

## More pattern work, more loops

Embedded Systems Interfacing

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## Overview

- Data Types in C-30
  - Integer
  - Floating-Point
- Arrays
- Finite For-Loop
- Fantazein® LED wand

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## Variable Declaration

- Done before first executable statement in function
- Data types in C-30

Type	Bits	Min	Max
char, signed char	8	-128	127
unsigned char	8	0	255
short, signed short	16	-32768	32767
unsigned short	16	0	65535
int, signed int	16	-32768	32767
unsigned int	16	0	65535
long, signed long	32	-2 <sup>31</sup>	2 <sup>31</sup> - 1
unsigned long	32	0	2 <sup>32</sup> - 1
long long**, signed long long**	64	-2 <sup>63</sup>	2 <sup>63</sup> - 1
unsigned long long**	64	0	2 <sup>64</sup> - 1

\*\* ANSI-89 extension

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## Variable Declaration

- Data types in C-30

Type	Bits	E Min	E Max	N Min	N Max
float	32	-126	127	2 <sup>-126</sup>	2 <sup>128</sup>
double*	32	-126	127	2 <sup>-126</sup>	2 <sup>128</sup>
long double	64	-1022	1023	2 <sup>-1022</sup>	2 <sup>1024</sup>

E = Exponent  
N = Normalized (approximate)  
\* double is equivalent to long double if -fno-short-double is used.

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## Variable Declaration

- Declaration examples:

```
int i = 6;  
unsigned char c;  
long double PI = 3.1415;
```

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## Arrays

- N-Dimensions allowed
  - Single A[10]
  - Double B[2][3]
- Declaration examples:  
unsigned char x[10] = {'A','B','C','D','e','f',6,7,8,9};

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## Increment/Decrement

- `j++` Use j then post increment
- `j--` Use j then post decrement
- `++j` Pre-increment then use j
- `--j` Pre-decrement then use j
- `j+=1;` Increment j by 1
- `j-=1;` Decrement j by 1

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## Finite For Loop

- `for(initialization_statement; test_expression; increment_statement){`  
`// loop statements`  
`};`
  - Before loop entered
  - Top of loop
  - At end of loop
- Example
 

```
for(i=0;i<10;i++){
    x[i]=x[i]+1;
}
```

```
i=0;
for_loop:
if(i<10) {
    x[i]=x[i]+1;
    i=i+1;
    goto for_loop;
}
```

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## Fantazein® LED Clock

- Moving bar of LEDs
- Eye has about 1/16 of a second persistence
- Will use LED bar on Explorer 16 Development Board



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## Fantazein® LED Wand<sup>1</sup>

- Preprocessor # defined statements
 

```
#define SHORT_DELAY 100
#define LONG_DELAY 800
```
- Message bitmap
 

```
char bitmap[30] = {
    0b11111111, //'H'
    ...
    0b00000000};
```

<sup>1</sup> Magic wand LED sign

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## Fantazein® LED Wand

- Initialization
 

```
TRISA = 0xFF00;
T1CON = 0x8030;
```
- Endless loop
 

```
while(1){
    ...
}
```


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## Fantazein® LED Wand

- Moving to right process
 

```
for(i=0;i<30;i++){
    PORTA = bitmap[i];
    TMR1 = 0;
    while(TMR1 < SHORT_DELAY);
}
```

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## Fantazein® LED Wand

- Moving to left process loop

```
PORTA = 0;
TMR1 = 0;
while(TMR1 < LONG_DELAY);
```

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## Homework

- Chapter 3
  - 1 (as written)
  - 2 (as written)

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