C Common Defects

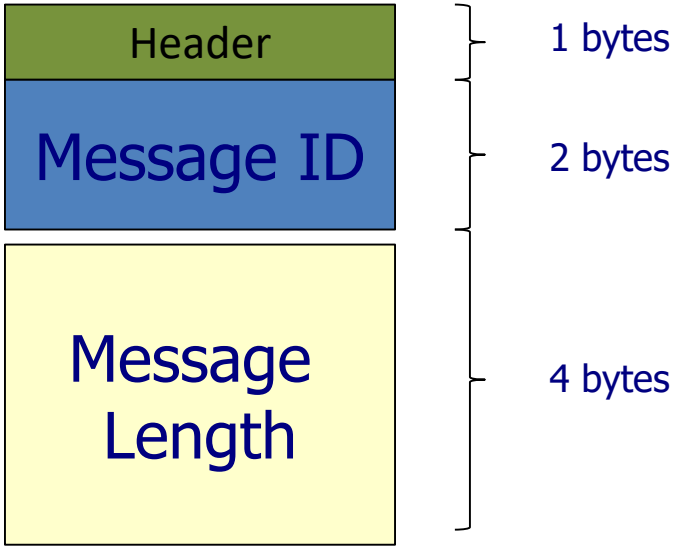
<Training Topic /Lesson Name>

Alignment and packing

```
typedef struct message {
      char              head_byte;
      short             message_id;
      unsigned int      length;
} message_header;
void receive_data ( void *buffer)
{
       message_header m;
      if(7 == sizeof(m))
      m = &((message_header)buffer);
}
```

- Are there any problems? If yes, how to fix them???

The format of message:



Alignment and packing

```
struct struct1{
    double d1; /* 8 bytes */
    char c; /* 1 byte */
    double d2; /* 8 bytes */
};
```

padding

```
struct struct1{
    double d1;          /* 8 bytes */
    char c;             /* 1 byte */
    char padding[7];    /* 7 bytes */
    double d2;          /* 8 bytes */
};
```

- You might think that sizeof(struct my_struct) should be 17 bytes, but it's actually 24 bytes. This is because of self-alignment. Compiler inserted 7 bytes of padding between c and x to keep the structure aligned.

#define

- ```
  #define SQUARE(x) x*x
  int x = 2;
  ```
  what will be `SQUARE(x + 1)`?

- ```
  #define DOUBLE(x) x+x
  int x = 3;
  ```
  what will be `DOUBLE((++x))`??

- How to fix it???

#define

- `#define max(a,b) ((a) > (b)? (a): (b))`
  is this always run true???
- ```
  biggest = x[0]
  int i = 1;
  while(i<n)
      biggest = max(biggest, x[i++]);
  ```
  biggest will be the biggest number in x array???
- Never pass an expression that has side effects as a macro argument
  ```

Semicolons

- ```
  #define MAX 10;
  int arr[MAX];
  ```
  What's problem?

- ```
  int x = 1, y = 2;
  if (x > y);
     printf("Impossible\n");
  if (x < y);
     printf("Possible\n");
  ```
  What it will print???

Semicolons

```
int test(int i)
{
  if(i > 0)
    return
    i = -1;
  if(i < 0)
    return
    i = 2;
}
 int a = -1;
printf("%d", test(a));
```

What it will print???

Overflow and underflow

- `int x;`
  Consider to `x*3/5`. What problem in this expression???
- Can be fix that: `(x/5)*3` ???

```
int x;
(float)(3/5)*x; ???
```

- `char buf[8];`

```
printf("What is your name?\n");
scanf("%s", buf);
```

  What's problem???
- `float x;`
  Consider to `(x/1e20)*1e30;`. What problem in this expression???

Const

- `const char *p;`
  `char * const p;`
  what is difference???
- `const char *p;`
  `const char p[];`
  what is difference???

Type

```
char x;
    for(x=0;x<200;x++)
        printf("%d ",x);
    putchar('\n');)
```

What's problem??

Type

- ```
  unsigned char c;
  c = '\xff';
  if ( c != '\xff' ) printf( "Impossible!\n" )
  else printf( “Possible!\n" )
  ```
  what it will print???
- ```
  char *p = “ab”;
  char p1[2] = {‘a’, ‘b’};
  ```
  are they identical???

Type

```
float f = 0.1;
 if (f != 0.1)
    printf("Impossible");
 else
    printf("Possible");
```

What it will print???

Operator

- `if(-5 <= x <= 5){…}`

  is it wrong???

  what it mean???

- ```
  if ( x < 0 ) {
   printf( "Invalid value.\n" );
   exit;
  }
  ```

  is it exit if x is a negative number???
  ```

Array

- `int x[10][10];`
  `int y = x[ ++i, ++j ];`

C doesn't actually have true multi-dimensional arrays

- `x[++i, ++j] ~ *(x+(++j))`

Which is an address, not an integer.

