Why learn C (after Java)?

- Both high-level and low-level language
- Better control of low-level mechanisms
- Performance better than Java (Unix, NT !)
- Java hides many details needed for writing OS code

  But,….
- Memory management responsibility
- Explicit initialization and error detection
- More room for mistakes

Simple Example

```
#include <stdio.h>
void main(void)
{
    /* print out a message */
    printf("Hello World. \n \t and you ! \n ");
    return;
}
```

- `#include <stdio.h>` = include header file stdio.h
  - No semicolon at end
  - Small letters only – C is case-sensitive
- `void main(void){ … }` is the only code executed
- `printf(" /* message you want printed */ ");`
- `\n` = newline `\t` = tab

Simple Data Types

Data type	#bytes	Values	Short-hand
int	4	**-2,147,483,648 to 2,147,483,647**	%d
char	1	**-128 to 127**	%c
float	4	**3.4E+/-38 (7 digits)**	%f
double	8	**1.7E+/-308 (15 digits long)**	%lf
long	4	**-2,147,483,648 to 2,147,483,647**	%l
Short	2	**-32,768 to 32,767**	
long long int	8	Very long ;)	%lld

Like Java, like C

- Operators same as Java:
  - Arithmetic
    - `int i = i+1; i++; i--; i *= 2;`
    - `+, -, *, /, %,`
  - Relational and Logical
    - `<, >, <=, >=, ==, !=`
    - `&&, ||, &, |, !`
- Syntax same as in Java:
  - `if ( ) { } else { }`
  - `while ( ) { }`
  - `do { } while ( );`
  - `for(i=1; i <= 100; i++) { }`
  - `switch ( ) {case 1: … }`
  - `continue; break;`

Like Java, somewhat like C

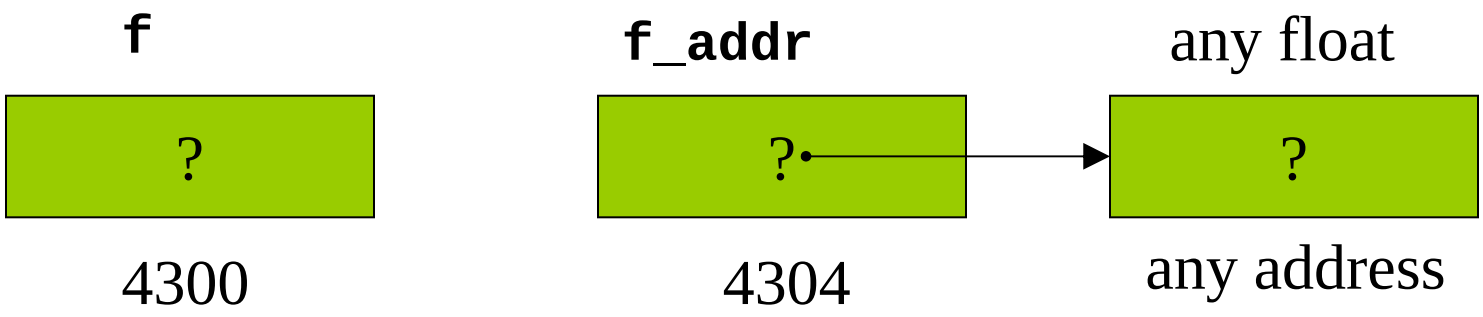
- Type conversions
  - but you can typecast from any type to any type
    - `c = (char) some_int;`
  - So be careful !
- Arrays
  - *Always* initialize before use
  - `int number[12];`
    `printf("%d", number[20]);`
    - produces undefined output, may terminate,
      Strings are terminated by `'\0'` character

```
char name[6] = {'C','S','4','1','4','\0'};
                                /* '\0'= end of string */
printf("%s", name); /* print until '\0' */
```

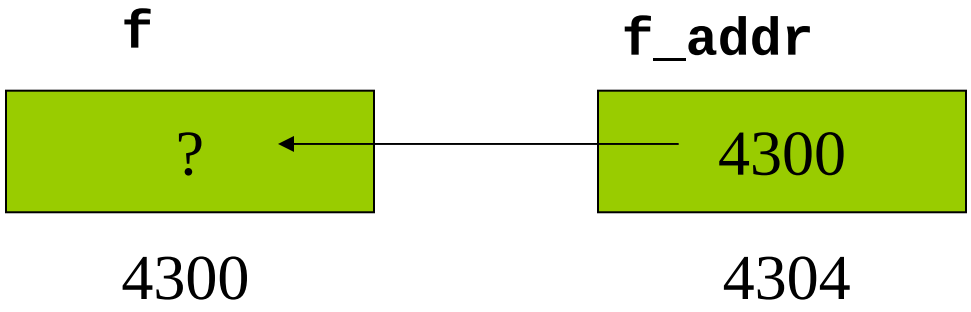
Pointers made easy - 1

- *Pointer* = variable containing address of another variable

```
float f;          /* data variable */
float *f_addr;    /* pointer variable */
```

