III. STRUCTURED ASSEMBLY LANGUAGE PROGRAMMING TECHNIQUES

Structured Data Types

Outline

1. Arrays
2. Strings
3. Structures/Records
4. Sets

Structures/Records

- collection of data with different types
- contiguous bytes of memory divided according to data type used by user
- We need to know the following:
  - the size of the whole structure
  - the size of each field
  - the starting address of each field

Implementing Structures

```
struct  student {
      char name[10];
      int age;
      int score;
};
struct student x;
```

name = 10
age = 2
score = 2
14 bytes

Implementing Structures

```
struct  student {
      char name[10];
      int age;
      int score;
};
struct student x;
```

```
name          =   10
age       =     2
score     =     2
                14 bytes
```

Define structure size:

student equ 14

Implementing Structures

```
struct  student {
      char name[10];
      int age;
      int score;
};
struct student x;
```

```
name          =   10
age         =     2
score      =     2
                  14 bytes
```

Define structure size:

```
student equ 14
```

Define starting byte of each field:

```
name equ      0
age   equ     10
score equ     12
```

Implementing Structures

```
struct  student {
      char name[10];
      int age;
      int score;
};
struct student x;
```

```
name          =   10
age       =     2
score     =     2
                14 bytes
```

Define structure size:

```
student equ 14
```

Define starting byte of each field:

```
name equ      0
age   equ     10
score equ     12
```

Reserve space for structure:

```
x resb student
```

Implementing Structures

Define structure size:

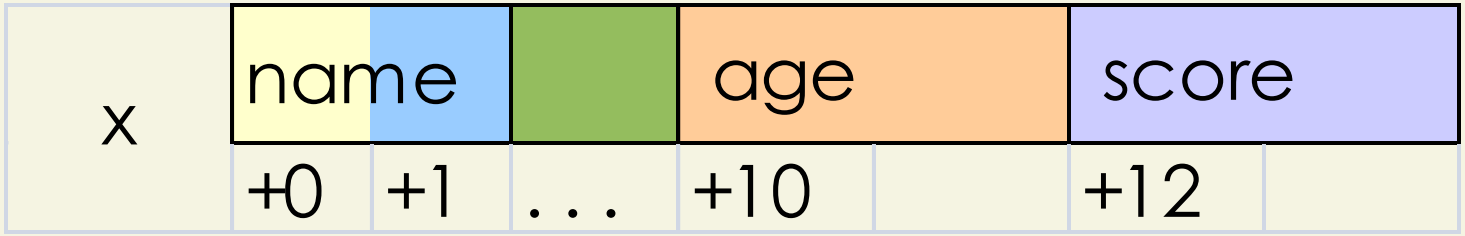
```
student equ 14
```

Define starting byte of each field:

```
name    equ 0
age     equ 10
score   equ 12
```

Reserve space for structure:

```
x resb student
```

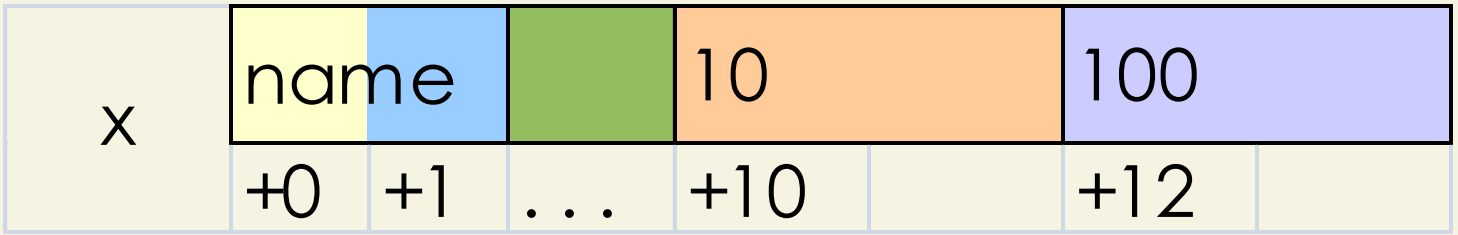


Accessing Fields

- To access a specific field, just identify the address of that field by specifying its offset from the base address.
- x.age = 10;

  mov word[x+age], 10
- x.score = 100;

  mov word[x+score], 100



Array of Structures

```
struct  student {
      char name[10];
      int age;
      int score;
};
struct student x[5];
```

name = 10
age = 2
score = 2
14 bytes

Array of Structures

```
struct  student {
      char name[10];
      int age;
      int score;
};
struct student x[5];
```

```
name          =   10
age       =     2
score     =     2
                14 bytes
```

```
student       equ     14
name          equ      0
age           equ     10
score         equ     12
```

Array of Structures

```
struct  student {
     char name[10];
     int age;
     int score;
};
struct student x[5];
```

```
name        =   10
age         =    2
score       =    2
              14 bytes
```

