

# Отчет по лабораторной работе № 10 по курсу Архитектура компьютера и информационных сетей

Студент группы М8О-103Б-22 Клименко Виталий Максимович, № по списку 11

Контакты www, e-mail, icq, skype vitalikklimenko96@gmail.com

Работа выполнена: 3 ноября 2022 г.

Преподаватель: доцент Никулин С.П.

Входной контроль знаний с оценкой \_\_\_\_\_

Отчет сдан «    » \_\_\_\_\_ 202 \_\_ г., итоговая оценка \_\_\_\_

Подпись преподавателя \_\_\_\_\_

1. **Тема:** Отладчик системы программирования ОС UNIX \_\_\_\_\_

2. **Цель работы:** Научиться пользоваться отладчиком GDB \_\_\_\_\_

3. **Задание (вариант №    ):** Скомпилировать программу с ошибкой времени выполнения, запустить и отладить \_\_\_\_\_

4. **Оборудование (лабораторное):**  
ЭВМ \_\_\_\_\_, процессор \_\_\_\_\_, имя узла сети \_\_\_\_\_ с ОП \_\_\_\_\_ Мб,  
НМД \_\_\_\_\_ Мб. Терминал \_\_\_\_\_ адрес \_\_\_\_\_. Принтер \_\_\_\_\_  
Другие устройства \_\_\_\_\_

*Оборудование ПЭВМ студента, если использовалось:*

Процессор Intel 4x 3.5GHz с ОП 16 ГБ НМД HDD 200 ГБ . Монитор Встроенный 1920x1080  
Другие устройства Touchpad Synaptics

5. **Программное обеспечение (лабораторное):**  
Операционная система семейства \_\_\_\_\_, наименование \_\_\_\_\_ версия \_\_\_\_\_  
интерпретатор команд \_\_\_\_\_ версия \_\_\_\_\_  
Система программирования \_\_\_\_\_ версия \_\_\_\_\_  
Редактор текстов \_\_\_\_\_ версия \_\_\_\_\_  
Утилиты операционной системы \_\_\_\_\_

Прикладные системы и программы \_\_\_\_\_

Местонахождение и имена файлов программ и данных \_\_\_\_\_

*Программное обеспечение ЭВМ студента, если использовалось:*

Операционная система семейства UNIX, наименование Pop!\_OS версия 22.04 jammy

интерпретатор команд bash версия 5.1.16

Система программирования GNU Compiler Collection (GCC) версия 11.2.0

Редактор текстов Visual Studio Code версия 1.72.2

Утилиты операционной системы \_\_\_\_\_

Прикладные системы и программы gcc, gdb

Местонахождение и имена файлов программ и данных на домашнем компьютере \_\_\_\_\_

**6. Идея, метод, алгоритм** решение задачи (в формах: словесной, псевдокода, графической [блок-схема, диаграмма, рисунок, таблица] или формальные спецификации с пред- и постусловиями)

Дополнить программу, написанную для лабораторной работы №8, специально совершить в ней ошибку, запустить и отладить

**7. Сценарий выполнения работы** (план работы, первоначальный текст программы в черновике [можно на отдельном листе] и тесты либо соображения по тестированию)

1. Взять программу из лабораторной работы №8
2. Доработать программу
3. Специально сделать ошибку рантайма
4. Отладить программу с помощью дебаггера и кор файла

