

# Презентация к лабораторной работе №13

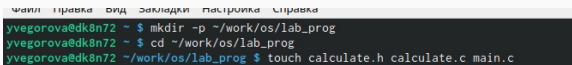
---

Егорова Юлия Владимировна

<sup>1</sup>RUDN University, Moscow, Russian Federation

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.

1) В домашнем каталоге создала подкаталог `~/work/os/lab_prog` в нём файлы: `calculate.h`, `calculate.c`, `main.c`:

A screenshot of a terminal window with a dark background. The window has a title bar with buttons for 'Файл', 'Правка', 'Вид', 'Закладки', 'Настройка', and 'Справка'. The terminal shows three lines of commands and their outputs: the first line creates the directory ~/work/os/lab\_prog, the second line changes the current directory to ~/work/os/lab\_prog, and the third line creates three files (calculate.h, calculate.c, and main.c) in the current directory.

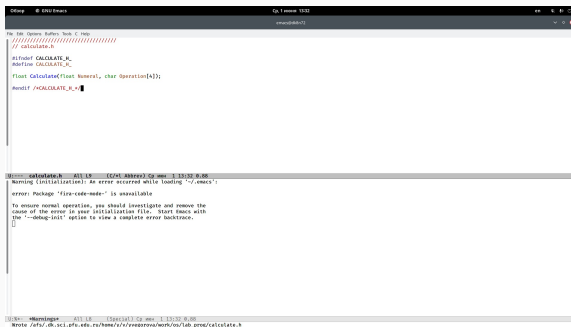
```
yvegorova@dk8n72 ~ $ mkdir -p ~/work/os/lab_prog
yvegorova@dk8n72 ~ $ cd ~/work/os/lab_prog
yvegorova@dk8n72 ~/work/os/lab_prog $ touch calculate.h calculate.c main.c
```

Figure 1: Создание подкаталога и файлов в нём.

```
yvegorova@dk8n72 ~/work/os/lab_prog $ ls
calculate.c calculate.h main.c
yvegorova@dk8n72 ~/work/os/lab_prog $ emacs &
[1] 20294
yvegorova@dk8n72 ~/work/os/lab_prog $
```

Figure 2: Проверка содержимого и переход в Emacs.

## 2) Написала программу для calculate.h:



```
File Edit Open Run Tools C Help
// calculate.h

#ifndef CALCULATE_H_
#define CALCULATE_H_

Float Calculate(Float Numer1, char operation[4]);

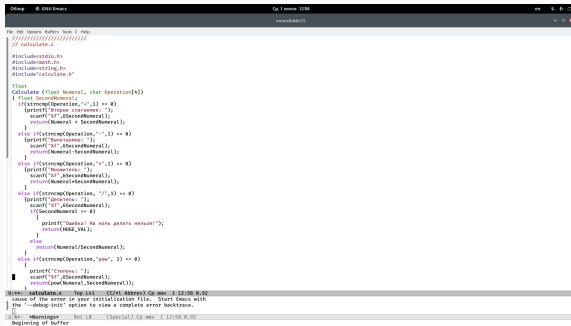
#endif //CALCULATE_H_

----- calculate.h All 18 C++11 Abbrs Cp mem 1 13:30 0.00
Warning (initialization): An error occurred while loading './cmacs':
error: Package 'fira-code-mode-' is unavailable
To ensure normal operation, you should investigate and remove the
cause of the error in your initialization file. Start Emacs with
the '--debug-init' option to view a complete error backtrace.
[]

[1] Src: *Warnings* All 18 C++11 Abbrs Cp mem 1 13:30 0.00
Wrote /afs/db.sci.physics.utoronto.ca/home/physics/professor/mwh/na/lab_prog/calculate.h
```

Figure 3: Программа для calculate.h.

