Tutorial 1
Data types and Conversion

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What to do in Tutorials?

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

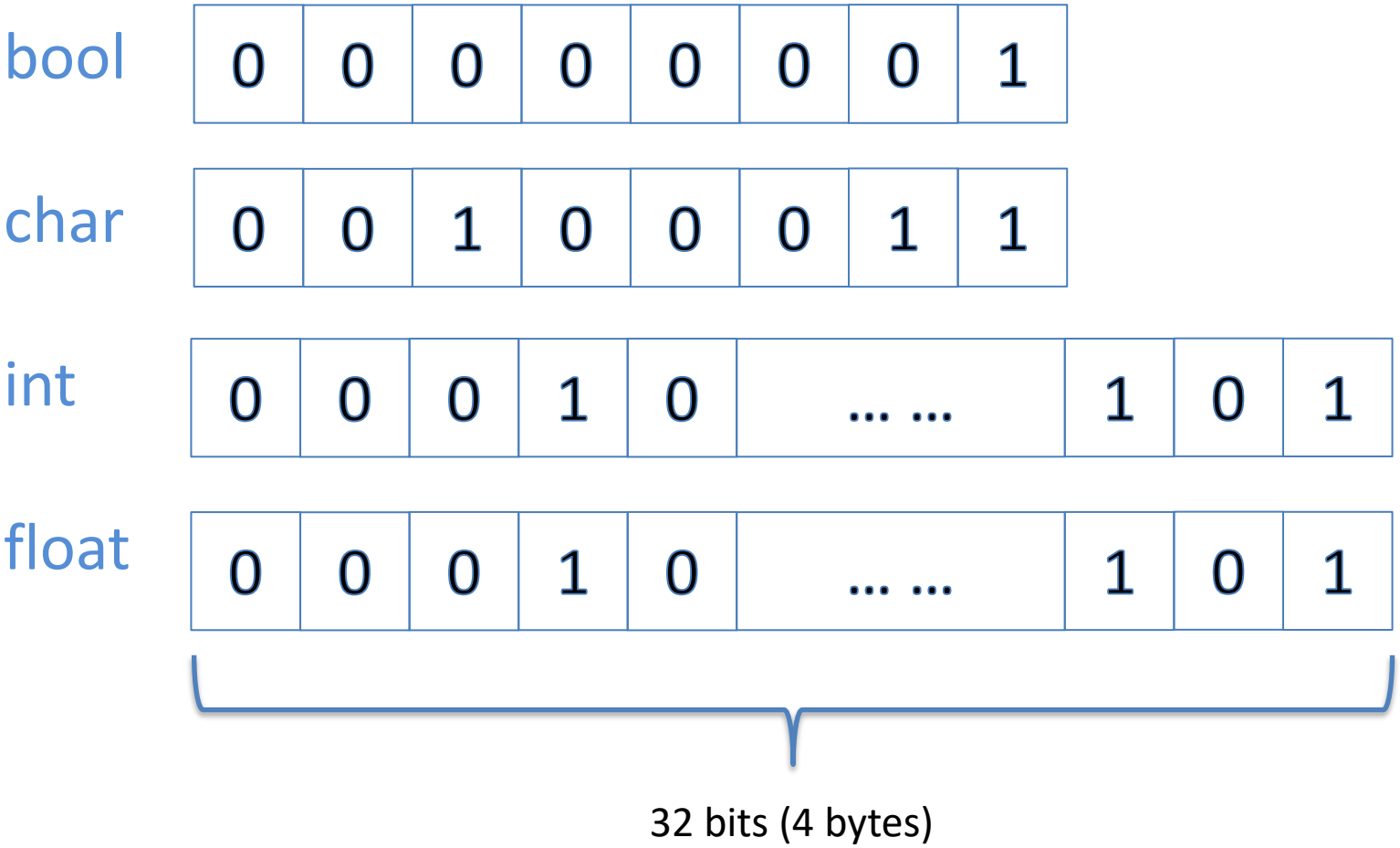
An example:

```
#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 rules:

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	25.0 ~ 30.0
Obese	>= 30.0

Output in which category the user belongs to.

Exercise 3 C Math Functions

Test these math functions in a program, understand the data types of parameters and return values.

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)	fabs(number)	returns the absolute value of given number.