

Indicate what data type you would use for the following variables:

- #3 give two factors that can affect time delay in the AVR Microcontroller

- #6 Explain why various C compilers produce different hex file size

- به دلیل اینکه کامیاب‌های مختلف در سرنوشت شبیه‌گرد C به اسپین از الگوریتم‌های مختلف استفاده می‌کنند و همین امر باعث اشتباهات فزاینده در کامیاب‌هاست.

#9 write a C program to toggle bits 1 and 3 of Port B every 200 ms :

```
#include <mega32.h>
#include <delay.h>

void main(void)
{
    DDRB = 0xFF;
    PORTB = 0x01;
    delay_ms(200);
    PORTB = 0x05;
    delay_ms(200);
}
```

#12 write a C program to count up port B 0-99 continuously.

```
#include <mega32.h>
#include <delay.h>

unsigned char i = 0;

void main(void)
{
    DDRB = 0xFF;
    PORTB = 0x00;
    while(1)
    {
        PORTB = i;
        i++;
        i = i == 99 ? 0 : i;
    }
}
```

#14 find the content of the port after each of the following operations

a) $\text{PORTB} = 0x65 \& 0x76 \rightarrow 0x64$

b) $\text{PORTB} = 0x70 | 0x6B \rightarrow 0x7B$

c) $\text{PORTC} = 0x95 \wedge 0xAA \rightarrow 0x3F$

d) $\text{PORTC} = 0x5D \& 0x78 \rightarrow 0x58$

e) $\text{PORTC} = 0xC5 | 0x12 \rightarrow 0xD7$

f) $\text{PORTD} = 0x6A \wedge 0x6E \rightarrow 0x04$

g) $\text{PORTB} = 0x37 | 0x26 \rightarrow 0x37$

#16 show the C code to swap 0x95 to make it 0x59.

```
void main(void)
```

```
{
```

```
    unsigned char x = 0x95;
```

```
    unsigned char y = (x >> 4) & 0x0F
```

```
    unsigned char
```

```
    x = (x << 4) & 0xF0
```

```
    x |= y
```

```
}
```

#19 write a program to convert ASCII digits of '7' and '2' to packed BCD and display them on PORTB

```
void main(void)
```

```
{
```

```
    unsigned char x = '7', y = '2', BCD
```

```
    DDRB = 0xFF;
```

```
    x &= 0x0F;
```

```
    x <<= 4;
```

```
    y &= 0x0F;
```

```
    BCD = x | y;
```

```
    PORTB = BCD;
```

```
}
```


#22

True or false. When using code space for data, the total size of the array should not exceed 256 bytes. → False

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what is the drawback of using Program code space for data?

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