## Написала программу для calculate.c:



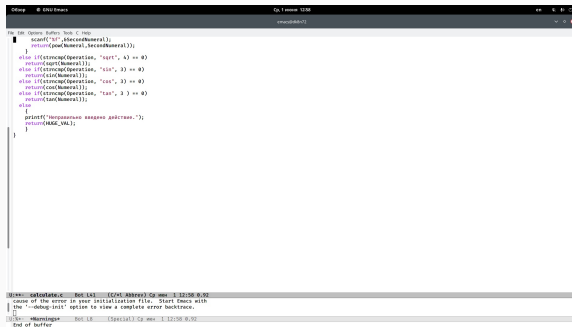
```
File Edit Open Runners Tools C Help
// calculate.c

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

float
Calculate (float Numeral, char Operation[4])
{ float SecondNumeral;
  if (strcmp(Operation, "+") == 0)
    { printf("Input second number: ");
      scanf("%f", &SecondNumeral);
      return(Numeral + SecondNumeral);
    }
  else if (strcmp(Operation, "-") == 0)
    { printf("Input second number: ");
      scanf("%f", &SecondNumeral);
      return(Numeral - SecondNumeral);
    }
  else if (strcmp(Operation, "*") == 0)
    { printf("Input second number: ");
      scanf("%f", &SecondNumeral);
      return(Numeral * SecondNumeral);
    }
  else if (strcmp(Operation, "/") == 0)
    { printf("Input second number: ");
      scanf("%f", &SecondNumeral);
      if (SecondNumeral == 0)
        { printf("Division by zero doesn't make sense!");
          return(MAKE_NULL);
        }
      else
        return(Numeral / SecondNumeral);
    }
  else if (strcmp(Operation, "pow", 3) == 0)
    { printf("Enter: ");
      scanf("%f", &SecondNumeral);
      return(pow(Numeral, SecondNumeral));
    }
  else
    { printf("Error: ");
      scanf("%f", &SecondNumeral);
      return(pow(Numeral, SecondNumeral));
    }
}
```

0: error: calculate.c: Top: 143: (C41: 10000) C4: 1000: 1: 12:50: 0:92  
cause of the error in your initialization file. Start Emacs with  
the "--debug-init" option to view a complete error backtrace.  
[]  
[0] 0: warning: Not LR (Special) C4: 1000: 1: 12:50: 0:92  
Beginning of buffer

Figure 4: Программа для calculate.c.

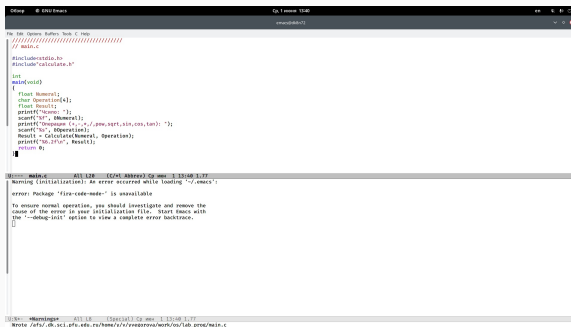


```
0:000> calculate.c:110:1: [CMAKE_80000000] Ca mmm: 1 12:58 0.92
Cause of the error in your initialization file. Start Emacs with
the '--debug-init' option to view a complete error backtrace.
0:000> *Mainframe* Not LR: [Special] Ca mmm: 1 12:58 0.92
End of buffer

1  int main() {
2      char *op;
3      double num1, num2;
4      if (scanf("%lf%lf", &num1, &num2) != 2)
5          return 1;
6      if (scanf("%c", &op) != 1)
7          return 1;
8      switch (op[0]) {
9          case '+':
10             return (num1 + num2);
11          case '-':
12             return (num1 - num2);
13          case '*':
14             return (num1 * num2);
15          case '/':
16             return (num1 / num2);
17          case 's':
18             return (sin(num1));
19          case 'c':
20             return (cos(num1));
21          case 't':
22             return (tan(num1));
23          default:
24             printf("Неправильно введено действие.");
25             return (HUGE_VAL);
26      }
27  }
```

Figure 5: Программа для calculate.c.

## Написала программу для main.c:



```
File Edit Open Buffer Tools C Help
main.c
// main.c

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

int
main(void)
{
    float Numeral;
    char Operation[4];
    float Result;
    printf("Num: ");
    scanf("%f", &Numeral);
    printf("Operation (%+,+,*,/,pow,sqrt,sin,cos,tan): ");
    scanf("%s", &Operation);
    Result = Calculate(Numeral, Operation);
    printf("No.2Fun: %s\n", Result);
    return 0;
}
```

Warning (Initialization): An error occurred while loading "/usr/bin/ld".  
error: Package "fire-code-node-" is unavailable  
To ensure normal operation, you should investigate and remove the cause of the error in your initialization file. Start Emacs with the "--debug-init" option to view a complete error backtrace.

