

Отчёт по лабораторной работе №13

Средства, применяемые при разработке программного обеспечения в ОС типа UNIX/Linux.

Дедова В. С.

05 апреля 2023

Российский университет дружбы народов, Москва, Россия

Информация

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- Дедова Виктория Сергеевна
- студентка НБИбд-01
- Российский университет дружбы народов

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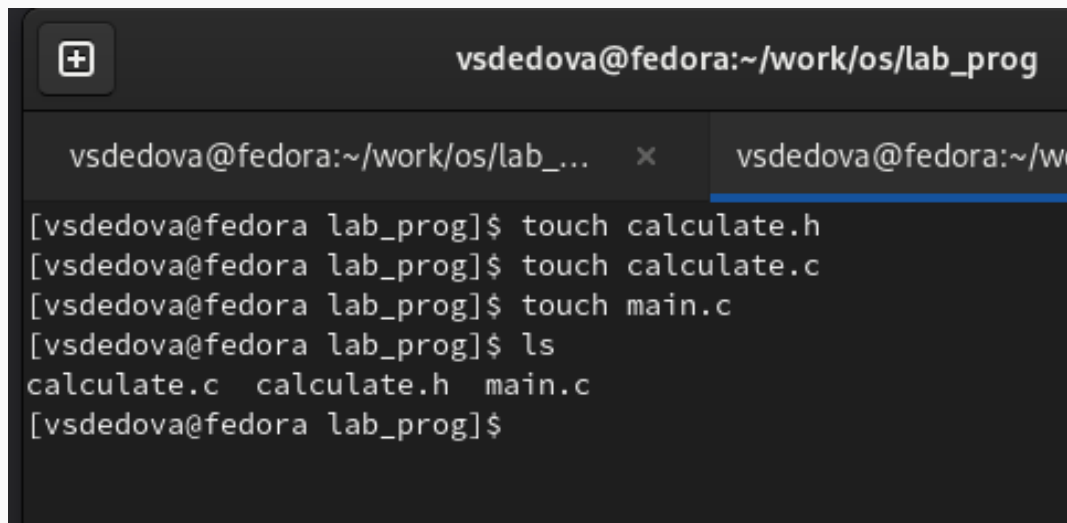
Приобрести простейшие навыки разработки, анализа, тестирования и отладки приложений в ОС типа UNIX/Linux на примере создания на языке программирования C калькулятора с простейшими функциями.

В домашнем каталоге создайте подкаталог lab_prog.Создайте файлы:calculate.h,calculate.c,main.c.



vsdedova@fedora:~/work/os/lab_prog

```
[vsdedova@fedora os]$ mkdir lab_prog  
[vsdedova@fedora os]$ cd lab_prog  
[vsdedova@fedora lab_prog]$
```

