EECS 10: Computational Methods in Electrical and Computer Engineering Lecture 20

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Lecture 20: Overview

- Data Structures
 - Structures
 - · Declaration and definition
 - · Instantiation and initialization
 - Member access
 - Unions
 - · Declaration and definition
 - Member access
 - Enumerators
 - · Declaration and definition
 - Type definitions

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- Structures (aka. records): struct
 - User-defined, composite data type
 - Type is a composition of (different) sub-types
 - Fixed set of members
 - · Names and types of members are fixed at structure definition
 - Member access by name
 - Member-access operator: structure_name.member_name
- · Example:

```
struct S { int i; float f;} s1, s2;

s1.i = 42;    /* access to members */
s1.f = 3.1415;
s2 = s1;    /* assignment */
s1.i = s1.i + 2*s2.i;
```

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Data Structures

- Structure Declaration
 - Declaration of a user-defined data type
- Structure Definition
 - Definition of structure members and their type
- Structure Instantiation and Initialization
 - Definition of a variable of structure type
 - Initializer list defines initial values of members
- · Example:

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Data Structures Structure Access - Members are accessed by their name - Member-access operator . Example: struct Student Jane { int ID; char Name[40]; ID 1001 char Grade; "Jane Doe" }; 'A' Grade struct Student Jane = {1001, "Jane Doe", 'A'}; void PrintStudent(struct Student s) ID: 1001 printf("ID: %d\n", s.ID); printf("Name: %s\n", s.Name); Name: Jane Doe printf("Grade: %c\n", s.Grade); Grade: A

Data Structures

- Unions: union
 - User-defined, composite data type
 - Type is a composition of (different) sub-types
 - Fixed set of *mutually exclusive* members
 - · Names and types of members are fixed at union definition
 - Member access by name

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- Member-access operator: union_name.member_name
- Only one member may be used at a time!
 - · All members share the same location in memory!
- Example:

```
union U { int i; float f;} u1, u2;
u1.i = 42;    /* access to members */
u2.f = 3.1415;
u1.f = u2.f;    /* destroys u1.i! */
```

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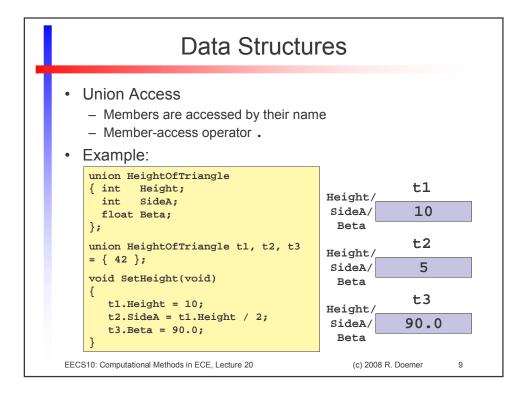
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Data Structures Union Declaration - Declaration of a user-defined data type Union Definition - Definition of union members and their type Union Instantiation and Initialization Definition of a variable of union type - Single initializer defines value of first member Example: union HeightOfTriangle; /* declaration */ union HeightOfTriangle /* definition */ { int Height; int LengthOfSideA; /* members */ float AngleBeta; **}**; union HeightOfTriangle H /* instantiation */ /* initialization */ EECS10: Computational Methods in ECE, Lecture 20 (c) 2008 R. Doemer

Data Structures Union Access - Members are accessed by their name - Member-access operator . Example: union HeightOfTriangle { int Height; t1 Height/ SideA; int SideA/ float Beta; Beta t2 union HeightOfTriangle t1, t2, t3 Height/ = { 42 }; SideA/ Beta t3 Height/ 42 SideA/ Beta EECS10: Computational Methods in ECE, Lecture 20 (c) 2008 R. Doemer 8



- Enumerators: enum
 - User-defined data type
 - · Members are an enumeration of integral constants
 - Fixed set of members
 - · Names and values of members are fixed at enumerator definition
 - Members are constants
 - · Member values cannot be changed after definition
- Example:

```
enum E { red, yellow, green };
   enum E LightNS, LightEW;
   LightEW = green;
                               /* assignment */
   if (LightNS == green)
                               /* comparison */
       { LightEW = red; }
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```

- Enumerator Declaration
 - Declaration of a user-defined data type
- · Enumerator Definition
 - Definition of enumerator members and their value
- Enumerator Instantiation and Initialization
 - Definition of a variable of enumerator type
 - Initializer should be one member of the enumerator
- Example:

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Data Structures

- Enumerator Values
 - Enumerator values are integer constants
 - By default, enumerator values start at 0 and are incremented by 1 for each following member
- Example:

Today

Wednesday

Day: 2

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```
{ Monday,
   Tuesday,
   Wednesday,
   Thursday,
   Friday,
   Saturday,
   Sunday
};
enum Weekday Today
= Wednesday;
void PrintWeekday(
        enum Weekday d)
{
   printf("Day: %d\n", d);
}
```

enum Weekday

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Data Structures Enumerator Values - Enumerator values are enum Weekday integer constants { Monday = 1, Tuesday, - By default, enumerator values Wednesday, start at 0 and are incremented Thursday, by 1 for each following member Friday, - Specific enumerator values Saturday, Sunday may be defined by the user }; Example: enum Weekday Today = Wednesday; Today void PrintWeekday(Wednesday enum Weekday d) printf("Day: %d\n", d); Day: 3 (c) 2008 R. Doemer EECS10: Computational Methods in ECE, Lecture 20 13

Data Structures Enumerator Values - Enumerator values are enum Weekday integer constants $\{ Monday = 2,$ Tuesday, By default, enumerator values Wednesday, start at 0 and are incremented Thursday, by 1 for each following member Friday, Specific enumerator values Saturday, Sunday = 1 may be defined by the user Example: enum Weekday Today = Wednesday; Today void PrintWeekday(enum Weekday d) Wednesday printf("Day: %d\n", d); Day: 4 EECS10: Computational Methods in ECE, Lecture 20 (c) 2008 R. Doemer 14

- Type definitions: typedef
 - A typedef can be defined as an alias type for another type
 - A typedef definition follows the same rules as a variable definition
 - Type definitions are usually used to abbreviate access to user-defined types
- Examples:

```
typedef long MyInteger;

typedef enum Weekday Day;
Day Today;

typedef struct Student Scholar;
Scholar Jane, John;
```

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