

# Лабораторная работа №13

---

Бешкуров Тимофей - студент группы НФИбд-01-21

04.06.2022

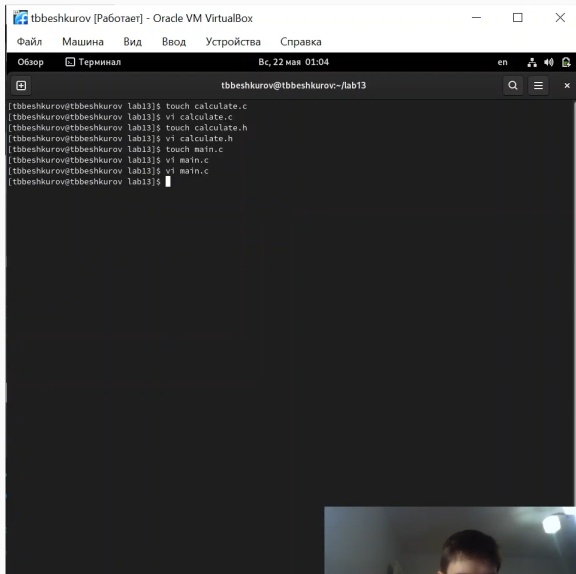
Средства, применяемые при  
разработке программного обеспечения  
в ОС типа UNIX/Linux

---

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.

# Выполнение лабораторной работы

## 1. Создание файлов (рис. 1)

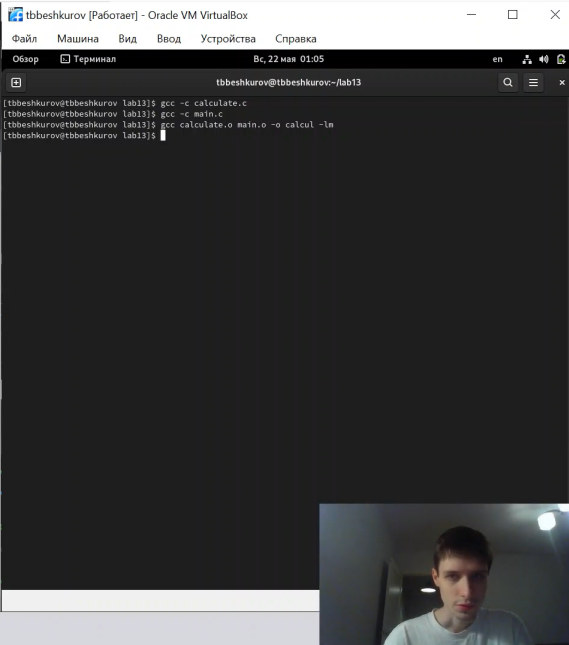


The screenshot shows a terminal window titled "tbbeshkurov [Работаer] - Oracle VM VirtualBox". The window has a menu bar with "Файл", "Машина", "Вид", "Ввод", "Устройства", and "Справка". Below the menu bar is a status bar with "Обзор", "Терминал", "Вт, 22 мая 01:04", "en", and icons for network, volume, and power. The terminal prompt is "tbbeshkurov@tbbeshkurov:~/lab13". The terminal output shows the following commands and their results:

```
tbbeshkurov@tbbeshkurov lab13]$ touch calculate.c
tbbeshkurov@tbbeshkurov lab13]$ vi calculate.c
tbbeshkurov@tbbeshkurov lab13]$ touch calculate.h
tbbeshkurov@tbbeshkurov lab13]$ vi calculate.h
tbbeshkurov@tbbeshkurov lab13]$ touch main.c
tbbeshkurov@tbbeshkurov lab13]$ vi main.c
tbbeshkurov@tbbeshkurov lab13]$ vi main.c
tbbeshkurov@tbbeshkurov lab13]$
```

In the bottom right corner of the slide, there is a small video feed showing a person's face.