*Пункты 1-7 отчета составляются строго до начала лабораторной работы.*

*Допущен к выполнению работы. Подпись преподавателя \_\_\_\_\_*

## 8. Распечатка протокола (подклеить листинг окончательного варианта программы с тестовыми примерами, подписанный преподавателем)

```
vitos@vitos-pop:~/Studying/mai/labs/l10$ ls
./ ../ 110-2011.djvu main* main.c protocol.txt
vitos@vitos-pop:~/Studying/mai/labs/l10$ cat main.c
/* Лабораторная работа №10
 * Студент гр. М80-103Б-22 Клименко В. М. */
#include <stdio.h>

unsigned long long mpow(unsigned long long a, unsigned long long n) {
    unsigned long long exp = 1;
    for (unsigned long long i = 1; i <= n; ++i) {
        exp *= a;
    }
    return exp;
}

int main() {
    unsigned long long a, n, ans;
    printf("Only natural numbers are allowed!\n");
    printf("Input a number you want to raise to a power:\n");
    scanf("%lld", &a);
    printf("Input a power you want to raise %lld to:\n", a);
    scanf("%lld", &n);

    ans = mpow(a, n);

    printf("Here is %lld to the power of %lld: %lld\n", a, n, ans);
    return 0;
}
vitos@vitos-pop:~/Studying/mai/labs/l10$ gcc -g main.c -o main
vitos@vitos-pop:~/Studying/mai/labs/l10$ ./main
Only natural numbers are allowed!
Input a number you want to raise to a power:
3
Segmentation fault (core dumped)
vitos@vitos-pop:~/Studying/mai/labs/l10$ ls
./ ../ .core.27733 110-2011.djvu main* main.c protocol.txt
vitos@vitos-pop:~/Studying/mai/labs/l10$ gdb -c .core.27733 main
GNU gdb (Ubuntu 12.1-0ubuntu1~22.04) 12.1
Copyright (C) 2022 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<https://www.gnu.org/software/gdb/bugs/>.
Find the GDB manual and other documentation resources online at:
<http://www.gnu.org/software/gdb/documentation/>.

For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from main...
[New LWP 27733]
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Core was generated by './main'.
Program terminated with signal SIGSEGV, Segmentation fault.
#0  0x00007ff6b8a641e5 in __vfscanf_internal (s=<optimized out>, format=<optimized out>, argptr=argptr@entry=0
x7ffeefd68ba0, mode_flags=mode_flags@entry=2) at ./stdio-common/vfscanf-internal.c:1891
1891      ./stdio-common/vfscanf-internal.c: No such file or directory.
(gdb) help
List of classes of commands:

aliases -- User-defined aliases of other commands.
breakpoints -- Making program stop at certain points.
data -- Examining data.
files -- Specifying and examining files.
internals -- Maintenance commands.
obscure -- Obscure features.
running -- Running the program.
stack -- Examining the stack.
status -- Status inquiries.
support -- Support facilities.
text-user-interface -- TUI is the GDB text based interface.
tracepoints -- Tracing of program execution without stopping the program.
user-defined -- User-defined commands.

Type "help" followed by a class name for a list of commands in that class.
Type "help all" for the list of all commands.
```

```

Type "help" followed by command name for full documentation.
Type "apropos word" to search for commands related to "word".
Type "apropos -v word" for full documentation of commands related to "word".
Command name abbreviations are allowed if unambiguous.
(gdb) list
1886   in ./stdio-common/vfscanf-internal.c
(gdb) run
Starting program: /home/vitos/Studying/mai/labs/l10/main
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Only natural numbers are allowed!
Input a number you want to raise to a power:
3

Program received signal SIGSEGV, Segmentation fault.
0x00007ffff7c641e5 in __vfscanf_internal (s=<optimized out>, format=<optimized out>, argptr=argptr@entry=0x7ffff7ffde00, mode_flags=mode_flags@entry=2) at ./stdio-common/vfscanf-internal.c:1891
1891   ./stdio-common/vfscanf-internal.c: No such file or directory.
(gdb) list
1886   in ./stdio-common/vfscanf-internal.c
(gdb) list mpow
1   /* Лабораторная работа №10
2   * Студент гр. М80-103Б-22 Клименко В. М. */
3   #include <stdio.h>
4
5   unsigned long long mpow(unsigned long long a, unsigned long long n) {
6       unsigned long long exp = 1;
7       for (unsigned long long i = 1; i <= n; ++i) {
8           exp *= a;
9       }
10      return exp;
(gdb) list 0
1   /* Лабораторная работа №10
2   * Студент гр. М80-103Б-22 Клименко В. М. */
3   #include <stdio.h>
4
5   unsigned long long mpow(unsigned long long a, unsigned long long n) {
6       unsigned long long exp = 1;
7       for (unsigned long long i = 1; i <= n; ++i) {
8           exp *= a;
9       }
10      return exp;
(gdb) list main
8       exp *= a;
9   }
10      return exp;
11  }
12
13  int main() {
14      unsigned long long a, n, ans;
15      printf("Only natural numbers are allowed!\n");
16      printf("Input a number you want to raise to a power:\n");
17      scanf("%lld", a);
(gdb) list 18
13  int main() {
14      unsigned long long a, n, ans;
15      printf("Only natural numbers are allowed!\n");
16      printf("Input a number you want to raise to a power:\n");
17      scanf("%lld", a);
18      printf("Input a power you want to raise %lld to:\n", a);
19      scanf("%lld", &n);
20
21      ans = mpow(a, n);
22
(gdb) break 16
Breakpoint 1 at 0x555555555217: file main.c, line 16.
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: /home/vitos/Studying/mai/labs/l10/main
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Only natural numbers are allowed!

Breakpoint 1, main () at main.c:16
16      printf("Input a number you want to raise to a power:\n");
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) n
Program not restarted.
(gdb) continue
Continuing.
Input a number you want to raise to a power:
4

