

# Средства для создания приложений в ОС UNIX.

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3 мая, 2023, Москва, Россия

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# Цели и задачи работы

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## Цель лабораторной работы

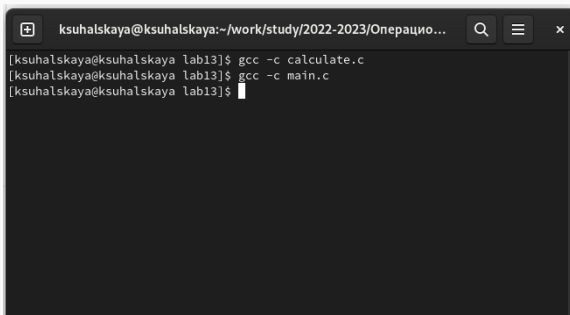
Приобрести простейшие навыки разработки, анализа, тестирования и отладки приложений в ОС типа UNIX/Linux на примере создания на языке программирования С калькулятора с простейшими функциями.

# Задачи лабораторной работы

- 1 Написать код приложения
- 2 Выполнить компиляцию
- 3 Подготовить Makefile
- 4 Выполнить отладку в GDB
- 5 Проанализировать код при помощи splint

# **Процесс выполнения лабораторной работы**

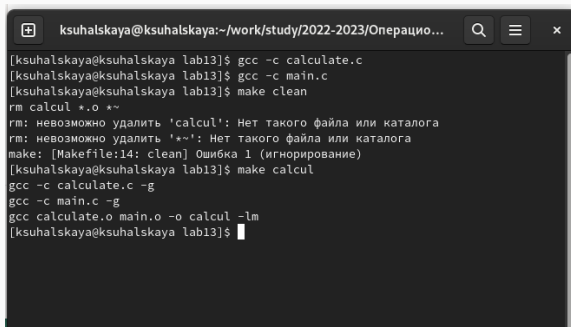
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A terminal window with a dark background. The title bar shows the user 'ksuhalskaya' and the path '~/work/study/2022-2023/Операцио...'. The terminal contains three lines of text: the first line shows the command 'gcc -c calculate.c' being executed; the second line shows 'gcc -c main.c' being executed; the third line shows the prompt '[ksuhalskaya@ksuhalskaya lab13]\$' with a cursor. The window has standard Linux window controls (minimize, maximize, close) and a search icon.

```
ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...  
[ksuhalskaya@ksuhalskaya lab13]$ gcc -c calculate.c  
[ksuhalskaya@ksuhalskaya lab13]$ gcc -c main.c  
[ksuhalskaya@ksuhalskaya lab13]$
```

**Рис. 1:** Компиляция

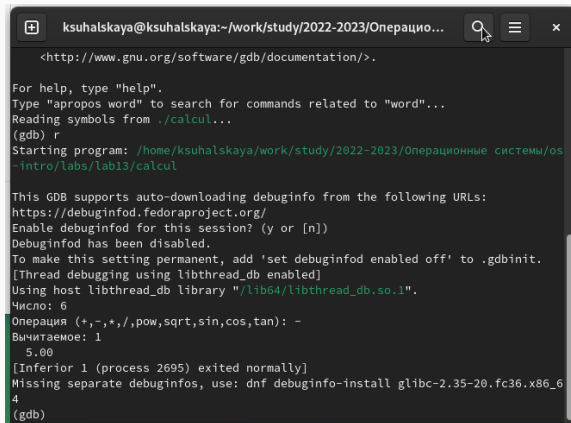
# Выполнение работы

A terminal window with a dark background and light text. The window title is "ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...". The terminal shows a series of commands and their outputs. The commands are: "gcc -c calculate.c", "gcc -c main.c", "make clean", "rm calcul \*.o \*~", "make calcul", and "gcc calculate.o main.o -o calcul -lm". The outputs include error messages for "rm" and a success message for "make".

```
ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...  
[ksuhalskaya@ksuhalskaya lab13]$ gcc -c calculate.c  
[ksuhalskaya@ksuhalskaya lab13]$ gcc -c main.c  
[ksuhalskaya@ksuhalskaya lab13]$ make clean  
rm calcul *.o *~  
rm: невозможно удалить 'calcul': Нет такого файла или каталога  
rm: невозможно удалить '*~': Нет такого файла или каталога  
make: [Makefile:14: clean] Ошибка 1 (игнорирование)  
[ksuhalskaya@ksuhalskaya lab13]$ make calcul  
gcc -c calculate.c -g  
gcc -c main.c -g  
gcc calculate.o main.o -o calcul -lm  
[ksuhalskaya@ksuhalskaya lab13]$
```

