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Lecture 13

Union data type and variants of records

Union type variable and sizes of its field data

```c
#include <stdio.h>

int main()
{
    typedef union {
            char name[12];
            char ID[7];
            int age;
            float cgpa;
        } student_rec;
        student_rec s;
        printf("%d %u\n", sizeof(s.name), &s.name);
        printf("%d %u\n", sizeof(s.ID), &s.ID);
        printf("%d %u\n", sizeof(s.age), &s.age);
        printf("%d %u\n", sizeof(s.cgpa), &s.cgpa);
        printf("%d %u\n", sizeof(s), &s);
        return 0;
}
```

Output

```
12 612403476
7 612403476
4 612403476
4 612403476
12 612403476
```

Issues with data access

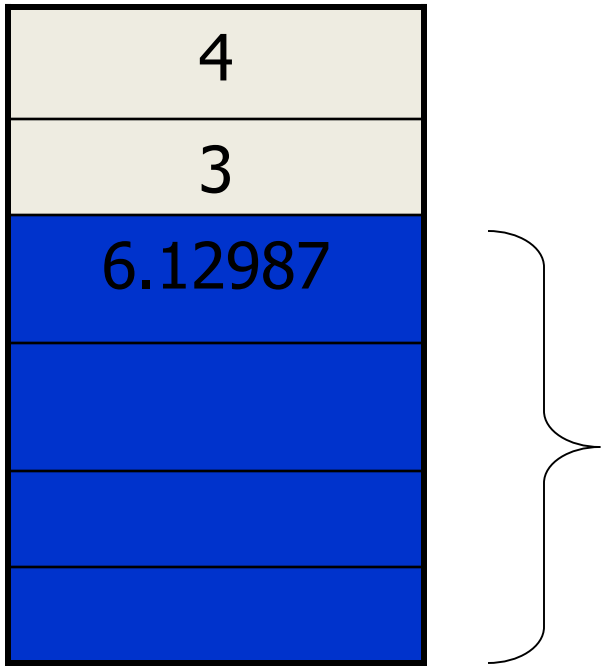
```c
int main()
{
    union node{
        int x;
        float y;
        char z;
    } var1;
    printf(" storing and printing values\n");
    var1.x = 2;
    printf("%d \n", var1.x);
    var1.y = 2.3;
    printf("%f \n", var1.y);
    var1.z = 'y';
    printf("%c \n", var1.z);

    printf(" Printing the stored values\n");
    printf("%d \n", var1.x);
    printf("%f \n", var1.y);
    printf("%c \n", var1.z);

    printf(" Printing the stored values again\n");
    printf("%d \n", var1.x);
    printf("%f \n", var1.y);
    printf("%c \n", var1.z);

    printf("locations of the field data items\n");
    printf("%u \n", &var1.x);
    printf("%u \n", &var1.y);
    printf("%u \n", &var1.z);
    return 0;
}
```

```
$main
 storing and printing values
2
2.300000
y
 Printing the stored values
1075000185
2.300017
y
 Printing the stored values
1075000185
2.300017
y
locations of the field data items
1385683868
1385683868
1385683868
```

Variant Records

- A maximum of 12 bytes of the memory is allocated for variable s.(total space layout for each variant record remains of fixed size)
- The variant field may leave some space unused depending upon the choice of the field in union.
- Variant records compromise type safety (tag and choice of the field is programmers job)

Example: Variant Record




```
struct weather{
        int day;
        int tag; //1:sunny,2:cloud, 3:rain
        union data{
                int brightness;
                float humidity;
                double rainfall;
        }
}
```

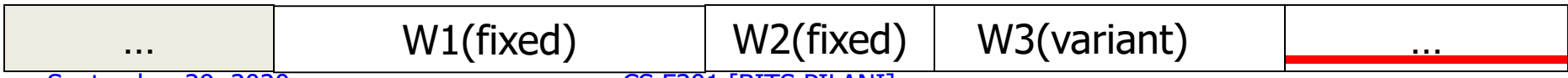
Variant records

- Variant Records have a part common to all records of that type, and a variant part, specific to some subset of the records.
- In C, union construct facilitates the variant records
- Example: registration status of a student

Memory layout of variant records

- The memory equal to the maximum of the sizes of the individual fields is allocated for a variable of union type.
- Example

```
struct var_Rec{
{
type1     var1;     //fixed
type2     tag;       //fixed
union{
            int x;
            float y;
            char name[12];
            } var1;    // variant
} v;
```



Design a node for annotated parse tree

- Annotated parse tree nodes not only store the information about the address of children, they store information about semantics such as type and code.

Sets

- A set of n numbers, each less than n, is implemented by a bit vector of n bits
- Example: set A={ 3, 6, 1, 8, 15, 0, 2}

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1	0	0	0	0	0	0	1	0	1	0	0	1	1	1	1

- Represented- by a simple integer word.
- limitation - only small element values can find their place as a bit (else two or more words are used)