```

```

Program received signal SIGSEGV, Segmentation fault.
0x00007ffff7c641e5 in __vfscanf_internal (s=<optimized out>, format=<optimized out>, argptr=argptr@entry=0x7fffffde00, mode_flags=mode_flags@entry=2) at ./stdio-common/vfscanf-internal.c:1891
1891  ./stdio-common/vfscanf-internal.c: No such file or directory.
(gdb) break 9
Breakpoint 2 at 0x7ffff7c62a17: ./stdio-common/./stdio-common/vfscanf-internal.c:9. (53 locations)
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: /home/vitos/Studying/mai/labs/l10/main
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Only natural numbers are allowed!

Breakpoint 1, main () at main.c:16
16      printf("Input a number you want to raise to a power:\n");
(gdb) continue
Continuing.
Input a number you want to raise to a power:

Breakpoint 2, char_buffer_rewind (buffer=0x7fffffde980) at ./stdio-common/vfscanf-internal.c:223
223  ./stdio-common/vfscanf-internal.c: No such file or directory.
(gdb) continue
Continuing.
Input a power you want to raise 100 to:

Breakpoint 2, char_buffer_rewind (buffer=0x7fffffde980) at ./stdio-common/vfscanf-internal.c:223
223  in ./stdio-common/vfscanf-internal.c
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: /home/vitos/Studying/mai/labs/l10/main
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Only natural numbers are allowed!

Breakpoint 1, main () at main.c:16
16      printf("Input a number you want to raise to a power:\n");
(gdb) ptype a
type = unsigned long long
(gdb) print a
$1 = 100
(gdb) set args "huh?"
(gdb) set var h = "Hello world!"
No symbol "h" in current context.
(gdb) set var a = 0
(gdb) print a
$2 = 0
(gdb) next
Input a number you want to raise to a power:
17      scanf("%lld", a);
(gdb) next

Breakpoint 2, char_buffer_rewind (buffer=0x7fffffde980) at ./stdio-common/vfscanf-internal.c:223
223  ./stdio-common/vfscanf-internal.c: No such file or directory.
(gdb) next
485  in ./stdio-common/vfscanf-internal.c
(gdb) next
488  in ./stdio-common/vfscanf-internal.c
(gdb) step
504  in ./stdio-common/vfscanf-internal.c
(gdb) step
525  in ./stdio-common/vfscanf-internal.c
(gdb) continue
Continuing.
Input a power you want to raise 0 to:

Breakpoint 2, char_buffer_rewind (buffer=0x7fffffde980) at ./stdio-common/vfscanf-internal.c:223
223  in ./stdio-common/vfscanf-internal.c
(gdb) bt
#0  char_buffer_rewind (buffer=0x7fffffde980) at ./stdio-common/vfscanf-internal.c:223
#1  __vfscanf_internal (s=<optimized out>, format=<optimized out>, argptr=argptr@entry=0x7fffffde00, mode_flags=mode_flags@entry=2) at ./stdio-common/vfscanf-internal.c:485
#2  0x00007ffff7c621c2 in __isoc99_scanf (format=<optimized out>) at ./stdio-common/isoc99_scanf.c:30
#3  0x0000555555555277 in main () at main.c:19
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: /home/vitos/Studying/mai/labs/l10/main "huh?"
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Only natural numbers are allowed!

Breakpoint 1, main () at main.c:16
16      printf("Input a number you want to raise to a power:\n");

