Tutorial 1
Data types and Conversion

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What to do in Tutorials?

- Discussion of 10 topics in C programming
- Doing exercises
- Q/A: any questions on programming with C

Topics to discuss in Tutorials:

- **Input/Output**
- **Data types and conversion**
- **Control and iteration**
- **Pointers**
- **Functions**
- **Passing by values vs. passing by references**
- **Memory allocation**
- **Pointer to pointer**
- **Macro and Header**
- **Some data structures**

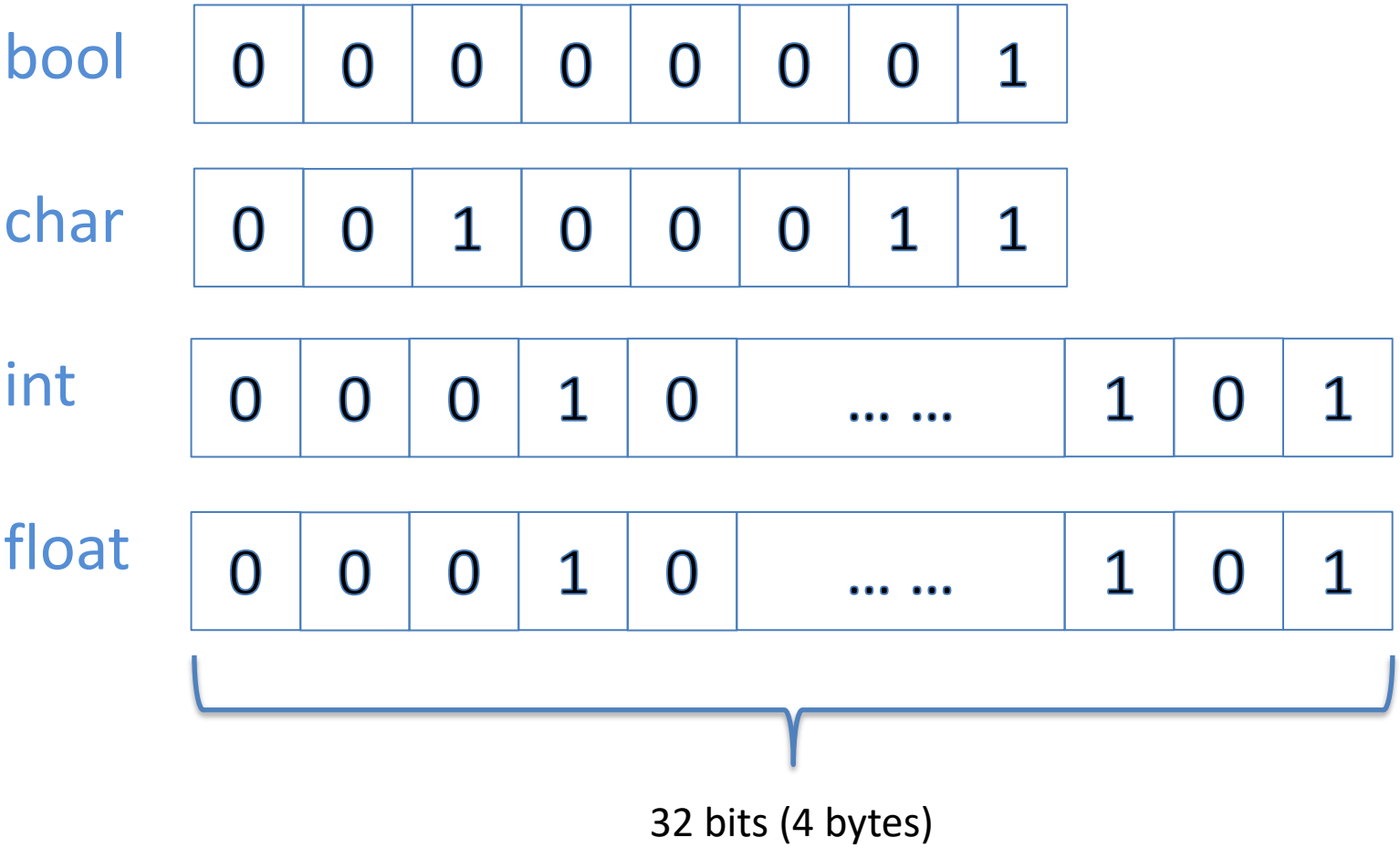
An example:

```
#include <stdio.h>
int main()
{
   int a = 2;
   float b = 1.5;
   int c;


   c = a+b;    // question 1: what value is c?
   b = c/a;    // question 2: what value is b?
  printf("%d,%.2f\n", c, b); // question 3: what is the output?;


   return 0;
}
```