**Рис. 2:** Использование make

# Выполнение работы

A screenshot of a terminal window with a dark background. The window title is 'ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...'. The terminal shows the execution of GDB on a program named 'calcul'. The user enters 'r' to run the program. The program outputs 'Число: 6' and 'Операция (+,-,\*,/,pow,sqrt,sin,cos,tan): -'. The user then enters '5.00' and the program outputs 'Вычитаемое: 1'. The terminal also shows GDB's internal messages about debuginfo and libthread\_db.

```
ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...
<http://www.gnu.org/software/gdb/documentation/>.

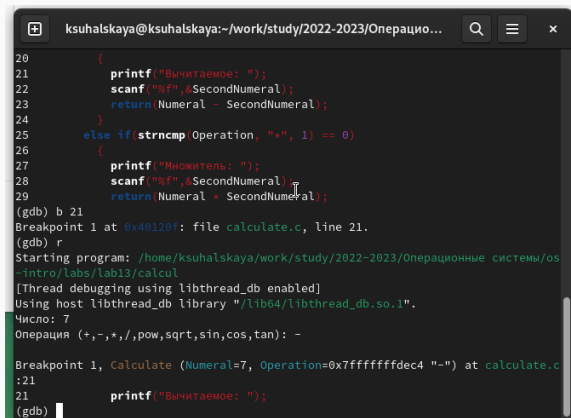
For help, type "help".
Type "apropos word" to search for commands related to "word"...
Reading symbols from ./calcul...
(gdb) r
Starting program: /home/ksuhalskaya/work/study/2022-2023/Операционные системы/os
-intro/labs/lab13/calcul

This GDB supports auto-downloading debuginfo from the following URLs:
https://debuginfod.fedoraproject.org/
Enable debuginfod for this session? (y or [n])
Debuginfod has been disabled.
To make this setting permanent, add 'set debuginfod enabled off' to .gdbinit.
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib64/libthread_db.so.1".
Число: 6
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): -
Вычитаемое: 1
5.00
[Inferior 1 (process 2695) exited normally]
Missing separate debuginfos, use: dnf debuginfo-install glibc-2.35-20.fc36.x86_64
(gdb)
```

Рис. 3: Использование отладчика



# Выполнение работы

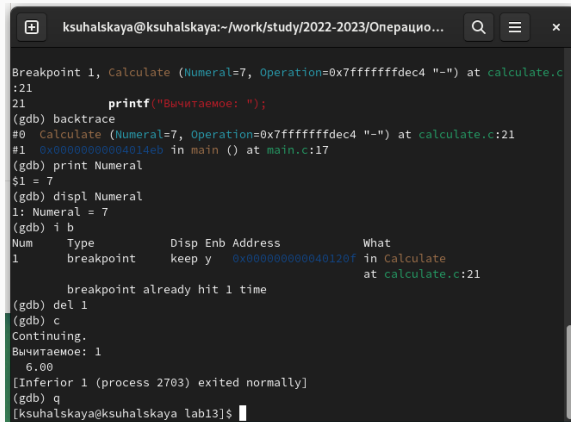


```
ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...
20     {
21         printf("Вычитаемое: ");
22         scanf("%f",&SecondNumeral);
23         return(Numeral - SecondNumeral);
24     }
25     else if(strncmp(Operation, "+", 1) == 0)
26     {
27         printf("Множитель: ");
28         scanf("%f",&SecondNumeral);
29         return(Numeral * SecondNumeral);
(gdb) b 21
Breakpoint 1 at 0x40120f: file calculate.c, line 21.
(gdb) r
Starting program: /home/ksuhalskaya/work/study/2022-2023/Операционные системы/os-intro/labs/lab13/calcul
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib64/libthread_db.so.1".
Число: 7
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): -

Breakpoint 1, Calculate (Numeral=7, Operation=0x7fffffffdec4 "-") at calculate.c:21
21         printf("Вычитаемое: ");
(gdb)
```

Рис. 4: Использование отладчика

# Выполнение работы

A screenshot of a terminal window with a dark background. The window title is 'ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...'. The terminal shows a GDB session where a breakpoint is set at line 21 of 'calculate.c'. The program is run, and the breakpoint is hit. The user then prints the value of 'Numeral', which is 7. Finally, the user deletes the breakpoint and continues the program. The output 'Вычитаемое: 1' and '6.00' is visible, followed by a message that the inferior process exited normally.

```
ksuhalskaya@ksuhalskaya:~/work/study/2022-2023/Операцио...
Breakpoint 1, Calculate (Numeral=7, Operation=0x7fffffffdec4 "-") at calculate.c:21
21      printf("Вычитаемое: ");
(gdb) backtrace
#0 Calculate (Numeral=7, Operation=0x7fffffffdec4 "-") at calculate.c:21
#1 0x00000000004014eb in main () at main.c:17
(gdb) print Numeral
$1 = 7
(gdb) displ Numeral
1: Numeral = 7
(gdb) i b
Num      Type           Disp Enb Address            What
1        breakpoint      keep y  0x000000000040120f in Calculate
                                           at calculate.c:21
breakpoint already hit 1 time
(gdb) del 1
(gdb) c
Continuing.
Вычитаемое: 1
6.00
[Inferior 1 (process 2703) exited normally]
(gdb) q
[ksuhalskaya@ksuhalskaya lab13]$
```

Рис. 5: Использование отладчика

## Выполнение работы

```
kshuhalskaya@kshuhalskaya:~/work/study/2022-2023/Операцио...  
7\377/os-intro/labs/lab13/main.c: (in function main)  
Return value (type int) ignored:  
scanf("%f", &Num...  
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)  
Format argument 1 to scanf (%s) expects char * gets char [4] *: &operation  
Type of parameter is not consistent with corresponding code in format string.  
(Use -formattype to inhibit warning)  
Corresponding format code  
Return value (type int) ignored:  
scanf("%s", &ope...
```

Finished checking --- 4 code warnings

```
[kshuhalskaya@kshuhalskaya lab13]$
```

### Рис. 6: Использование splint

## **Выводы по проделанной работе**

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