

Numbers in C (1C)

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Format String

2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|



```
#include <stdio.h>
```

```
void main() {  
    unsigned char x;
```

```
    x = 65;
```

```
    printf("x in decimal      = %d \n", x);  
    printf("x in hexadecimal = %x \n", x);  
    printf("x in octal       = %o \n", x);  
    printf("x in ASCII char  = %c \n", x);
```

```
}
```

2^7 2^6 2^5 2^4 2^3 2^2 2^1 2^0

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|---|---|

x in decimal = 65
x in hexadecimal = 41
x in octal = 101
x in ASCII char = A

Singed & Unsigned Numbers

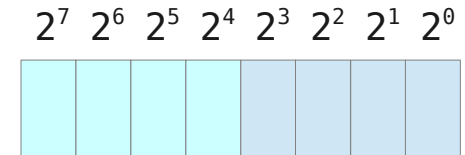
unsigned char x;
(signed) **char** y;

```
-----  
x = 127 0x7f    y = +127 0x0000007f  
x = 128 0x80    y = -128 0xffffffff80  
x = 129 0x81    y = -127 0xffffffff81  
-----  
x = 255 0xff    y = -1 0xffffffffff  
-----  
x = 128 0x80    y = -128 0xffffffff80  
x = 129 0x81    y = -127 0xffffffff81  
x = 130 0x82    y = -126 0xffffffff82  
-----  
x = 255 0xff    y = -1 0xffffffffff
```

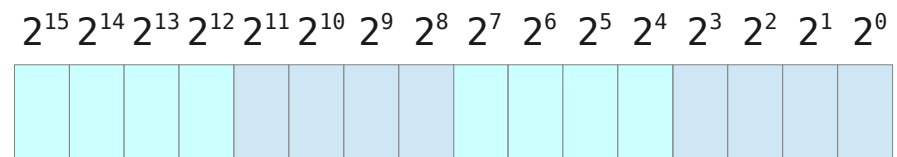
```
printf("-----\n");  
x = y = 127;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);  
x = y = 128;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);  
x = y = 129;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);  
printf("-----\n");  
x = y = 255;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);  
printf("-----\n");  
y = x = -128;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);  
y = x = -127;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);  
y = x = -126;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);  
printf("-----\n");  
y = x = -1;  
printf("x = %d %#0x  y = %+5d %#010x\n", x, x, y, y);
```