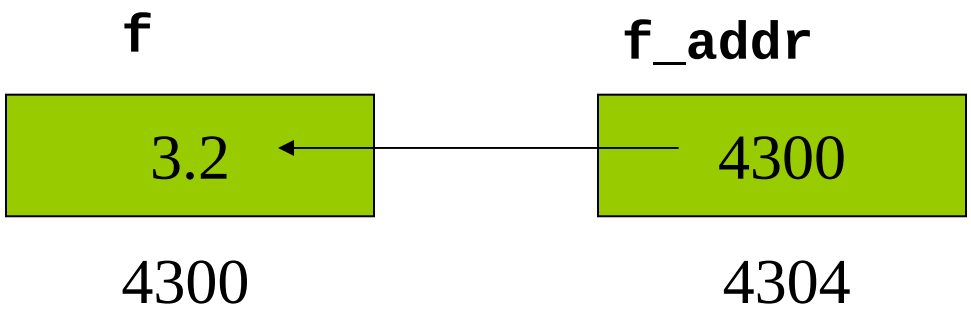



```
f_addr = &f; /* & = address operator */
```



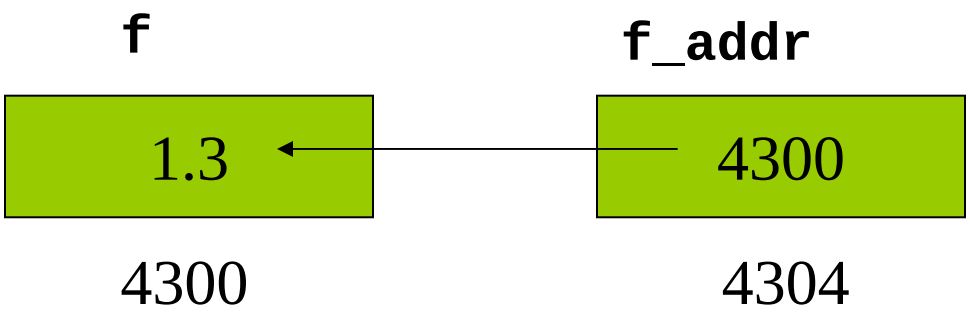
Pointers made easy - 2

```
*f_addr = 3.2;    /* indirection operator */
```




```
float g=*f_addr; /* indirection:g is now 3.2 */

f = 1.3;
```



Pointer Example

```
#include <stdio.h>

void main(void) {
      int j;
      int *ptr;

      ptr=&j;   /* initialize ptr before using it */
                /* *ptr=4 does NOT initialize ptr */

      *ptr=4;     /* j <- 4 */

      j=*ptr;     /* j <- ??? */
}
```

Why pointer arguments?!

```
#include <stdio.h>
void swap(int, int);
main() {
  int num1 = 5, num2 = 10;
  swap(num1, num2);
  printf(“num1 = %d and num2 = %d\n”, num1, num2);
}
void swap(int n1, int n2) { /* passed by value */
  int temp;

  temp = n1;
  n1 = n2;
  n2 = temp;
}
```

Why pointer arguments? This is why

```
#include <stdio.h>

void swap(int *, int *);

main() {
  int num1 = 5, num2 = 10;
  swap(&num1, &num2);
  printf(“num1 = %d and num2 = %d\n”, num1, num2);
}

void swap(int *n1, int *n2) { /* passed and returned by
                                          pointer */
  int temp;

  temp = *n1;
  *n1 = *n2;
  *n2 = temp;
}
```

Structures

- Equivalent of Java's classes with only data (no methods)

```
#include <stdio.h>

struct birthday{
    int month;
    int day;
    int year;
  };

main() {
  struct birthday mybday;     /* - no 'new' needed ! */
                              /* then, it's just like Java ! */
  mybday.day=1; mybday.month=1; mybday.year=1977;
  printf("I was born on %d/%d/%d", birth.day,
                                 birth.month, birth.year);
}
```

More on Structures

```
struct person{
    char name[41];
    int age;
    float height;
    struct {        /* embedded structure */
      int month;
      int day;
      int year;
    } birth;
 };

struct person me;

me.birth.year=1977;……

struct person class[60];
      /* array of info about everyone in class */

class[0].name="Gun"; class[0].birth.year=1971;……
```

enum - enumerated data types

```
#include <stdio.h>
enum month{
      JANUARY,       /* like #define JANUARY 0 */
      FEBRUARY,      /* like #define FEBRUARY 1 */
      MARCH          /* … */
};

/* JANUARY is the same as month.JANUARY */

/* alternatively, …. */

enum month{
      JANUARY=1,     /* like #define JANUARY 1 */
      FEBRUARY,      /* like #define FEBRUARY 2 */
      MARCH          /* … */
};
```

Synonym for a data type

```
typedef int Employees;

Employees my_company;  /* same as int my_company; */

typedef struct person Person;

Person me;             /* same as struct person me; */

typedef struct person *Personptr;

Personptr ptrtome;     /* same as struct person *ptrtome;*/
```

- Easier to remember
- Clean code

Externs

```
#include <stdio.h>

extern char user2line [20];   /* global variable defined
                                 in another file */
char user1line[30];           /* global for this file */
void dummy(void);

void main(void) {
 char user1line[20];        /* different from earlier
                               user1line[30] */
 . . .                      /* restricted to this func */
}

void dummy(){
 extern char user1line[];  /* the global user1line[30] */
 . . .
}
```