河南工业大学 Linux 基础与应用 实验报告

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实验题目： Linux 下 C 语言编程

实验目的： （1）理解 GCC；（2）理解程序维护工具 make。

实验内容：

1. 简单的编写一个 C 语言程序，使用 GCC 编译该程序，要求按照以下步骤进行：预处理、编译、汇编、连接，并查看中间结果。
2. 编写两个 C 语言程序，其中一个程序的编译需要另一个程序的编译完成，试写出一个 makefile 文件，并测试。

实验步骤：

本次实验在 Mac OS X Yosemite 上运行。

脚本的运行结果如图??。

1.

```
$ ls
aplusb.c
$ gcc -E aplusb.c -o aplusb.i
$ ls
aplusb.c aplusb.i
$ gcc -S aplusb.c -o aplusb.s
$ ls
aplusb.c aplusb.i aplusb.s
$ gcc -c aplusb.s -o aplusb.o
$ ls
aplusb.c aplusb.i aplusb.o aplusb.s
$ gcc aplusb.o -o aplusb
$ ls
aplusb   aplusb.c aplusb.i aplusb.o aplusb.s
$ ./aplusb
12 34
46
```

Listing 1: aplusb.c

```c
#include <stdio.h>

int main(int argc, char* argv[])
{
        int a, b;
        scanf("%d%d", &a, &b);
        int c = a + b;
        printf("%d\n", c);
        return 0;
}
```

2.