Unsigned Integer Numbers in 1, 2, 4 Bytes

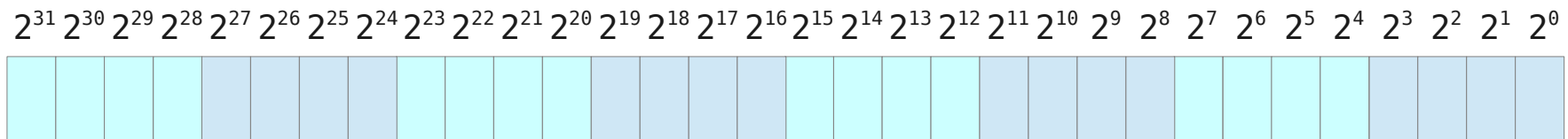
1 Byte : unsigned char



2 Bytes: unsigned short



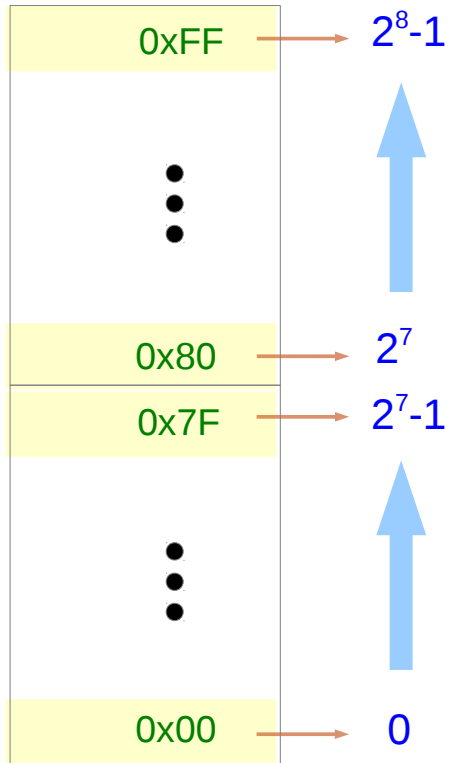
4 Bytes: unsigned int
unsigned long



Unsigned Integer Ranges

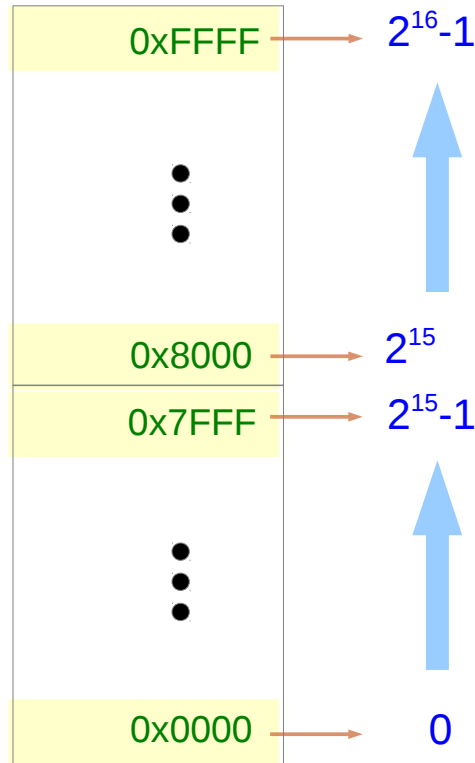
1 Byte

| | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 2^7 | 2^6 | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |
|-------|-------|-------|-------|-------|-------|-------|-------|



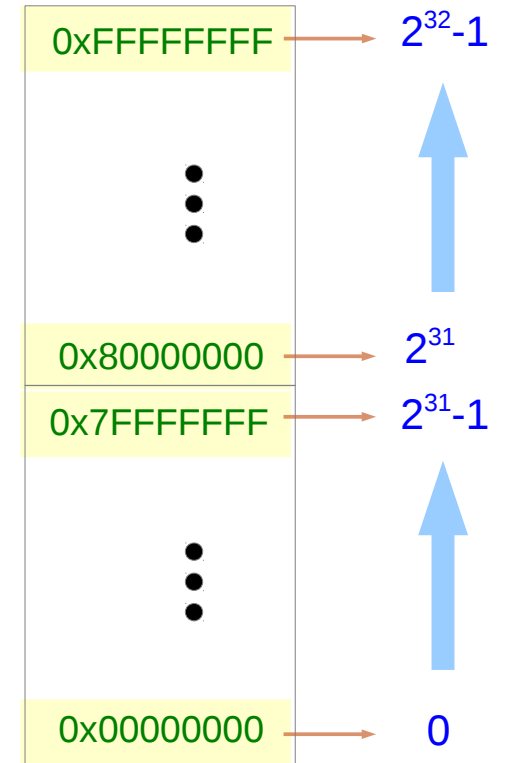
2 Bytes

| | | | | | | | |
|----------|----------|----------|----------|----------|----------|-------|-------|
| 2^{15} | 2^{14} | 2^{13} | 2^{12} | 2^{11} | 2^{10} | 2^9 | 2^8 |
| 2^7 | 2^6 | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |



4 Bytes

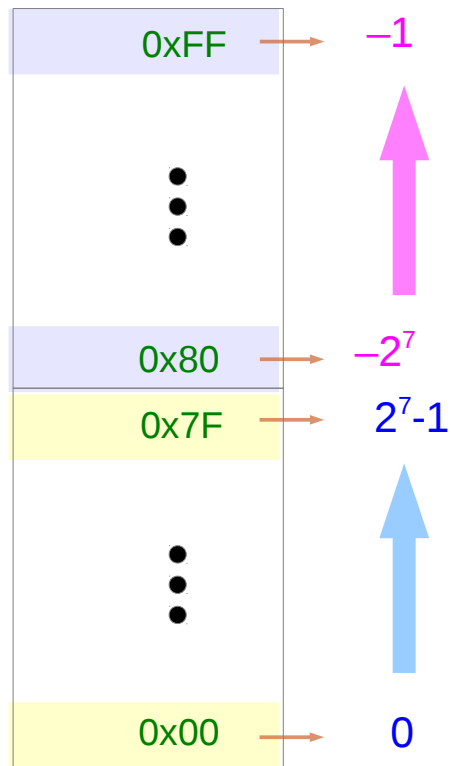
| | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 2^{31} | 2^{30} | 2^{29} | 2^{28} | 2^{27} | 2^{26} | 2^{25} | 2^{24} |
| 2^{23} | 2^{22} | 2^{21} | 2^{20} | 2^{19} | 2^{18} | 2^{17} | 2^{16} |
| 2^{15} | 2^{14} | 2^{13} | 2^{12} | 2^{11} | 2^{10} | 2^9 | 2^8 |
| 2^7 | 2^6 | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |



Signed Integer Ranges

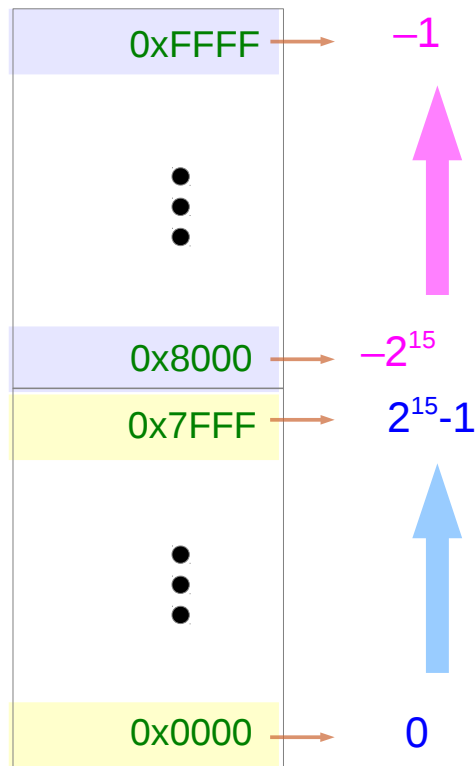
1 Byte

| | | | | | | | |
|-------|-------|-------|-------|-------|-------|-------|-------|
| 2^7 | 2^6 | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |
|-------|-------|-------|-------|-------|-------|-------|-------|



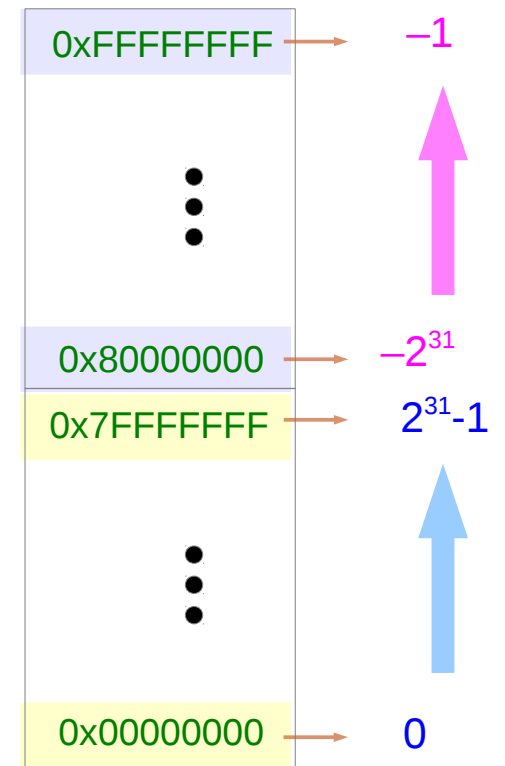
2 Bytes

| | | | | | | | |
|----------|----------|----------|----------|----------|----------|-------|-------|
| 2^{15} | 2^{14} | 2^{13} | 2^{12} | 2^{11} | 2^{10} | 2^9 | 2^8 |
| 2^7 | 2^6 | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |



4 Bytes

| | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 2^{31} | 2^{30} | 2^{29} | 2^{28} | 2^{27} | 2^{26} | 2^{25} | 2^{24} |
| 2^{23} | 2^{22} | 2^{21} | 2^{20} | 2^{19} | 2^{18} | 2^{17} | 2^{16} |
| 2^{15} | 2^{14} | 2^{13} | 2^{12} | 2^{11} | 2^{10} | 2^9 | 2^8 |
| 2^7 | 2^6 | 2^5 | 2^4 | 2^3 | 2^2 | 2^1 | 2^0 |



Signed & Unsigned Interpretation of Hex Numbers

```

unsigned char  x1;
signed   char  y1;
unsigned short x2;
signed   short y2;
unsigned int   x4;
signed   int   y4;
    
```

```

x1 = y1 = 0x7F;   x2 = y2 = 0x7FFF;   x4 = y4 = 0x7FFFFFFF;
x1 = y1 = 0x80;   x2 = y2 = 0x7FFF;   x4 = y4 = 0x80000000;
x1 = y1 = 0x81;   x2 = y2 = 0xFFFF;   x4 = y4 = 0xFFFFFFFF;
    
```



```
printf("x = %+12d %+12x  y = %+12d %+12x\n", x, x, y, y);
```

```

-----
x1 =      +127          7f   y1 =      +127          7f
x1 =      +128          80   y1 =      -128        ffffffff80
x1 =      +255          ff   y1 =       -1         ffffffff

-----
x2 =     +32767         7fff   y2 =     +32767         7fff
x2 =     +32768         8000   y2 =     -32768        ffff8000
x2 =     +65535         ffff   y2 =       -1         ffffffff

-----
x4 = +2147483647       7fffffff   y4 = +2147483647       7fffffff
x4 = -2147483648       80000000   y4 = -2147483648       80000000
x4 =          -1       ffffffff   y4 =          -1       ffffffff
-----
    
```

```

X1, x1, y1, y1
X2, x2, y2, y2
X4, x4, y4, y4
    
```



Laplace Equation

Laplace Equation

References

- [1] <http://en.wikipedia.org/>
- [2] <http://planetmath.org/>
- [3] M.L. Boas, "Mathematical Methods in the Physical Sciences"