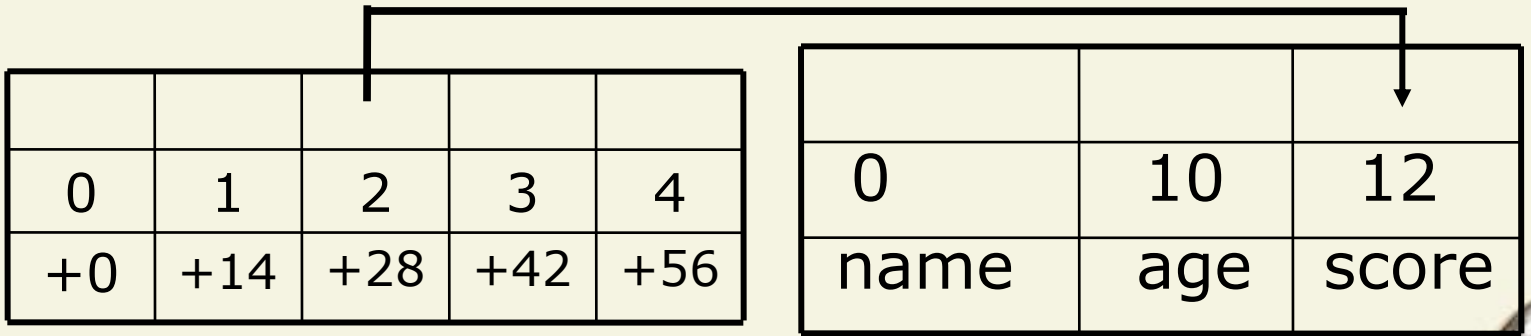
```
array_size    equ     5
student       equ    14
name          equ     0
age           equ    10
score         equ    12

x  resb array_size*student
```

Array of Structures

- specify array cell to use (i*size)
- specify field to use

- x[2].score = 100;
- mov word[x+student*2+score], 100



Array of Structures with Array Field

```
struct  student {
      char name[10];
      int age;
      int scores[3];
};
struct student x[5];
```

name = 10
age = 2
score = 6
18 bytes

Array of Structures with Array Field

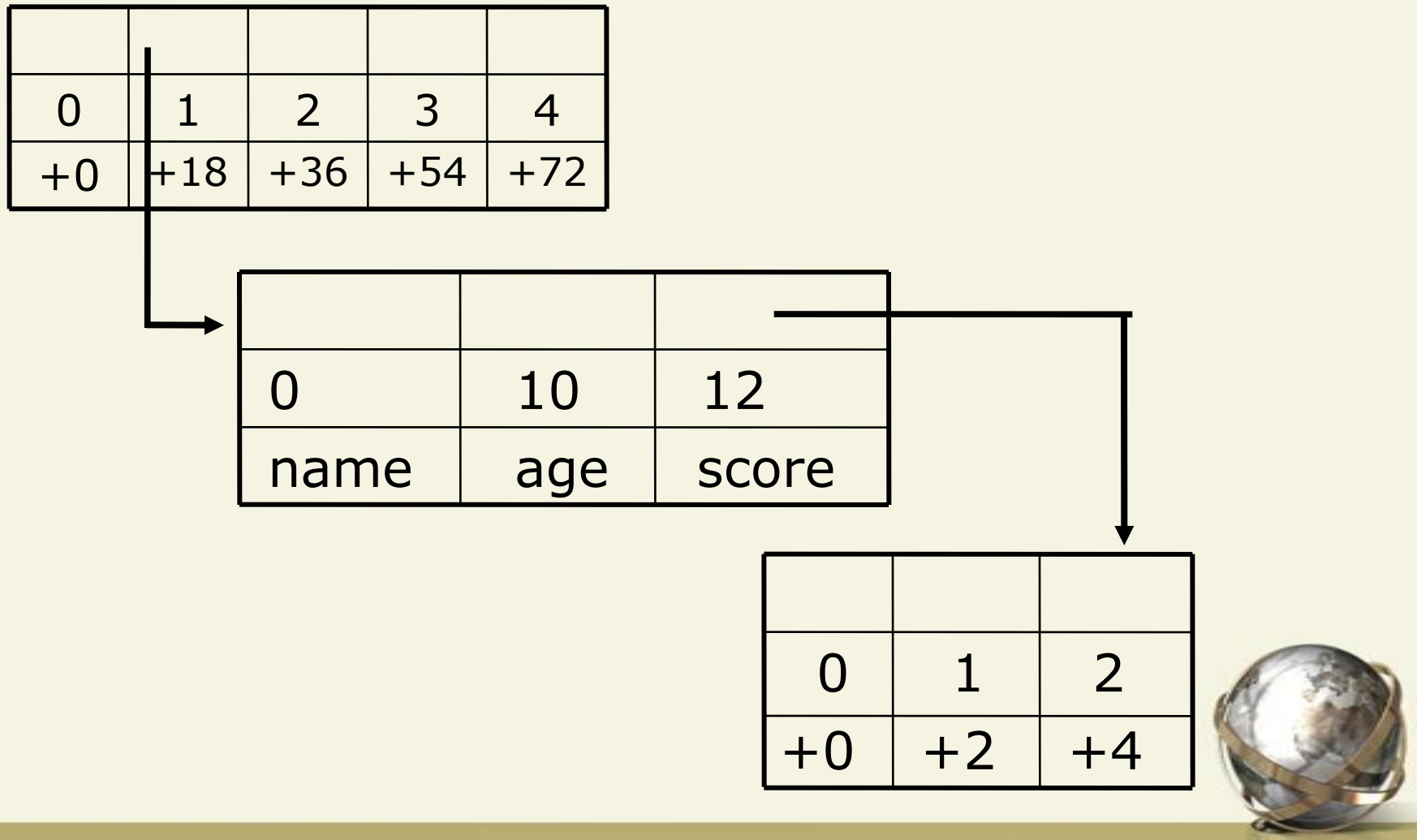
```
struct  student {
     char name[10];
     int age;
     int scores[3];
};
struct student x[5];
```

```
name        =   10
age         =    2
score       =    6
              18 bytes
```

```
array_size    equ     5
integer       equ     2
student       equ    18
name          equ     0
age           equ    10
scores        equ    12

x  resb array_size*student
```

Array of Structures with Array Field



Array of Structures with Array Field

x[1].scores[2] = 100; ; C equivalent

Array of Structures with Array Field

x[3].scores[2] = 100; ; C equivalent

mov word[x+student*3+scores+integer*2], 100