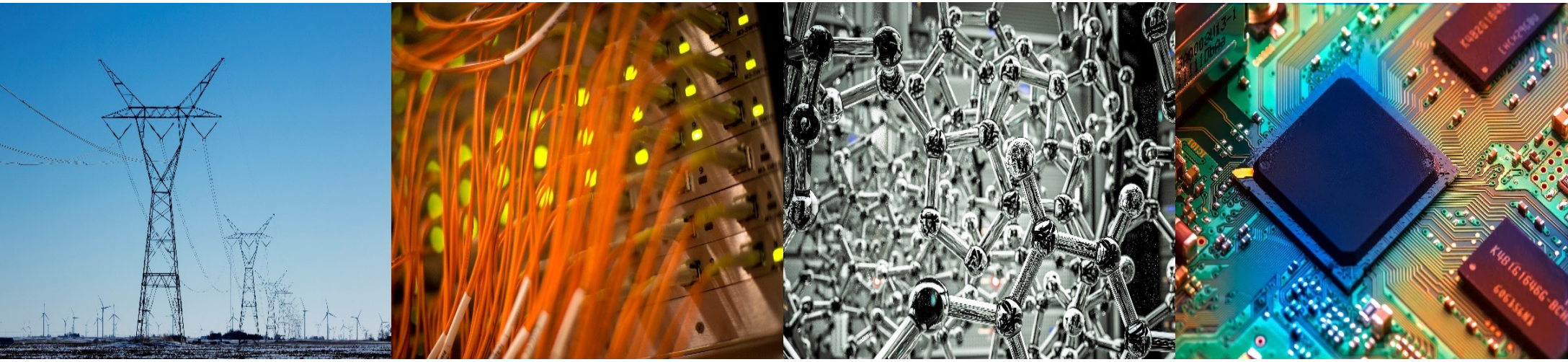
ECE 220 Computer Systems & Programming

Lecture 15 – Data Structures

March 12, 2026



- **MT2 is scheduled for 4/2**

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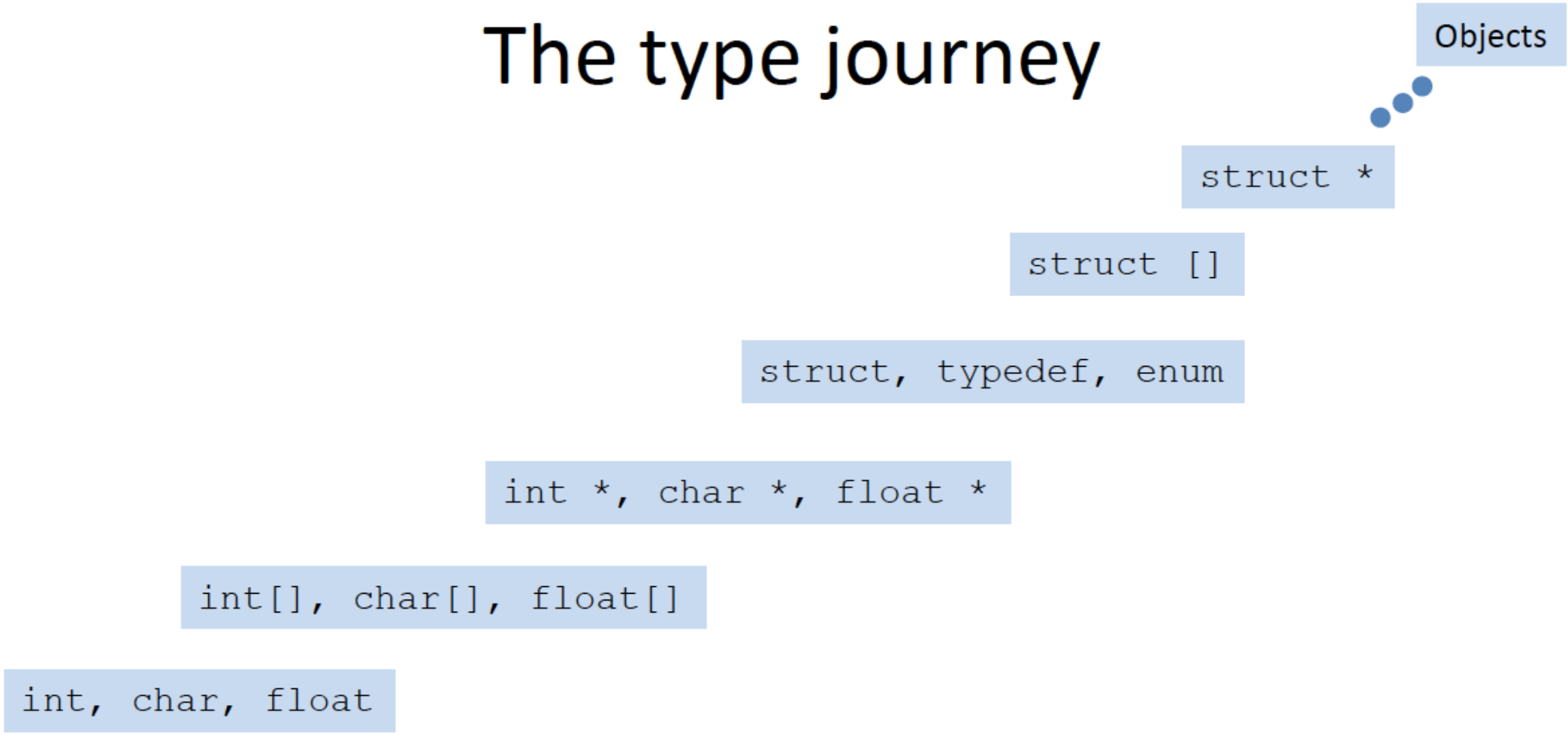
The type journey