## Компилирование (рис. 2)

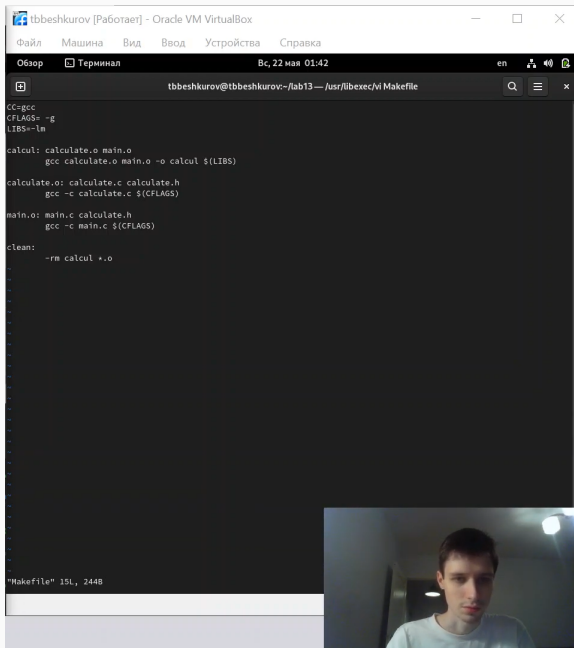


The screenshot shows a terminal window titled "tbbeshkurov [Работаer] - Oracle VM VirtualBox". The window has a menu bar with "Файл", "Машина", "Вид", "Ввод", "Устройства", and "Справка". Below the menu bar is a status bar with "Обзор", "Терминал", and "Вт, 22 мая 01:05". The terminal itself has a title bar "tbbeshkurov@tbbeshkurov:~/lab13" and a search icon. The terminal content shows the following commands and their outputs:

```
[tbbeshkurov@tbbeshkurov lab13]$ gcc -c calculate.c
[tbbeshkurov@tbbeshkurov lab13]$ gcc -c main.c
[tbbeshkurov@tbbeshkurov lab13]$ gcc calculate.o main.o -o calcul -lm
[tbbeshkurov@tbbeshkurov lab13]$
```

In the bottom right corner of the slide, there is a small video inset showing a man with dark hair and a light blue shirt, looking directly at the camera.

## 2. Изменение makefile (рис. 3)



```
tbbeshkurov [Работаer] - Oracle VM VirtualBox
Файл  Машина  Вид  Ввод  Устройства  Справка
Обзор  Терминал  Вс, 22 мая 01:42  en  [иконки]
tbbeshkurov@tbbeshkurov:~/lab13 — /usr/libexec/vi Makefile

CC=gcc
CFLAGS= -g
LIBS=-lm

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

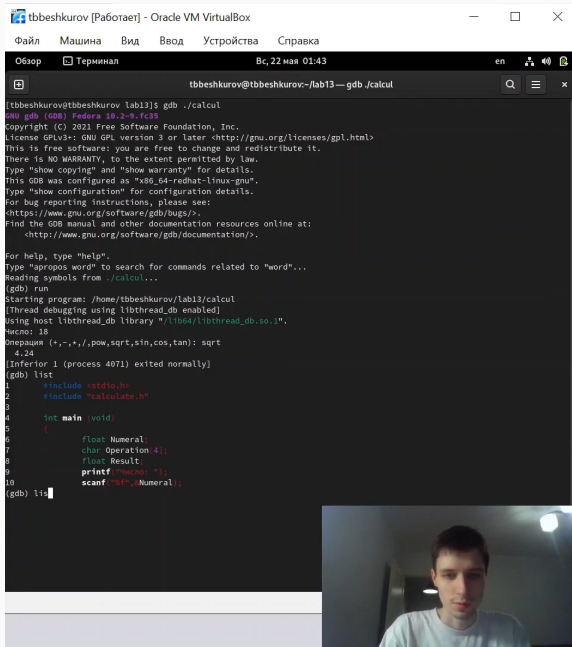
calculate.o: calculate.c calculate.h
    gcc -c calculate.c $(CFLAGS)

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

clean:
    -rm calcul *.o

"Makefile" 15L, 244B
```

### 3. Работа с gdb (рис. 4-6)



The screenshot shows a terminal window titled "tbbeshkurov [Работаer] - Oracle VM VirtualBox". The terminal output shows the execution of `gdb ./calcul` in a Fedora 10.2-9.fc35 environment. The GDB version is 10.2.1. The user runs `run`, and the program starts, displaying a menu with options like `sqrt`, `pow`, `sin`, `cos`, and `tan`. The user then runs `list`, which shows the source code of the `main` function in `calculate.h`. The code includes `stdio.h` and `calculate.h`, and defines a `main` function that takes a character argument and calls `scanf` to read a float into a variable named `Numeral`. The video inset shows a man with short dark hair, wearing a light blue shirt, looking at the camera.

```
tbbeshkurov@tbbeshkurov:~/lab13$ gdb ./calcul
GNU gdb (GDB) Fedora 10.2-9.fc35
Copyright (C) 2021 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-redhat-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 ./calcul...
(gdb) run
Starting program: /home/tbbeshkurov/lab13/calcul
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib64/libthread_db.so.1".
Введите 18
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): sqrt
4.24
[Inferior 1 (process 4071) exited normally]
(gdb) list
1      #include <stdio.h>
2      #include "calculate.h"
3
4      int main (void)
5      {
6          float Numeral;
7          char Operation[4];
8          float Result;
9          printf("Введите: ");
10         scanf("%f",&Numeral);
(gdb) list
```

```
(gdb) list calculate.c:20,27
20         return (Numeral * SecondNumeral);
21     }
22     else if(strncmp(Operation, "/", 1) == 0)
23     {
24         printf("Делить: ");
25         scanf("%f",&SecondNumeral);
26         if(SecondNumeral == 0)
27     {
(gdb) break 21
Breakpoint 1 at 0x401295: file calculate.c, line 22.
(gdb) info breakpoints
Num   Type             Disp Enb Address            What
1     breakpoint       keep y   0x0000000000401295 in Calculate at
(gdb)
```

