

Bitwise Operators and Expressions

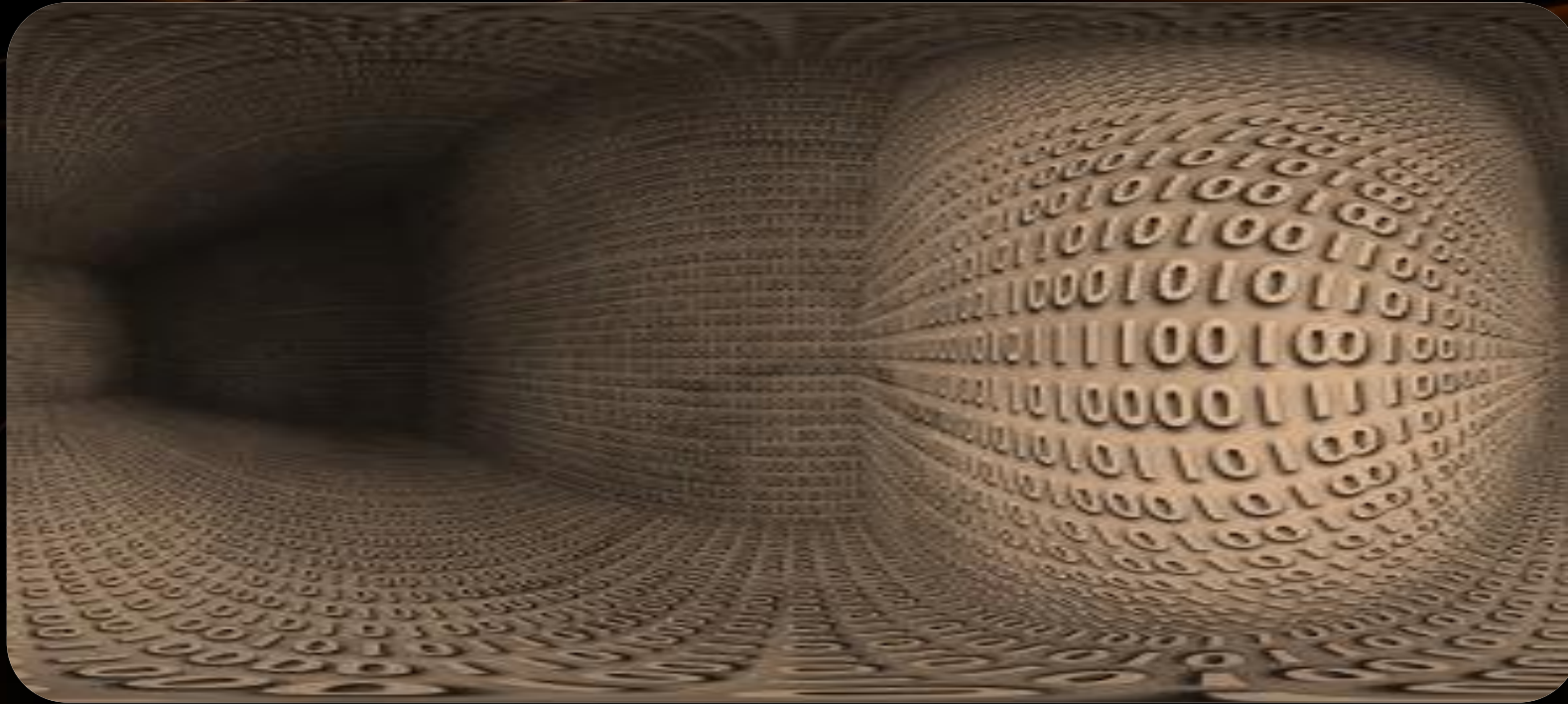
Bit Manipulation Operators, Extracting and Changing Bits



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```
int bit = (n & (1 << p)) >> p;  
n = n & (~ (1 << p)) | (bit << p);
```



Bitwise Operators

Bitwise Operators

- Bitwise operator `~` turns all `0` to `1` and all `1` to `0`
 - Like `!` for boolean expressions but bit by bit
- The operators `|`, `&` and `^` behave like `||`, `&&` and `^` for boolean expressions but bit by bit
- The `<<` and `>>` move the bits (left or right)
- Behavior of the operators `|`, `&` and `^`:

Operator					&	&	&	&	^	^	^	^
Operand1	0	0	1	1	0	0	1	1	0	0	1	1
Operand2	0	1	0	1	0	1	0	1	0	1	0	1
Result	0	1	1	1	0	0	0	1	0	1	1	0

Bitwise Operators (2)

- Bitwise operators are used on integer numbers (**char**, **int**, **unsigned int**, **long**, **unsigned long**, etc.)
- Bitwise operators are applied bit by bit
- Examples:

```
unsigned short a = 3;      // 00000000 00000011
unsigned short b = 5;      // 00000000 00000101
printf("%d\n", a | b);     // 00000000 00000111
printf("%d\n", a & b);     // 00000000 00000001
printf("%d\n", a ^ b);     // 00000000 00000110
printf("%d\n", ~a & b);    // 00000000 00000100
printf("%d\n", a << 1);    // 00000000 00000110
printf("%d\n", a >> 1);    // 00000000 00000001
```

Bitwise Operators – Tips & Tricks

- How to get the bit at position **p** from a number **n**?

```
int p = 5;  
int n = 291;           // 00000001 00100011  
int nRightP = n >> p;  // 00000000 00001001  
int bit = nRightP & 1;  // 00000000 00000001  
printf("%d", bit);     // 1
```

- How to set the bit at position **p** to **0**?

```
int p = 5;  
int n = 291;           // 00000001 00100011  
int mask = ~(1 << p);  // 11111111 11011111  
int result = n & mask;  // 00000001 00000011  
printf("%d", result);   // 259
```



Bitwise Operators – Tips & Tricks (2)

- How to set the bit at position **p** to **1**?

```
int p = 4;
int n = 291;           // 00000001 00100011
int mask = 1 << p;    // 00000000 00010000
int result = n | mask; // 00000001 00110011
printf("%d", result);  // 307
```



Bitwise Operators

Live Demo



C Programming – Characters and Strings



Questions?



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