Listing 2: aplusb.i

```
# 1 "aplusb.c"
# 1 "<built-in>" 1
# 1 "<built-in>" 3
# 321 "<built-in>" 3
# 1 "<command line>" 1
# 1 "<built-in>" 2
# 1 "aplusb.c" 2
# 1 "/usr/include/stdio.h" 1 3 4
# 64 "/usr/include/stdio.h" 3 4
# 1 "/usr/include/sys/cdefs.h" 1 3 4
# 506 "/usr/include/sys/cdefs.h" 3 4
# 1 "/usr/include/sys/_symbol_aliasing.h" 1 3 4
# 507 "/usr/include/sys/cdefs.h" 2 3 4
# 572 "/usr/include/sys/cdefs.h" 3 4
# 1 "/usr/include/sys/_posix_availability.h" 1 3 4
# 573 "/usr/include/sys/cdefs.h" 2 3 4
# 65 "/usr/include/stdio.h" 2 3 4
# 1 "/usr/include/Availability.h" 1 3 4
# 153 "/usr/include/Availability.h" 3 4
# 1 "/usr/include/AvailabilityInternal.h" 1 3 4
# 154 "/usr/include/Availability.h" 2 3 4
# 66 "/usr/include/stdio.h" 2 3 4

# 1 "/usr/include/_types.h" 1 3 4
# 27 "/usr/include/_types.h" 3 4
# 1 "/usr/include/sys/_types.h" 1 3 4
# 33 "/usr/include/sys/_types.h" 3 4
# 1 "/usr/include/machine/_types.h" 1 3 4
# 32 "/usr/include/machine/_types.h" 3 4
# 1 "/usr/include/i386/_types.h" 1 3 4
# 37 "/usr/include/i386/_types.h" 3 4
typedef signed char __int8_t;



typedef unsigned char __uint8_t;
typedef short __int16_t;
typedef unsigned short __uint16_t;
typedef int __int32_t;
typedef unsigned int __uint32_t;
typedef long long __int64_t;
typedef unsigned long long __uint64_t;

typedef long __darwin_intptr_t;
typedef unsigned int __darwin_natural_t;
# 70 "/usr/include/i386/_types.h" 3 4
typedef int __darwin_ct_rune_t;





typedef union {
 char __mbstate8[128];
 long long _mbstateL;
} __mbstate_t;

typedef __mbstate_t __darwin_mbstate_t;


typedef long int __darwin_ptrdiff_t;







typedef long unsigned int __darwin_size_t;





typedef __builtin_va_list __darwin_va_list;





typedef int __darwin_wchar_t;




typedef __darwin_wchar_t __darwin_rune_t;


typedef int __darwin_wint_t;




typedef unsigned long __darwin_clock_t;
typedef __uint32_t __darwin_socklen_t;
typedef long __darwin_ssize_t;
typedef long __darwin_time_t;
```

```
# 33 "/usr/include/machine/_types.h" 2 3 4
# 34 "/usr/include/sys/_types.h" 2 3 4
# 55 "/usr/include/sys/_types.h" 3 4
typedef __int64_t __darwin_blkcnt_t;
typedef __int32_t __darwin_blksize_t;
typedef __int32_t __darwin_dev_t;
typedef unsigned int __darwin_fsblkcnt_t;
typedef unsigned int __darwin_fsfilcnt_t;
typedef __uint32_t __darwin_gid_t;
typedef __uint32_t __darwin_id_t;
typedef __uint64_t __darwin_ino64_t;

typedef __darwin_ino64_t __darwin_ino_t;



typedef __darwin_natural_t __darwin_mach_port_name_t;
typedef __darwin_mach_port_name_t __darwin_mach_port_t;
typedef __uint16_t __darwin_mode_t;
typedef __int64_t __darwin_off_t;
typedef __int32_t __darwin_pid_t;
typedef __uint32_t __darwin_sigset_t;
typedef __int32_t __darwin_suseconds_t;
typedef __uint32_t __darwin_uid_t;
typedef __uint32_t __darwin_useconds_t;
typedef unsigned char __darwin_uuid_t[16];
typedef char __darwin_uuid_string_t[37];


# 1 "/usr/include/sys/_pthread/_pthread_types.h" 1 3 4
# 57 "/usr/include/sys/_pthread/_pthread_types.h" 3 4
struct __darwin_pthread_handler_rec {
 void (*__routine)(void *);
 void *__arg;
 struct __darwin_pthread_handler_rec *__next;
};

struct _opaque_pthread_attr_t {
 long __sig;
 char __opaque[56];
};

struct _opaque_pthread_cond_t {
 long __sig;
 char __opaque[40];
};

struct _opaque_pthread_condattr_t {
 long __sig;
 char __opaque[8];
};

struct _opaque_pthread_mutex_t {
 long __sig;
 char __opaque[56];
};

struct _opaque_pthread_mutexattr_t {
 long __sig;
 char __opaque[8];
};

struct _opaque_pthread_once_t {
 long __sig;
 char __opaque[8];
};

struct _opaque_pthread_rwlock_t {
 long __sig;
 char __opaque[192];
};

struct _opaque_pthread_rwlockattr_t {
 long __sig;
 char __opaque[16];
};

struct _opaque_pthread_t {
 long __sig;
 struct __darwin_pthread_handler_rec *__cleanup_stack;
 char __opaque[8176];
};

typedef struct _opaque_pthread_attr_t __darwin_pthread_attr_t;
typedef struct _opaque_pthread_cond_t __darwin_pthread_cond_t;
typedef struct _opaque_pthread_condattr_t __darwin_pthread_condattr_t;
typedef unsigned long __darwin_pthread_key_t;
typedef struct _opaque_pthread_mutex_t __darwin_pthread_mutex_t;
typedef struct _opaque_pthread_mutexattr_t __darwin_pthread_mutexattr_
typedef struct _opaque_pthread_once_t __darwin_pthread_once_t;
typedef struct _opaque_pthread_rwlock_t __darwin_pthread_rwlock_t;
typedef struct _opaque_pthread_rwlockattr_t __darwin_pthread_rwlockatt
typedef struct _opaque_pthread_t *__darwin_pthread_t;
# 81 "/usr/include/sys/_types.h" 2 3 4
# 28 "/usr/include/_types.h" 2 3 4
# 39 "/usr/include/_types.h" 3 4
typedef int __darwin_nl_item;
typedef int __darwin_wctrans_t;

typedef __uint32_t __darwin_wctype_t;
# 68 "/usr/include/stdio.h" 2 3 4



# 1 "/usr/include/sys/_types/_va_list.h" 1 3 4
# 31 "/usr/include/sys/_types/_va_list.h" 3 4
typedef __darwin_va_list va_list;
# 72 "/usr/include/stdio.h" 2 3 4
# 1 "/usr/include/sys/_types/_size_t.h" 1 3 4
# 30 "/usr/include/sys/_types/_size_t.h" 3 4
typedef __darwin_size_t size_t;
# 73 "/usr/include/stdio.h" 2 3 4
# 1 "/usr/include/sys/_types/_null.h" 1 3 4
# 74 "/usr/include/stdio.h" 2 3 4

# 1 "/usr/include/sys/stdio.h" 1 3 4
# 39 "/usr/include/sys/stdio.h" 3 4
int renameat(int, const char *, int, const char *) __attribute__((avai
# 76 "/usr/include/stdio.h" 2 3 4

typedef __darwin_off_t fpos_t;
# 88 "/usr/include/stdio.h" 3 4
struct __sbuf {
 unsigned char *_base;
 int _size;
};


struct __sFILEX;
# 122 "/usr/include/stdio.h" 3 4
typedef struct __sFILE {
 unsigned char *_p;
 int _r;
 int _w;
 short _flags;
 short _file;
 struct __sbuf _bf;
 int _lbfsize;


 void *_cookie;
 int (*_close)(void *);
 int (*_read) (void *, char *, int);
 fpos_t (*_seek) (void *, fpos_t, int);