```

```

(gdb) set args 4
(gdb) run
The program being debugged has been started already.
Start it from the beginning? (y or n) y
Starting program: /home/vitos/Studying/mai/labs/l10/main 4
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Only natural numbers are allowed!

Breakpoint 1, main () at main.c:16
16      printf("Input a number you want to raise to a power:\n");
(gdb) continue
Continuing.
Input a number you want to raise to a power:

Breakpoint 2, char_buffer_rewind (buffer=0x7fffffff980) at ./stdio-common/vfscanf-internal.c:223
223      ./stdio-common/vfscanf-internal.c: No such file or directory.
(gdb) continue
Continuing.
Input a power you want to raise 100 to:

Breakpoint 2, char_buffer_rewind (buffer=0x7fffffff980) at ./stdio-common/vfscanf-internal.c:223
223      in ./stdio-common/vfscanf-internal.c
(gdb) bt
#0 char_buffer_rewind (buffer=0x7fffffff980) at ./stdio-common/vfscanf-internal.c:223
#1 __vfscanf_internal (s=<optimized out>, format=<optimized out>, argptr=argptr@entry=0x7fffffffde00, mode_flags=mode_flags@entry=2) at ./stdio-common/vfscanf-internal.c:485
#2 0x00007ffff7c621c2 in __isoc99_scanf (format=<optimized out>) at ./stdio-common/isoc99_scanf.c:30
#3 0x0000555555555277 in main () at main.c:19
(gdb) next
485      in ./stdio-common/vfscanf-internal.c
(gdb) next 10
622      in ./stdio-common/vfscanf-internal.c
(gdb) next 100
2
34
3
3
eixt
exit
quit
~C
Program received signal SIGINT, Interrupt.
0x00005555555551cf in mpow (a=100, n=140737488348153) at main.c:8
8      exp *= a;
(gdb) next
7      for (unsigned long long i = 1; i <= n; ++i) {
(gdb) step
8      exp *= a;
(gdb) step
7      for (unsigned long long i = 1; i <= n; ++i) {
(gdb) step 10
7      for (unsigned long long i = 1; i <= n; ++i) {
(gdb) step 100
7      for (unsigned long long i = 1; i <= n; ++i) {
(gdb) step
8      exp *= a;
(gdb) bt
#0 mpow (a=100, n=140737488348153) at main.c:8
#1 0x000055555555528a in main () at main.c:21
(gdb) help
List of classes of commands:

aliases -- User-defined aliases of other commands.
breakpoints -- Making program stop at certain points.
data -- Examining data.
files -- Specifying and examining files.
internals -- Maintenance commands.
obscure -- Obscure features.
running -- Running the program.
stack -- Examining the stack.
status -- Status inquiries.
support -- Support facilities.
text-user-interface -- TUI is the GDB text based interface.
tracepoints -- Tracing of program execution without stopping the program.
user-defined -- User-defined commands.

Type "help" followed by a class name for a list of commands in that class.
Type "help all" for the list of all commands.
Type "help" followed by command name for full documentation.
Type "apropos word" to search for commands related to "word".
Type "apropos -v word" for full documentation of commands related to "word".
Command name abbreviations are allowed if unambiguous.
(gdb) help breakpoints
Making program stop at certain points.