In C, always use one pair of [] for each level of array subscripting

Strings and Characters

- `char c = '\n';`
- ```
  char *p = "\n";
  printf("%s", &c);
  printf("%s", p);
  ```

Is it the same???

How to fix???
  ```

Precedence

- `r` *to an 8-bit value whose low-order bits are those of* `l` *and whose high-order bits are those of* `h`*:*
  `r = h<<4 + l;`
- *but the real mean:* `r = h << (4 + l);`
- *How to fix???*
- `r = (h << 4) + l;`
- `r = h << 4 | l;`
- `*p++` *is ???*

Precedence

- *Arithmetic operators (++, --, +, -, …)*
- *Shift Operators (<<, >>)*
- *Relation Operator (==, !=, <, <=, >, >=)*
- *Logical Operators (&&, ||)*
- *Assignment Operators*

Memory

```
void b(char **p){
    char * str="print this string";
    *p = str;
}
int main(void){
    char * s;
    b(&s);
    s[0]='j';
    return 0;
}
```

- What's problem???

Memory

```
int main(void){
    char *line = NULL;
    size_t size = 0;
    getline(&line, &size, stdin);
    return 0;
}
```

- What's problem???

Syntax

- ```
  if (xcnt < 2)
   return
  date = x[0];
  time = x[1];
  ```
  What it mean???
- ```
  int x = 3;
  int *p = &x;
  int y = x/*p   /* p point to x */;
  ```
  What is value of `y`???

Syntax

- `int *g(), (*h)();`
  are these the same???
- ```
  struct foo{
   int x;
  }
  f()
  {
   …
  }
  ```
  what's problem???
  ```

Pointer

- ```
  char * curstr;
  char * prvstr;
  curstr = (char *) malloc( 10 );
  prvstr = (char *) malloc( 10 );
  strcpy( curstr, "abc" );
  prvstr = curstr;
  strcpy( curstr, "xyz" );
  ```
  what is `prvstr` value???
- `*prvstr = *curstr;` ???
  ```

Misc

- ```
  char *p;
  if(p == (char *) 0) …
  if(strcmp(p, (char *) 0) == 0) …
  ```
  are they the same???
- ```
  char c;
  while ((c=getchar()) != EOF)
      putchar(c);
  ```
  How this code works???

Function pointer

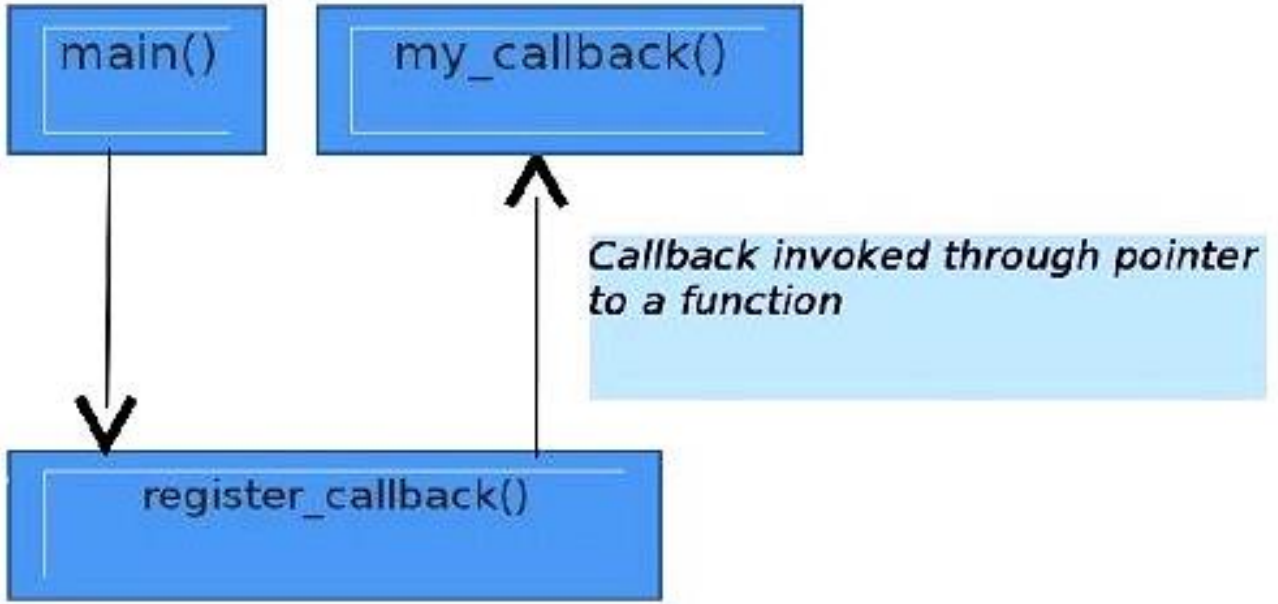
- Definition: Function pointer is a pointer that points to functions
- Declaration:

```
<return_type> (* pfunc)(arg1, arg2);
```

- Purpose
  - ✓Menu implementation
  - ✓Callback function

Function pointer

- Callback function



Thank you