 int (*_write)(void *, const char *, int);


 struct __sbuf _ub;
 struct __sFILEX *_extra;
 int _ur;


 unsigned char _ubuf[3];
 unsigned char _nbuf[1];


 struct __sbuf _lb;


 int _blksize;
 fpos_t _offset;
} FILE;


extern FILE *__stdinp;
extern FILE *__stdoutp;
extern FILE *__stderrp;
# 231 "/usr/include/stdio.h" 3 4
void clearerr(FILE *);
int fclose(FILE *);
int feof(FILE *);
int ferror(FILE *);
int fflush(FILE *);
int fgetc(FILE *);
int fgetpos(FILE * restrict, fpos_t *);
char *fgets(char * restrict, int, FILE *);



FILE *fopen(const char * restrict, const char * restrict) __asm("_" "f

int fprintf(FILE * restrict, const char * restrict, ...) __attribute__
int fputc(int, FILE *);
int fputs(const char * restrict, FILE * restrict) __asm("_" "fputs" );
size_t fread(void * restrict, size_t, size_t, FILE * restrict);
FILE *freopen(const char * restrict, const char * restrict,
                 FILE * restrict) __asm("_" "freopen" );
int fscanf(FILE * restrict, const char * restrict, ...) __attribute__(
int fseek(FILE *, long, int);
int fsetpos(FILE *, const fpos_t *);
long ftell(FILE *);
size_t fwrite(const void * restrict, size_t, size_t, FILE * restrict)
int getc(FILE *);
int getchar(void);
char *gets(char *);
void perror(const char *);
```

```c
int printf(const char * restrict, ...) __attribute__((__format__ (__pr
int putc(int, FILE *);
int putchar(int);
int puts(const char *);
int remove(const char *);
int rename (const char *, const char *);
void rewind(FILE *);
int scanf(const char * restrict, ...) __attribute__((__format__ (__sca
void setbuf(FILE * restrict, char * restrict);
int setvbuf(FILE * restrict, char * restrict, int, size_t);
int sprintf(char * restrict, const char * restrict, ...) __attribute__
int sscanf(const char * restrict, const char * restrict, ...) __attrib
FILE *tmpfile(void);


__attribute__((deprecated("This function is provided for compatibility
Due to security concerns inherent in the design of tmpnam(3), it is hi

char *tmpnam(char *);
int ungetc(int, FILE *);
int vfprintf(FILE * restrict, const char * restrict, va_list) __attrib
int vprintf(const char * restrict, va_list) __attribute__((__format__
int vsprintf(char * restrict, const char * restrict, va_list) __attrib
# 296 "/usr/include/stdio.h" 3 4
char *ctermid(char *);





FILE *fdopen(int, const char *) __asm("_" "fdopen" );

int fileno(FILE *);
# 315 "/usr/include/stdio.h" 3 4
int pclose(FILE *);



FILE *popen(const char *, const char *) __asm("_" "popen" );
# 337 "/usr/include/stdio.h" 3 4
int __srget(FILE *);
int __svfscanf(FILE *, const char *, va_list) __attribute__((__format_
int __swbuf(int, FILE *);
# 348 "/usr/include/stdio.h" 3 4
inline __attribute__ ((__always_inline__)) int __sputc(int _c, FILE *_
 if (--_p->_w >= 0 || (_p->_w >= _p->_lbfsize && (char)_c != '\n'))
  return (*_p->_p++ = _c);
 else
  return (__swbuf(_c, _p));
```

```
}
# 374 "/usr/include/stdio.h" 3 4
void flockfile(FILE *);
int ftrylockfile(FILE *);
void funlockfile(FILE *);
int getc_unlocked(FILE *);
int getchar_unlocked(void);
int putc_unlocked(int, FILE *);
int putchar_unlocked(int);



int getw(FILE *);
int putw(int, FILE *);



__attribute__((deprecated("This function is provided for compatibility
Due to security concerns inherent in the design of tempnam(3), it is h

char *tempnam(const char *, const char *) __asm("_" "tempnam" );
# 411 "/usr/include/stdio.h" 3 4
# 1 "/usr/include/sys/_types/_off_t.h" 1 3 4
# 30 "/usr/include/sys/_types/_off_t.h" 3 4
typedef __darwin_off_t off_t;
# 412 "/usr/include/stdio.h" 2 3 4


int fseeko(FILE *, off_t, int);
off_t ftello(FILE *);





int snprintf(char * restrict, size_t, const char * restrict, ...) __at
int vfscanf(FILE * restrict, const char * restrict, va_list) __attribu
int vscanf(const char * restrict, va_list) __attribute__((__format__ (
int vsnprintf(char * restrict, size_t, const char * restrict, va_list)
int vsscanf(const char * restrict, const char * restrict, va_list) __a
# 436 "/usr/include/stdio.h" 3 4
# 1 "/usr/include/sys/_types/_ssize_t.h" 1 3 4
# 30 "/usr/include/sys/_types/_ssize_t.h" 3 4
typedef __darwin_ssize_t ssize_t;
# 437 "/usr/include/stdio.h" 2 3 4


int dprintf(int, const char * restrict, ...) __attribute__((__format__
int vdprintf(int, const char * restrict, va_list) __attribute__((__for
ssize_t getdelim(char ** restrict, size_t * restrict, int, FILE * rest
ssize_t getline(char ** restrict, size_t * restrict, FILE * restrict)
# 452 "/usr/include/stdio.h" 3 4
extern const int sys_nerr;
extern const char *const sys_errlist[];

int asprintf(char ** restrict, const char * restrict, ...) __attribute
char *ctermid_r(char *);
char *fgetln(FILE *, size_t *);
const char *fmtcheck(const char *, const char *);
int fpurge(FILE *);
void setbuffer(FILE *, char *, int);
int setlinebuf(FILE *);
int vasprintf(char ** restrict, const char * restrict, va_list) __attr
FILE *zopen(const char *, const char *, int);





FILE *funopen(const void *,
                 int (*)(void *, char *, int),
                 int (*)(void *, const char *, int),
                 fpos_t (*)(void *, fpos_t, int),
                 int (*)(void *));
# 492 "/usr/include/stdio.h" 3 4
# 1 "/usr/include/secure/_stdio.h" 1 3 4
# 31 "/usr/include/secure/_stdio.h" 3 4
# 1 "/usr/include/secure/_common.h" 1 3 4
# 32 "/usr/include/secure/_stdio.h" 2 3 4
# 42 "/usr/include/secure/_stdio.h" 3 4
extern int __sprintf_chk (char * restrict, int, size_t,
     const char * restrict, ...);
# 52 "/usr/include/secure/_stdio.h" 3 4
extern int __snprintf_chk (char * restrict, size_t, int, size_t,
      const char * restrict, ...);







extern int __vsprintf_chk (char * restrict, int, size_t,
      const char * restrict, va_list);