Warning: All 1.8 [g++(9)] C++ 1.13/00 1.77  
Note /afs/ds.csi.cfu.edu.au/home/p/ci/program/work/os/lab\_prog/main.c

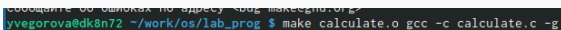
Figure 6: Программа для main.c.



3)Выполнила компиляцию программы посредством gcc:

```
yvegorova@dk8n72 ~/work/os/lab_prog $ gcc -c calculate.c  
yvegorova@dk8n72 ~/work/os/lab_prog $ gcc -c main.c  
yvegorova@dk8n72 ~/work/os/lab_prog $ gcc calculate.o main.o -o calcul -lm
```

Figure 7: Выполнение компиляции.

A terminal window with a dark background. The prompt is 'yvegorova@edk8n72 ~/work/os/lab\_prog \$'. The command entered is 'make calculate.o gcc -c calculate.c -g'. The output is not visible, suggesting a successful compilation.

```
сообщайте об ошибках по адресу <a href="mailto:bug-makesgn.org">bug-makesgn.org</a>  
yvegorova@edk8n72 ~/work/os/lab_prog $ make calculate.o gcc -c calculate.c -g
```

Figure 8: Вывод компиляции.

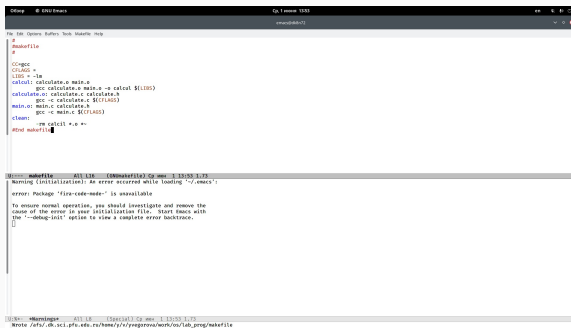
```
yvegorova@dk8n72 ~/work/os/lab_prog $ make main.o gcc -c main.c -g
```

Figure 9: Вывод компиляции.

```
yvegorova@dk8n72 ~/work/os/lab_prog $ make calcul gcc calculate.o main.o -o calcul -lm
```

Figure 10: Вывод компиляции.

## 4) Создание и заполнение содержимого Makefile:

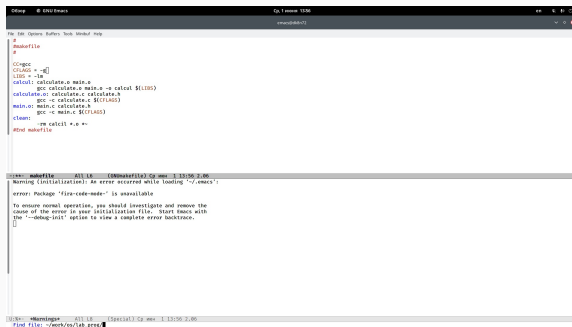


```
0
$ makefile
$
CC=gcc
CFLAGS =
LDS = -lc
calcul: calculate.o main.o
    gcc calculate.o main.o -o calcul $(LDS)
calculate.o: calculate.c calculate.h
    gcc -c calculate.c $(CFLAGS)
main.o: main.c calculate.h
    gcc -c main.c $(CFLAGS)
clean:
    rm calcul *.o *~
#end makefile

$ makefile All Lib [00makefile] Cp mem 1 13/55 1.75
Warning (initialization): An error occurred while loading './emacs':
error: Package 'fire-code-node-' is unavailable
To ensure normal operation, you should investigate and remove the
cause of the error in your initialization file. Start Emacs with
the '--debug-init' option to view a complete error backtrace.
$
```

Figure 11: Создание файла.

