PG – DESD

Module – Embedded C Programming

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Structure

- Structure is a user-defined data type.

- Structure stores logically related (similar or non-similar) elements in contiguous memory location.

- Structure members can be accessed using "." operator via struct variable.

- Structure members can be accessed using "->" operator via struct pointer.

- Size of struct = Sum of sizes of struct members.

- If struct variable initialized partially at its point of declaration, remaining elements are initialized to zero.

```
// struct data-type declaration (global or local)
struct emp {
    int empno;
    char ename[20];
    double sal;
};
// struct variable declaration
struct emp e1 = {11, "John", 20000.0};
// print struct members
printf("%d%s%lf", e1.empno, e1.ename, e1.sal);
```

Struct

- A variable of a struct can be member of another struct.
- This can be done with nested struct declaration.

```
struct emp {
    int empno;
    char ename[20];
    double sal;
    struct {
        int day, month, year;
    }join;
};
```

```
struct date {
    int day, month, year;
};
struct emp {
    int empno;
    char ename[20];
    double sal;
    struct date join;
};
struct emp e = { 11, "John", 2000.0, {1, 1, 2000} };
printf("%d %s %d-%d-%d\n", e.empno, e.ename, e.join.day, e.join.month, e.join.year);
```

Struct padding

- For efficient access compiler may add hidden bytes into the struct called as "struct padding" or "slack bytes".

- On x86 architecture compiler add slack bytes to make struct size multiple of 4 bytes (word size).

- These slack bytes not meant to be accessed by the program.

- Programmer may choose to turn off this feature by using #pragma.
  - #pragma pack(1)

```
struct test {
    int a;
    char b;
};
printf("%u\n", sizeof(struct test));


#pragma pack(1)
struct test {
    int a;
    char b;
};
printf("%u\n", sizeof(struct test));
```

Bit Fields

- A bit-field is a data structure that allows the programmer to allocate memory to structures and unions in bits in order to utilize computer memory in an efficient manner.

- Bit-fields can be signed or unsigned.
  - Signed bit-field, MSB represent size + or -.
  - Unsigned bit-field, all bits store data.

- Limitations of bit-fields
  - Cannot take address of bit-field (&)
  - Cannot create array of bit-fields.
  - Cannot store floating point values.

```
struct student {
    char name[20];
    unsigned int age: 7;
    unsigned int roll: 6;
};
struct student s1 = { "Ram", 10, 21 };
printf("%s, %d, %d", s1.name, s1.age, s1.roll);
```

Thank you!

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