```

```



extern int __vsnprintf_chk (char * restrict, size_t, int, size_t,
       const char * restrict, va_list);
# 493 "/usr/include/stdio.h" 2 3 4
# 2 "aplusb.c" 2

int main(int argc, char* argv[])
{
 int a, b;
 scanf("%d%d", &a, &b);
 int c = a + b;
 printf("%d\n", c);
 return 0;
}
```

3.

Listing 3: aplusb.s

```
        .section        __TEXT,__text,regular,pure_instructions
        .macosx_version_min 10, 10
        .globl  _main
        .align  4, 0x90
_main:                                  ## @main
        .cfi_startproc
## BB#0:
        pushq   %rbp
Ltmp0:
        .cfi_def_cfa_offset 16
Ltmp1:
        .cfi_offset %rbp, -16
        movq    %rsp, %rbp
Ltmp2:
        .cfi_def_cfa_register %rbp
        subq    $48, %rsp
        leaq    L_.str(%rip), %rax
        leaq    -20(%rbp), %rcx
        leaq    -24(%rbp), %rdx
        movl    $0, -4(%rbp)
        movl    %edi, -8(%rbp)
        movq    %rsi, -16(%rbp)
        movq    %rax, %rdi
        movq    %rcx, %rsi
        movb    $0, %al
        callq   _scanf
        leaq    L_.str1(%rip), %rdi
        movl    -20(%rbp), %r8d
        addl    -24(%rbp), %r8d
        movl    %r8d, -28(%rbp)
        movl    -28(%rbp), %esi
        movl    %eax, -32(%rbp)         ## 4-byte Spill
        movb    $0, %al
        callq   _printf
        xorl    %esi, %esi
        movl    %eax, -36(%rbp)         ## 4-byte Spill
        movl    %esi, %eax
        addq    $48, %rsp
        popq    %rbp
        retq
        .cfi_endproc

        .section        __TEXT,__cstring,cstring_literals
L_.str:                                 ## @.str
        .asciz  "%d%d"

L_.str1:                                ## @.str1
        .asciz  "%d\n"


.subsections_via_symbols
```

4.

实验体会：