Data Types

Fundamental data types: int, float/double, char

Arrays & Pointers

Enumerated data type:

- user-defined
- a list of related items (enumeration constants)
- count starts at 0 by default

```
/* Example: create an enumerated data type for days of the week */
enum Days {SUN, MON, TUE, WED, THU, FRI, SAT};
enum Days today;
today = THU;
```

➢ What is the value of today?

➢ What if we define 'Days' this way?

```
enum Days {SUN=1, MON, TUE, WED, THU, FRI, SAT};
```

Structures

- allow users to define a new type consists of a combination of fundamental and pre-defined data types (**aggregate** data type)

```
/* Example: use a struct to store student record */
struct StudentStruct{
   char Name[100];
   int UIN;
   float GPA;
};

struct StudentStruct student_var;
strncpy(student_var.Name, "Jamie", sizeof(student_var.Name));
student_var.UIN = 123456789;
student_var.GPA = 3.89;

/* use just one line to declare and initialize variable */
struct StudentStruct student_var2 = {"Alex", 987654321, 3.98};
```

Using typedef

```
struct StudentStruct{
   char Name[100];
   int UIN;
   float GPA;
};
typedef struct StudentStruct student;
student s1, s2;
```

```
/* use 'typedef' in a slightly different way */
typedef struct StudentStruct{
   char Name[100];
   int UIN;
   float GPA;
}student;
student s1, s2;
```

Unions

- similar to struct, but members of the union share the same memory location(s)

```
typedef union StudentUnion{
        char Name[100];
        int UIN;
        float GPA;
}studentU;
```

➢ What is the size of studentU?

➢ What would happen if we execute the following code?

```
studentU su1;
su1.UIN = 123456789;
su1.GPA = 3.89;
```

Arrays of Structs

```
/* create an array of student struct */
student ece220[200];

/* access each element of the array */
ece220[0]
ece220[1]

/* access individual fields in each element */
ece220[0].Name[0] = 'J';
ece220[0].Name[1] = 'a';
ece220[0].Name[2] = 'm';
ece220[0].Name[3] = 'i';
ece220[0].Name[4] = 'e';
ece220[0].UIN = 123456789;
ece220[0].GPA = 3.89;
```

Pointer to Struct

```
student ece220[200];
student s1;
student *s_ptr, *s_ptr2;
s_ptr = ece220; /* pointer to a struct array */
s_ptr2 = &s1; /* pointer to a struct */

strncpy(s_ptr->Name, "Jamie", sizeof(s1.Name));
s_ptr->UIN = 123456789;
s_ptr->GPA = 3.89;
```

- Which student record has been changed?

```
s_ptr++;
```

- Where is s_ptr pointing to now?