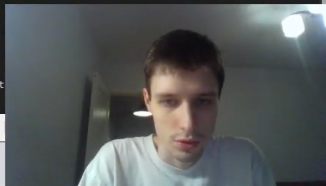


Рис. 5: Работа с gdb



```

(gdb) list calculate.c:20,27
20         return Numeral * SecondNumeral);
21     }
22     else if(strncmp Operation, "/", 1) == 0)
23     {
24         printf("Делить: ");
25         scanf("%f",&SecondNumeral);
26         if(SecondNumeral == 0)
27         {
(gdb) run
Starting program: /home/tbbeshkurov/lab13/calcul
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib64/libthread_db.so.1".
Число: 5
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): /

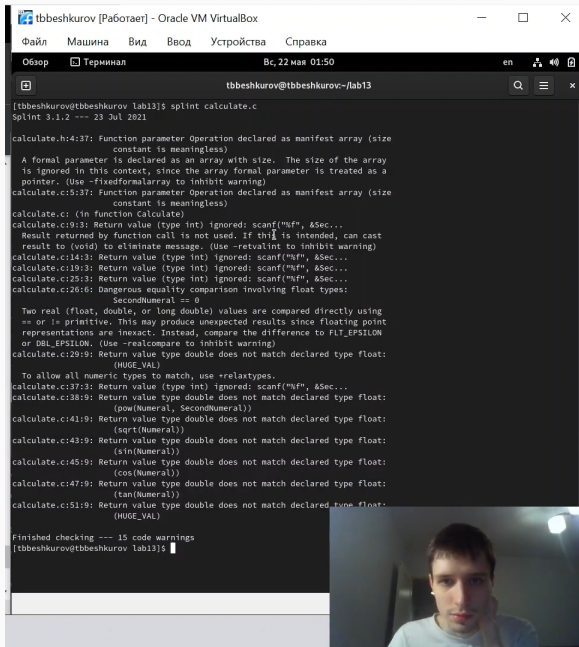
Breakpoint 1, Calculate (Numeral=5, Operation=0x7fffffffdf44 "/") at calculate.c:22
22     else if(strncmp Operation, "/", 1) == 0)
(gdb) backtrace
#0 Calculate (Numeral=5, Operation=0x7fffffffdf44 "/") at calculate.c:22
#1 0x00000000004014eb in main () at main.c:13
(gdb) print Numeral
$1 = 5
(gdb) display Numeral
1: Numeral = 5
(gdb) delete 1
(gdb) info breakpoints
No breakpoints or watchpoints.
(gdb)

```



Рис. 6: Работа с gdb

## 4. splint (рис. 5)



```
tbbbeshkurov [Работаer] - Oracle VM VirtualBox
Файл  Машина  Вид  Ввод  Устройства  Справка
Обзор  Терминал  Вс, 22 мая 01:50  en  [иконки]
tbbbeshkurov@tbbbeshkurov:~/lab13

[tbbeshkurov@tbbbeshkurov lab13]$ splint calculate.c
Splint 3.1.2 --- 23 Jul 2021

calculate.h:4:37: 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:5:37: Function parameter Operation declared as manifest array (size
        constant is meaningless)
calculate.c: (in function Calculate)
calculate.c:9:3: 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:14:3: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:19:3: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:25:3: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:26:6: 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
    or DBL_EPSILON.  (Use -realcompare to inhibit warning)
calculate.c:29:9: Return value type double does not match declared type float:
    (HUGE_VAL)
    To allow all numeric types to match, use -relaxtypes.
calculate.c:37:3: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:38:9: Return value type double does not match declared type float:
    (pow(Numeral, SecondNumeral))
calculate.c:41:9: Return value type double does not match declared type float:
    (sqrt(Numeral))
calculate.c:43:9: Return value type double does not match declared type float:
    (sin(Numeral))
calculate.c:45:9: Return value type double does not match declared type float:
    (cos(Numeral))
calculate.c:47:9: Return value type double does not match declared type float:
    (tan(Numeral))
calculate.c:51:9: Return value type double does not match declared type float:
    (HUGE_VAL)

Finished checking --- 15 code warnings
[tbbeshkurov@tbbbeshkurov lab13]$
```

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.