Bitwise Operators and Expressions
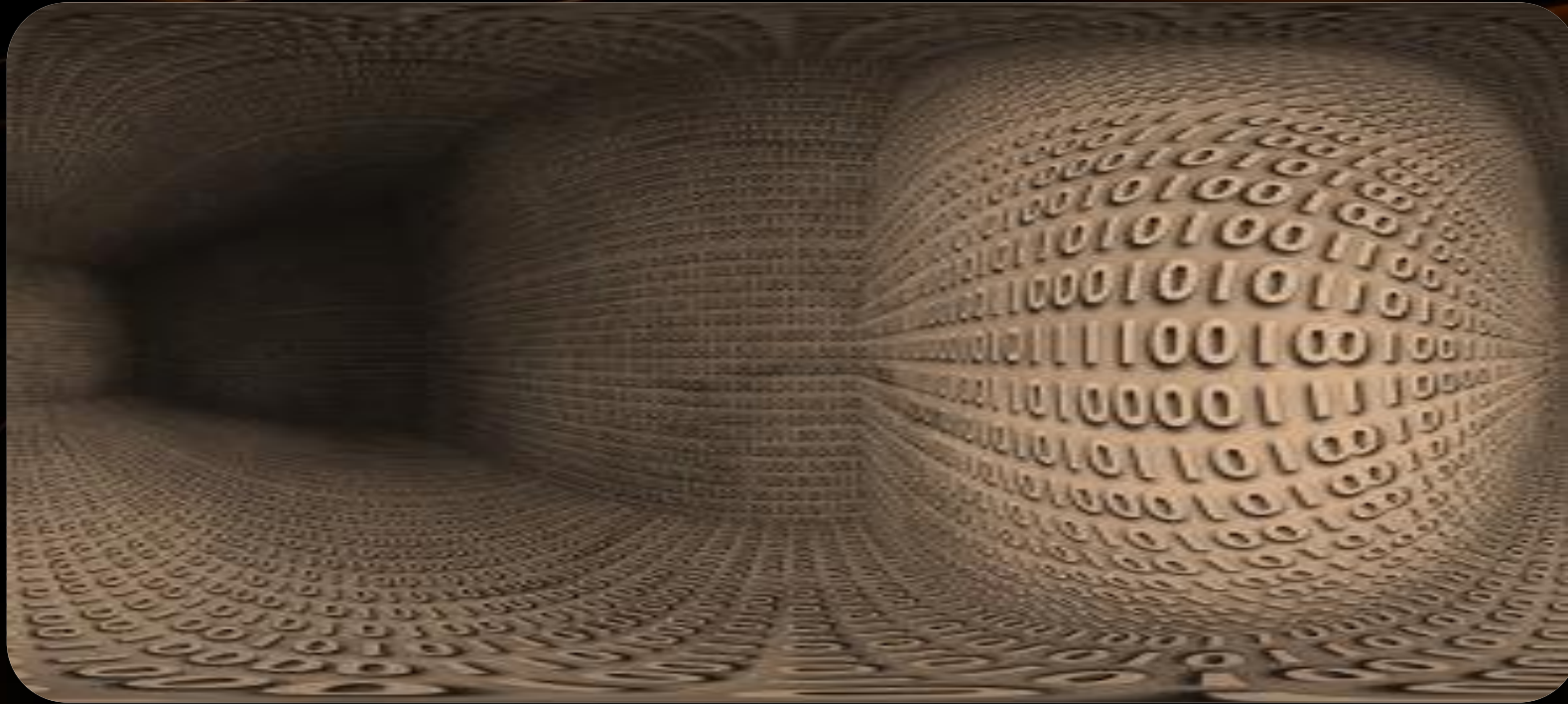
Bit Manipulation Operators, Extracting and Changing Bits

Programming with C

SoftUni Team

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```c
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?

https://softuni.bg/trainings/1212/C-Programming-October-2015

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