```

List of commands:

```
awatch -- Set an access watchpoint for EXPRESSION.
break, brea, bre, br, b -- Set breakpoint at specified location.
break-range -- Set a breakpoint for an address range.
catch -- Set catchpoints to catch events.
catch assert -- Catch failed Ada assertions, when raised.
catch catch -- Catch an exception, when caught.
catch exception -- Catch Ada exceptions, when raised.
catch exec -- Catch calls to exec.
catch fork -- Catch calls to fork.
catch handlers -- Catch Ada exceptions, when handled.
catch load -- Catch loads of shared libraries.
catch rethrow -- Catch an exception, when rethrown.
catch signal -- Catch signals by their names and/or numbers.
catch syscall -- Catch system calls by their names, groups and/or numbers.
catch throw -- Catch an exception, when thrown.
catch unload -- Catch unloads of shared libraries.
catch vfork -- Catch calls to vfork.
clear, cl -- Clear breakpoint at specified location.
commands -- Set commands to be executed when the given breakpoints are hit.
condition -- Specify breakpoint number N to break only if COND is true.
delete, del, d -- Delete all or some breakpoints.
delete bookmark -- Delete a bookmark from the bookmark list.
delete breakpoints -- Delete all or some breakpoints or auto-display expressions.
delete checkpoint -- Delete a checkpoint (experimental).
delete display -- Cancel some expressions to be displayed when program stops.
delete mem -- Delete memory region.
delete tracepoints, delete tr -- Delete specified tracepoints.
delete tvariable -- Delete one or more trace state variables.
disable, disa, dis -- Disable all or some breakpoints.
disable breakpoints -- Disable all or some breakpoints.
disable display -- Disable some expressions to be displayed when program stops.
disable frame-filter -- GDB command to disable the specified frame-filter.
disable mem -- Disable memory region.
disable pretty-printer -- GDB command to disable the specified pretty-printer.
disable probes -- Disable probes.
disable type-printer -- GDB command to disable the specified type-printer.
disable unwinder -- GDB command to disable the specified unwinder.
disable xmethod -- GDB command to disable a specified (group of) xmethod(s).
dprintf -- Set a dynamic printf at specified location.
enable, en -- Enable all or some breakpoints.
enable breakpoints -- Enable all or some breakpoints.
enable breakpoints count -- Enable some breakpoints for COUNT hits.
enable breakpoints delete -- Enable some breakpoints and delete when hit.
enable breakpoints once -- Enable some breakpoints for one hit.
enable count -- Enable some breakpoints for COUNT hits.
enable delete -- Enable some breakpoints and delete when hit.
enable display -- Enable some expressions to be displayed when program stops.
--Type <RET> for more, q to quit, c to continue without paging--q
Quit
(gdb) clear
No breakpoint at this line.
(gdb) clear -a
invalid explicit location argument, "-a"
(gdb) clear all
Function "all" not defined.
(gdb) quit
A debugging session is active.
```

Inferior 1 [process 62460] will be killed.

```
Quit anyway? (y or n) y
vitos@vitos-pop:~/Studying/mai/labs/l10$ cat main.c
/* Лабораторная работа №10
 * Студент гр. М80-103Б-22 Клименко В. М. */
#include <stdio.h>
```

```
unsigned long long mpow(unsigned long long a, unsigned long long n) {
    unsigned long long exp = 1;
    for (unsigned long long i = 1; i <= n; ++i) {
        exp *= a;
    }
    return exp;
}
```

```
int main() {
    unsigned long long a, n, answ;
    printf("Only natural numbers are allowed!\n");
    printf("Input a number you want to raise to a power:\n");
    scanf("%lld", &a);
    printf("Input a power you want to raise %lld to:\n", a);
    scanf("%lld", &n);
```

```
    answ = mpow(a, n);

    printf("Here is %lld to the power of %lld: %lld\n", a, n, answ);
    return 0;
}vitos@vitos-pop:~/Studying/mai/labs/l10$ gcc -g main.c -o main
vitos@vitos-pop:~/Studying/mai/labs/l10$ ./main
Only natural numbers are allowed!
Input a number you want to raise to a power:
3
Input a power you want to raise 3 to:
4
Here is 3 to the power of 4: 81
```



**9. Дневник отладки** должен содержать дату и время сеансов отладки и основные события (ошибки в сценарии и программе, нестандартные ситуации) и краткие комментарии к ним. В дневнике отладки приводятся сведения об использовании ЭВМ, существенном участии преподавателя и других лиц в написании и отладке программы.

№	Лаб. или дом.	Дата	Время	Событие	Действие по исправлению	Примечание

**10. Замечания автора** по существу работы: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**11. Выводы:** Я научился пользоваться дебаггером GCC - GDB, научился отлаживать простые программы с несколькими функциями и вводами из терминала  
 \_\_\_\_\_  
 \_\_\_\_\_

Недочёты при выполнении задания могут быть устранены следующим образом: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Подпись студента \_\_\_\_\_