Tutorial 1
Data types and Conversion

Jiawei Li (Michael)

Office hours: Tuesday 3:00-5:00pm
Office: PMB426
Email: jiawei.li@nottingham.edu.cn

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**

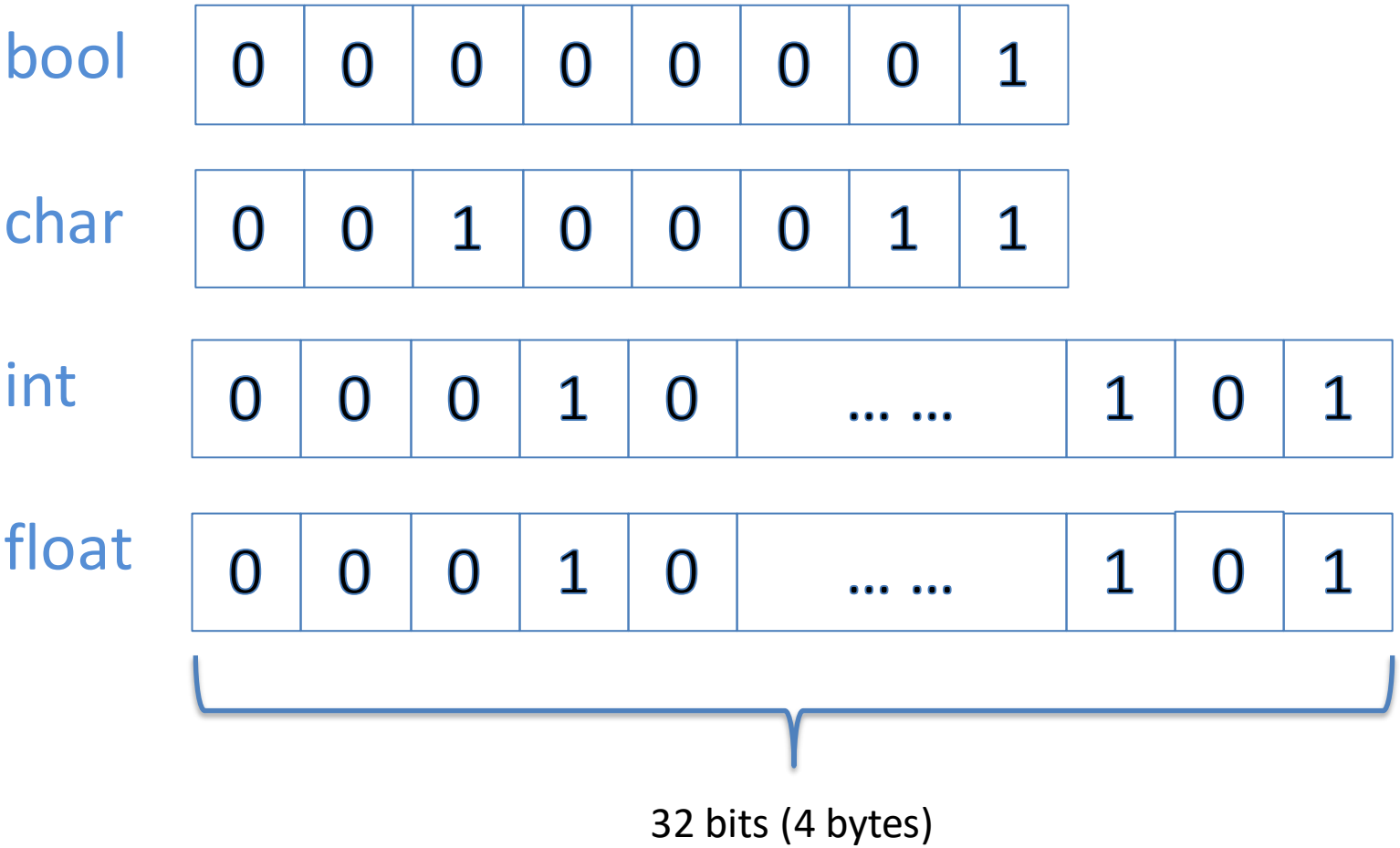
An example:

```
#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:

```c
#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

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

int main()
{
      int a = -2;

      if(a)
            printf("True.");
      else
            printf("False.");
                                    // question 1

      while(a)
      {
            printf("%d\n", a);
            a = a + 1;
      }
                                    // question 2

      if(a)
            printf("True.");
      else
            printf("False.");
                                    // question 3
      return;
}
```

Exercise 3

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	25.0 ~ 30.0
Obese	>= 30.0

Output in which category the user belongs to.