Data types

• bool	logic	true or false	8bit=1byte	
• char	character	‘A’	8bit	1
• int	integer	2	32bit	4
• float	real	2.4	32bit	4
• double	real	3.1415926	64bit	8

Other keywords for data type: short, long, unsigned


bool
0 0 0 0 0 0 0 1
char
0 0 1 0 0 0 1 1
int
0 0 0 1 0 … … 1 0 1
float
0 0 0 1 0 … … 1 0 1
32 bits (4 bytes)

Conversions

General rule:

1. Once defined, the data type of a variable cannot change.
2. Same data type can be operated directly; different data types should be converted to same type.

Several operators convert operand values from one type to another automatically.

1. characters, and integers.

   char--> short --> int

2. double, float and integer

   int --> float --> double

3. float(double) --> integer (only for assignment operation)

An example:

```
#include <stdio.h>
int main()
{
   int a = 2;
   float b = 1.5;
   int c;


   c = a+b;    // question 1: what value is c?
   b = c/a;    // question 2: what value is b?
  printf(“%d,%.2f\n”, c, b); // question 3: what is the output?;


   return 0;
}
```

Conversions

Several operators convert operand values from one type to another automatically.

```
#include <stdio.h>
int main()
{
     int a = 2;
     char b = ‘A’;  // ‘A’==65
     float c = 1.5;
     double d = 3.1415926;
     float x;

     x = a+b+c+d;
     c = a/3;
     b = b+1;
     d = d*a*a;
     printf(“%c,%f,%lf\n”, b, c, d);

     return 0;
}
```

Frequent mistakes

- Integer divisions

  a=2/3*b;

- Divided by zero

  a=b/c;

- Comparison operator ‘==’

  float a= b*c-d+e…;

  if(a=0) …;

Exercise 1

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

int main()
{
      bool a = true; // true == 1
      char x = ‘A’;  // ‘A’ == 65
      int b = 2;
      float c = 3;
      double d = 3.1415926;

      b = b/3*c;
      printf(“%d\n”, b);  // question 1

      c = a/2.0*c;
      printf(“%f\n”, c);  // question 2

      d = d*2/a;
      printf(“%f\n”, d);  // question 3

      a = a+1;
      printf(“%d\n”, a);  // question 4

      x = x+1;
      printf(“%c\n”, x);  // question 5
      return 0;
}
```

Exercise 2

Write a program to compute the body mass index (BMI). Input variables are the weight (in kg) and height (in metre). Compute BMI by formula

BMI= weight/(height*height);

Category	BMI
Underweight	<= 18.4
Normal	18.4 ~ 24.9
Overweight	24.9 ~ 30.0
Obese	>= 30.0

Output in which category the user belongs to.

Exercise 3: C Math Functions

Write a program which computes 2^16.

1)	ceil(number)	rounds up the given number. It returns the integer value which is greater than or equal to given number.
2)	floor(number)	rounds down the given number. It returns the integer value which is less than or equal to given number.
3)	sqrt(number)	returns the square root of given number.
4)	pow(base, exponent)	returns the power of given number.
5)	abs(number)	returns the absolute value of given number.