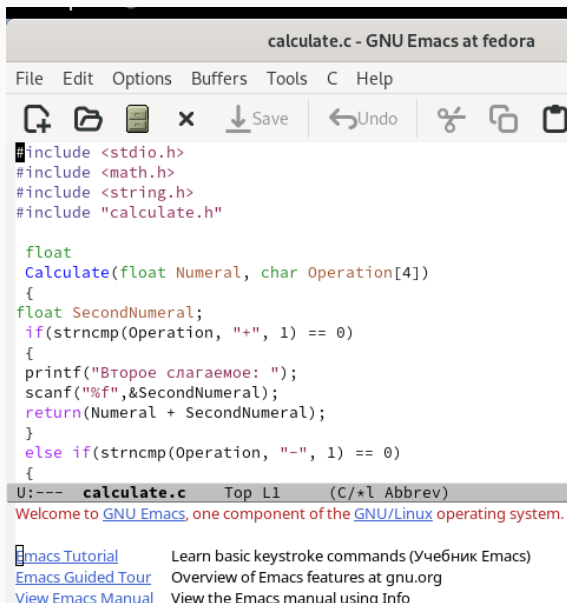


A terminal window with a dark background. The title bar at the top shows a plus icon in a square on the left and the text "vsdedova@fedora:~/work/os/lab_prog" on the right. Below the title bar, there are two tabs. The first tab is labeled "vsdedova@fedora:~/work/os/lab_..." and has a close button (an 'x' icon) on its right. The second tab is labeled "vsdedova@fedora:~/w..." and is currently selected, indicated by a blue underline. The terminal content shows a series of commands and their outputs:

```
[vsdedova@fedora lab_prog]$ touch calculate.h
[vsdedova@fedora lab_prog]$ touch calculate.c
[vsdedova@fedora lab_prog]$ touch main.c
[vsdedova@fedora lab_prog]$ ls
calculate.c calculate.h main.c
[vsdedova@fedora lab_prog]$
```

Рис. 2: 2

Это будет примитивнейший калькулятор, способный выполнять математические операции.



```
calculate.c - GNU Emacs at fedora
File Edit Options Buffers Tools C Help
[Icons: New, Open, Save, Close, Save, Undo, Cut, Copy, Paste]

#include <stdio.h>
#include <math.h>
#include <string.h>
#include "calculate.h"

float
Calculate(float Numeral, char Operation[4])
{
float SecondNumeral;
if(strncmp(Operation, "+", 1) == 0)
{
printf("Второе слагаемое: ");
scanf("%f",&SecondNumeral);
return(Numeral + SecondNumeral);
}
else if(strncmp(Operation, "-", 1) == 0)
{
U:--- calculate.c Top L1 (C/*l Abbrev)
Welcome to GNU Emacs, one component of the GNU/Linux operating system.

[Emacs Tutorial] Learn basic keystroke commands (Учебник Emacs)
[Emacs Guided Tour] Overview of Emacs features at gnu.org
[View Emacs Manual] View the Emacs manual using Info
```

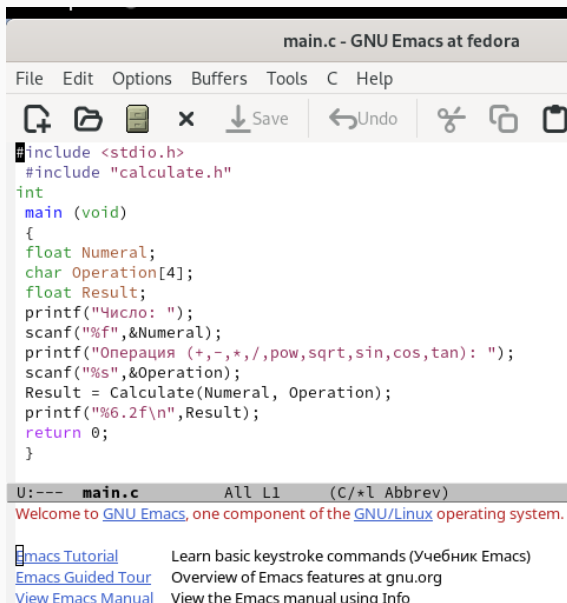
Интерфейсный файл calculate.h, описывающий формат вызова функции-калькулятора:



vsdedova@fedora:~/work/os/lab_prog

```
[vsdedova@fedora os]$ mkdir lab_prog  
[vsdedova@fedora os]$ cd lab_prog  
[vsdedova@fedora lab_prog]$
```


Основной файл main.c, реализующий интерфейс пользователя к калькулятору:



