Las funciones definen las operaciones de la estructura.

tipos compuestos

tipos compuestos

```c
typedef struct vector3d
{
  double x;
  double y;
  double z;
} Vec3D;

Vec3D vec3d_create(double x, double y, double z)
{ ... }

double vec3d_dot_prod(Vec3D v1, Vec3D v1)
{ ... }

Vec3D vec3d_cross_prod(Vec3D v1, Vec3D v1)
{ ... }
```

Estos tipos son *tipos* en los que no nos interesa usar referencias.

Actúan literalmente como contenedores, sin ninguna propiedad ni significado.

tipos compuestos

```c
typedef struct vector3d
{
  double x;
  double y;
  double z;
} Vec3D;

Vec3D vec3d_create(double x, double y; double z;)
{ ... }

double vec3d_dot_prod(Vec3D v1, Vec3D v1)
{ ... }

Vec3D vec3d_cross_prod(Vec3D v1, Vec3D v1)
{ ... }
```

Las funciones son operadores del *struct*

¡Muchas Gracias!

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