

Лабораторная работа №13

Операционные системы

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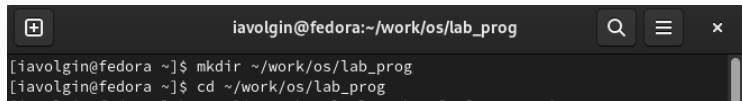
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Приобрести простейшие навыки разработки, анализа, тестирования и отладки приложений в ОС типа UNIX/Linux на примере создания на языке программирования С калькулятора с простейшими функциями.

Создание нужных подкаталог ~/work/os/lab_prog



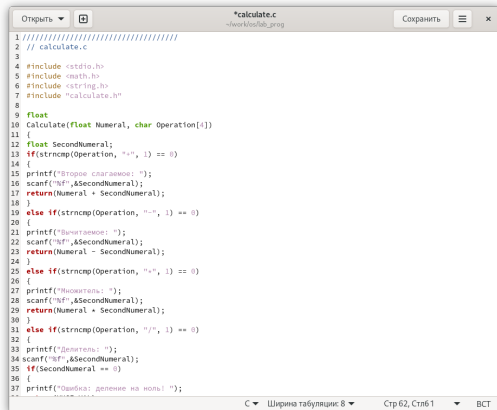
```
iavolgin@fedora:~/work/os/lab_prog
```

A terminal window with a dark background. The title bar shows a plus icon, the text "iavolgin@fedora:~/work/os/lab_prog", a search icon, a menu icon, and a close icon. The terminal content shows two commands being executed: "mkdir ~/work/os/lab_prog" and "cd ~/work/os/lab_prog".

```
[iavolgin@fedora ~]$ mkdir ~/work/os/lab_prog  
[iavolgin@fedora ~]$ cd ~/work/os/lab_prog
```

Создание в нем файлы calculate.h, calculate.c, main.c и ввести код в них

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



```
1 //////////////////////////////////////////////////
2 // calculate.c
3
4 #include <stdio.h>
5 #include <math.h>
6 #include <string.h>
7 #include "calculate.h"
8
9 float
10 Calculate(float Numeral, char Operation[1])
11 {
12     float SecondNumeral;
13     if(strncmp(Operation, "+", 1) == 0)
14     {
15         printf("Второе слагаемое: ");
16         scanf("%f", &SecondNumeral);
17         return(Numeral + SecondNumeral);
18     }
19     else if(strncmp(Operation, "-", 1) == 0)
20     {
21         printf("Вчитаемое: ");
22         scanf("%f", &SecondNumeral);
23         return(Numeral - SecondNumeral);
24     }
25     else if(strncmp(Operation, "*", 1) == 0)
26     {
27         printf("Умножитель: ");
28         scanf("%f", &SecondNumeral);
29         return(Numeral * SecondNumeral);
30     }
31     else if(strncmp(Operation, "/", 1) == 0)
32     {
33         printf("Делитель: ");
34         scanf("%f", &SecondNumeral);
35         if(SecondNumeral == 0)
36         {
37             printf("Ошибка: деление на ноль! ");
38         }
39     }
40 }
```

Код файлов calculate.h и main.c

```
1 //////////////////////////////////////////////////
2 // calculate.h
3
4 #ifndef CALCULATE_H_
5 #define CALCULATE_H_
6
7 float Calculate(float Numeral, char Operation[]);
8
9 #endif //CALCULATE_H_
```

Заголовок C/ObjC Ширина табуляции: 8 Стр 9, Стлб 1 ВСТ

```
1 //////////////////////////////////////////////////
2 // main.c
3
4 #include <stdio.h>
5 #include "calculate.h"
6
7 int main (void)
8 {
9     float Numeral;
10     char Operation[4];
11     float Result;
12     printf("Число: ");
13     scanf("%f", &Numeral);
14     printf("Операция (+, -, *, /, pow, sqrt, sin, cos, tan): ");
15     scanf("%s", &Operation);
16     Result = Calculate(Numeral, Operation);
17     printf("%6.2f\n", Result);
18     return 0;
19 }
```

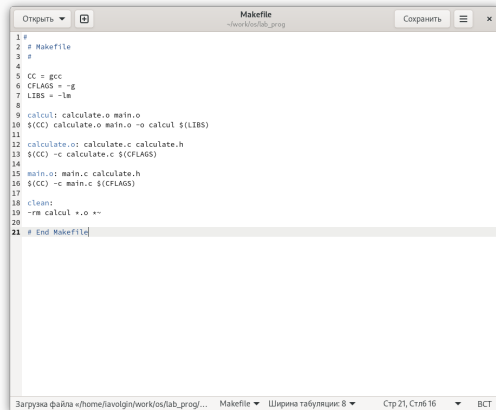
Загрузка файла «/home/ivolgin/work/os/lab_prog/main.c»... С Ширина табуляции: 8 Стр 19, Стлб 1 ВСТ

Выполнение компиляции программы посредством gcc.

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

Создание Makefile

```
[iavolgin@fedora lab_prog]$ touch Makefile
[iavolgin@fedora lab_prog]$ ls
calcul calculate.c calculate.h calculate.o main.c main.o Makefile
[iavolgin@fedora lab_prog]$
```



```
1 #
2 # Makefile
3 #
4
5 CC = gcc
6 CFLAGS = -g
7 LIBS = -lm
8
9 calcul: calculate.o main.o
10 $(CC) calculate.o main.o -o calcul $(LIBS)
11
12 calculate.o: calculate.c calculate.h
13 $(CC) -c calculate.c $(CFLAGS)
14
15 main.o: main.c calculate.h
16 $(CC) -c main.c $(CFLAGS)
17
18 clean:
19 -rm calcul *.o *~
20
21 # End Makefile
```


Запуск gdb и программы в нем

```
[iavolgin@fedora lab_prog]$ gdb ./calcul
GNU gdb (GDB) Fedora Linux 13.1-1.fc37
Copyright (C) 2023 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/>.
```

```
(gdb) run
Starting program: /home/iavolgin/work/os/lab_prog/calcul
Downloading separate debug info for system-supplied DSO at 0x7ffff7fc6000
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib64/libthread_db.so.1".
Число: 3
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): *
Множитель: 5
15.00
[Inferior 1 (process 4534) exited normally]
(gdb)
```

Анализ кода файлов calculate.c и main.c с помощью утилиты splint.

```
iavolgin@fedora:~/work/os/lab_prog
[iavolgin@fedora lab_prog]$ splint calculate.c
Splint 3.1.2 --- 23 Jul 2022

calculate.h:7:38: 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:10:32: Function parameter Operation declared as manifest array
(size constant is meaningless)
calculate.c: (in function Calculate)
calculate.c:16:2: 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:22:2: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:28:2: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:34:1: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:35:5: 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
    or DBL_EPSILON. (Use -realcompare to inhibit warning)
calculate.c:38:8: Return value type double does not match declared type float:
```

```
iavolgin@fedora:~/work/os/lab_prog
(HUGE_VAL)

Finished checking --- 15 code warnings
[iavolgin@fedora lab_prog]$ splint main.c
Splint 3.1.2 --- 23 Jul 2022

calculate.h:7:38: 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)
main.c: (in function main)
main.c:13:2: 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)
main.c:15:13: 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)
    main.c:15:10: Corresponding format code
main.c:15:2: Return value (type int) ignored: scanf("%s", &Ope...

Finished checking --- 4 code warnings
[iavolgin@fedora lab_prog]$
```

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