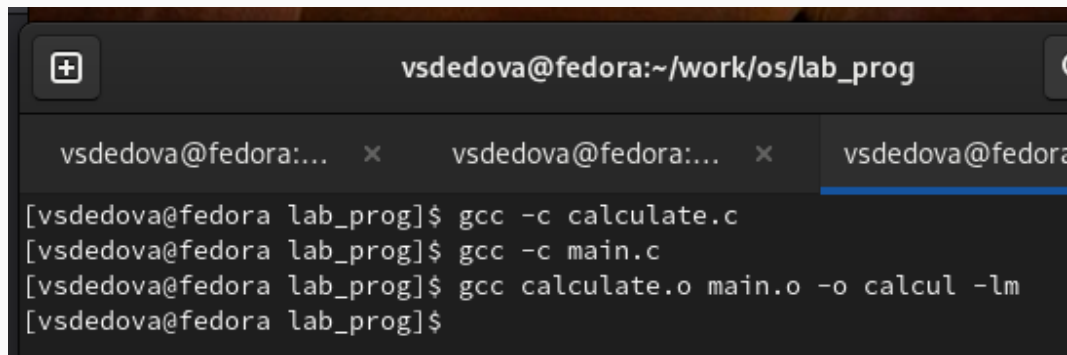
```
#include <stdio.h>
#include "calculate.h"
int
main (void)
{
  float Numeral;
  char Operation[4];
  float Result;
  printf("Число: ");
  scanf("%f",&Numeral);
  printf("Операция (+,-,*,/,pow,sqrt,sin,cos,tan): ");
  scanf("%s",&Operation);
  Result = Calculate(Numeral, Operation);
  printf("%6.2f\n",Result);
  return 0;
}
```

U:--- **main.c** All L1 (C/*l Abbrev)

Welcome to [GNU Emacs](#), one component of the [GNU/Linux](#) operating system.

[Emacs Tutorial](#) Learn basic keystroke commands (Учебник Emacs)
[Emacs Guided Tour](#) Overview of Emacs features at gnu.org
[View Emacs Manual](#) View the Emacs manual using Info

Выполните компиляцию программы посредством gcc:

A terminal window with a dark background. The title bar shows a plus icon and the text 'vsdedova@fedora:~/work/os/lab_prog'. Below the title bar are three tabs, each labeled 'vsdedova@fedora:...' followed by a close icon. The active tab is highlighted with a blue underline. The terminal content shows four lines of commands and their prompts: '[vsdedova@fedora lab_prog]\$ gcc -c calculate.c', '[vsdedova@fedora lab_prog]\$ gcc -c main.c', '[vsdedova@fedora lab_prog]\$ gcc calculate.o main.o -o calcul -lm', and '[vsdedova@fedora lab_prog]\$'.

```
vsdedova@fedora:~/work/os/lab_prog

vsdedova@fedora:... x vsdedova@fedora:... x vsdedova@fedora...

[vsdedova@fedora lab_prog]$ gcc -c calculate.c
[vsdedova@fedora lab_prog]$ gcc -c main.c
[vsdedova@fedora lab_prog]$ gcc calculate.o main.o -o calcul -lm
[vsdedova@fedora lab_prog]$
```

Рис. 6: 6

Создайте Makefile со следующим содержанием:

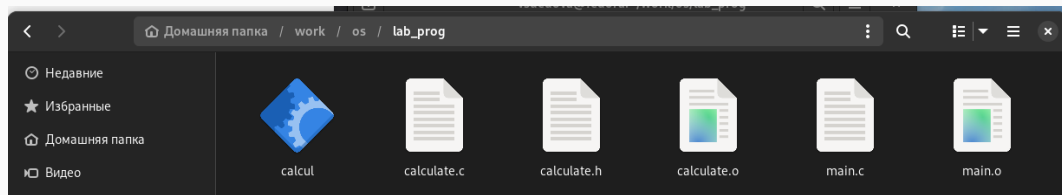
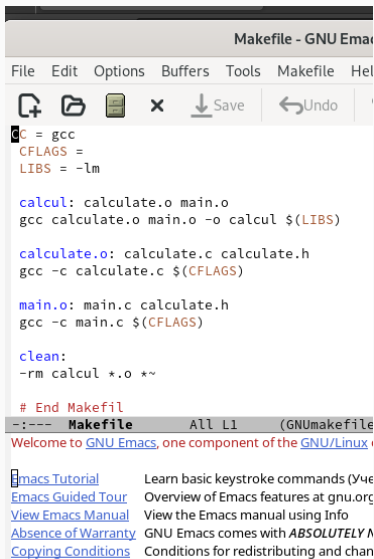