- What is the difference between the following function calls?

```
printname(s1);
PRINTNAME(&s1);
```

Struct within a Struct

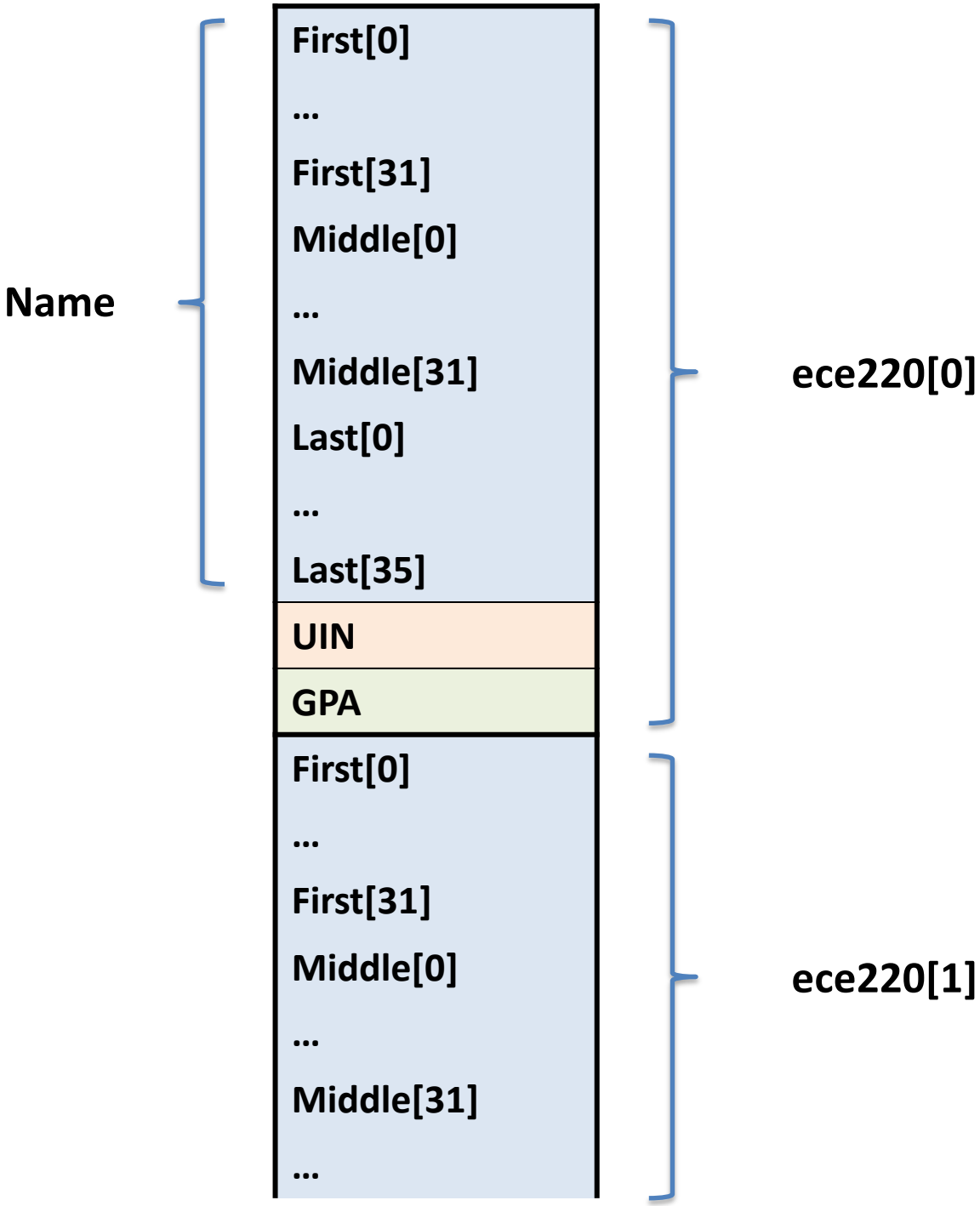
```
typedef struct StudentName{
   char First[32];
   char Middle[32];
   char Last[36];
}name;

typedef struct StudentStruct{
   name Name;
   int UIN;
   float GPA;
}student;

student ece220[200];
student *ptr;
ptr = ece220;
```

➢ How can we set the 'First' name in the first student record?

```
strncpy(                    , "Jamie",                    );
```


Name
First[0]
…
First[31]
Middle[0]
…
Middle[31]
Last[0]
…
Last[35]
UIN
GPA
ece220[0]
First[0]
…
First[31]
Middle[0]
…
Middle[31]
…
ece220[1]