## 5)Исправила этот файл:



```
0
makefile
0
CC=gcc
CFLAGS = -g
LDFLAGS = -lm
calcul: calculate.o main.o
    gcc calculate.o main.o -o calcul $(LDFLAGS)
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 *~
endif makefile

===== makefile All LE [30makefile] Cp mes 1 13:56 2,86
Warning (initialization): An error occurred while loading './emacs':
error: Package 'fire-code-node-' is unavailable
To ensure normal operation, you should investigate and remove the
cause of the error in your initialization file. Start Emacs with
the '--debug-init' option to view a complete error backtrace.
[]

===== warnings All LE [30makefile] Cp mes 1 13:56 2,86
Find file: ~/work/es/lab_prog
```

Figure 12: Исправление файла.

6)С помощью gdb выполнила отладку программы calcul (перед использованием gdb исправила Makefile), а затем запустила отладчик GDB, загрузив в него программу для отладки:

```
yvegorova@edk8n72 ~/work/os/lab_prog $ gdb ./calcul
GNU gdb (Gentoo 10.2 vanilla) 10.2
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-pc-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<https://bugs.gentoo.org/>.
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) █
```

Figure 13: Команданда gdb ./calcul.

# Проверка работы калькулятора

Нажала run, ввела число 7, выбрала операцию сложения, прибавила 7 и получила верный ответ 14:

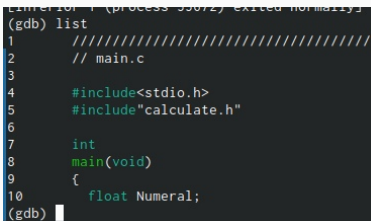
```
yvegorova@dkn72 ~/work/os/lab_prog $ gdb ./calcul
GNU gdb (Gentoo 10.2 vanilla) 10.2
Copyright (C) 2021 Free Software Foundation, Inc.
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.
Type "show copying" and "show warranty" for details.
This GDB was configured as "x86_64-pc-linux-gnu".
Type "show configuration" for configuration details.
For bug reporting instructions, please see:
<https://bugs.gentoo.org/>.
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: /afs/.dk.sci.pfu.edu.ru/home/y/v/yvegorova/work/os/lab_prog/calcul
Число: 7
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): +
Второе слагаемое: 7
14.00
[Inferior 1 (process 33672) exited normally]
(gdb) █
```

Figure 14: Проверка работы.



Затем последовательно ввела команды `list`, `list 12,15`, `list calculate.c:20,29`, `list calculate.c:20,27`, `break 21`, `info breakpoints`, `backtrace`, `print Numeral`, `display Numeral`, `info breakpoints` и `delete 1`:



```
[inferior 1 (process 95672) exited normally]
(gdb) list
1  //////////////////////////////////////
2  // main.c
3
4  #include<stdio.h>
5  #include"calculate.h"
6
7  int
8  main(void)
9  {
10     float Numeral;
(gdb) █
```

Figure 15: Команда `list`.

```
10 float Numeral1;  
(gdb) list 12,15  
12     float Result;  
13     printf("Число: ");  
14     scanf("%f", &Numeral);  
15     printf("Операция (+,-,*,/,pow,sqrt,sin,cos,tan): ");  
(gdb) □
```

Figure 16: Команда list 12,15.

```
(gdb) list calculate.c:20,29
20         return(Numeral-SecondNumeral);
21     }
22     else if(strncmp(Operation,"*",1) == 0)
23     {printf("Множитель: ");
24       scanf("%f",&SecondNumeral);
25       return(Numeral*SecondNumeral);
26     }
27     else if(strncmp(Operation, "/",1) == 0)
28     {printf("Делитель: ");
29       scanf("%f",&SecondNumeral);
(gdb) █
```

Figure 17: Команда list calculate.c:20,29.

## Ввод команд

[illegible]

**Figure 18:** Команды break 21, info breakpoints, backtrace.

## Ввод команд

[illegible]

**Figure 19:** Команда print Numeral, display Numeral, info breakpoints и delete 1.

В ходе выполнения данной лабораторной работы я приобрела простейшие навыки разработки, анализа, тестирования и отладки приложений в ОС типа UNIX/Linux на примере создания на языке программирования C калькулятора с простейшими функциями.