Рис. 7: 7

С помощью gdb выполните отладку программы calcul (перед использованием gdb исправьте Makefile):



```
Makefile - GNU Emacs

File Edit Options Buffers Tools Makefile Help

C = gcc
CFLAGS =
LIBS = -lm

calcul: calculate.o main.o
gcc calculate.o main.o -o calcul $(LIBS)

calculate.o: calculate.c calculate.h
gcc -c calculate.c $(CFLAGS)

main.o: main.c calculate.h
gcc -c main.c $(CFLAGS)

clean:
-rm calcul *.o *~

# End Makefile

--:--- Makefile All L1 (GNUmakefile)
Welcome to GNU Emacs, one component of the GNU/Linux system.

Emacs Tutorial Learn basic keystroke commands (Уче
Emacs Guided Tour Overview of Emacs features at gnu.org
View Emacs Manual View the Emacs manual using Info
Absence of Warranty GNU Emacs comes with ABSOLUTELY N
Copying Conditions Conditions for redistributing and chan
```

Для запуска программы внутри отладчика введите команду run:

```
Using host libthread_db library "/lib64/libthread_db.so.1".
Число: 3
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): -
Вычитаемое: 2
    1.00
[Inferior 1 (process 3707) exited normally]
(gdb)
```

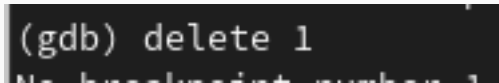
Рис. 9: 9

Для постраничного (по 9 строк) просмотра исходного код используйте команду list

```
[Inferior 1 (process 3707) exited normally]
(gdb) list
Downloading 0.00 MB source file /usr/src/debug/glibc-2.36-9.fc37.x86_64/elf/sofini.c
1      /* Terminate the frame unwind info section with a 4byte 0 as a sentinel;
2         this would be the 'length' field in a real FDE.  */
3
4      typedef unsigned int ui32 __attribute__ ((mode (SI)));
5      static const ui32 __FRAME_END__[1]
6          __attribute__ ((used, section (".eh_frame")))
7          = { 0 };
```

Рис. 10: 10

Уберите точки останова:

A screenshot of a GDB terminal window. The prompt is '(gdb)'. The user has entered the command 'delete 1'. The output of the command is 'No breakpoint at number 1'.

```
(gdb) delete 1
No breakpoint at number 1
```

Рис. 11: 12

С помощью утилиты splint попробуйте проанализировать коды файлов calculate.c и main.c.

```
[vsdedova@fedora lab_prog]$ splint calculate.c
Splint 3.1.2 --- 23 Jul 2022

calculate.h:4:38: Function parameter Operation declared as manifest array (size
                    constant is meaningless)
    A formal parameter is declared as an array with size.  The size of the array
    is ignored in this context, since the array formal parameter is treated as a
    pointer. (Use -fixedformalarray to inhibit warning)
calculate.c:7:32: Function parameter Operation declared as manifest array (size
                    constant is meaningless)
calculate.c: (in function Calculate)
calculate.c:13:2: Return value (type int) ignored: scanf("%f", &Sec...
    Result returned by function call is not used. If this is intended, can cast
    result to (void) to eliminate message. (Use -retvalint to inhibit warning)
calculate.c:19:2: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:25:2: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:31:2: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:32:5: Dangerous equality comparison involving float types:
                    SecondNumeral == 0
    Two real (float, double, or long double) values are compared directly using
    == or != primitive. This may produce unexpected results since floating point
    representations are inexact. Instead, compare the difference to FLT_EPSILON
```


На данной лабораторной работе мы приобрели простейшие навыки разработки, анализа, тестирования и отладки приложений в ОС типа UNIX/Linux на примере создания на языке программирования C калькулятора с простейшими функциями.