

Средства для создания приложений в ОС UNIX.

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Цели и задачи работы

Цель лабораторной работы

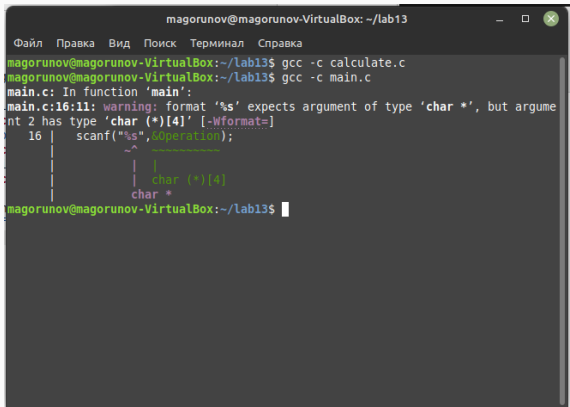
Приобрести простейшие навыки разработки, анализа, тестирования и отладки приложений в ОС типа UNIX/Linux на примере создания на языке программирования С калькулятора с простейшими функциями.

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

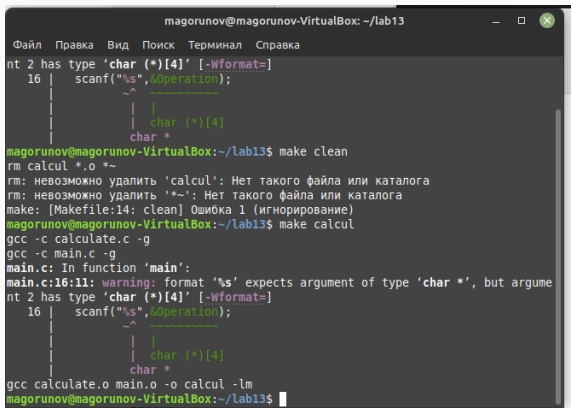
Выполнение работы



```
magorunov@magorunov-VirtualBox: ~/lab13
Файл  Правка  Вид  Поиск  Терминал  Справка
magorunov@magorunov-VirtualBox:~/lab13$ gcc -c calculate.c
magorunov@magorunov-VirtualBox:~/lab13$ gcc -c main.c
main.c: In function 'main':
main.c:16:11: warning: format '%s' expects argument of type 'char *', but argume
nt 2 has type 'char (*)[4]' [-Wformat=]
   16 |     scanf("%s", &operation);
      |           ~^
      |           |
      |           | char (*)[4]
      |           char *
magorunov@magorunov-VirtualBox:~/lab13$
```

Figure 1: Компиляция

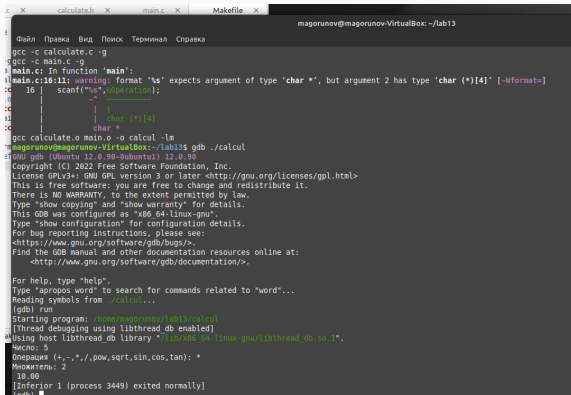
Выполнение работы



```
magorunov@magorunov-VirtualBox: ~/lab13
Файл  Правка  Вид  Поиск  Терминал  Справка
nt 2 has type 'char (*)[4]' [-Wformat=]
16 | scanf("%s", &operation);
    |             ^
    |             | char (*)[4]
    |             char *
magorunov@magorunov-VirtualBox:~/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)
magorunov@magorunov-VirtualBox:~/lab13$ make calcul
gcc -c calculate.c -g
gcc -c main.c -g
main.c: In function 'main':
main.c:16:11: warning: format '%s' expects argument of type 'char *', but argume
nt 2 has type 'char (*)[4]' [-Wformat=]
16 |   scanf("%s", &operation);
    |   ~^
    |   | char (*)[4]
    |   char *
gcc calculate.o main.o -o calcul -lm
magorunov@magorunov-VirtualBox:~/lab13$
```

Figure 2: Использование make

Выполнение работы

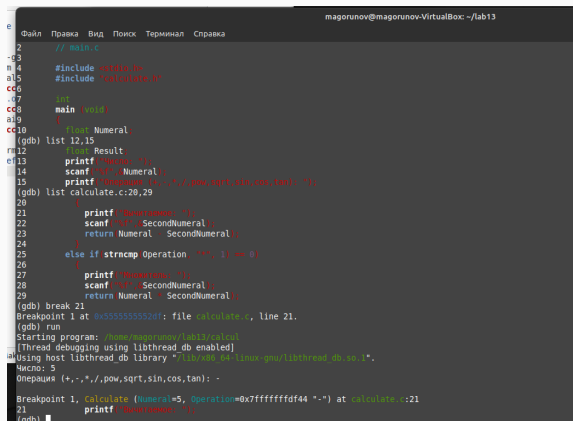


```
File Edit View Search Terminal Help
gcc -c calculate.c -g
gcc -c main.c -g
main.c: In function 'main':
main.c:10:11: warning: format '%s' expects argument of type 'char *', but argument 2 has type 'char (*)[4]' [-Wformat=]
10 |     scanf("%s", operation);
    |             ^~
    |             |
    |             | char (*)[4]
    |             char *
gcc calculate.o main.o -o calcul -lm
magorunov@magorunov-VirtualBox: ~/lab13$ gdb ./calcul
GNU gdb (Ubuntu 12.0.90-ubuntu1) 12.0.90
Copyright (C) 2022 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-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/magorunov/lab13/calcul
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Число: 5
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): *
Мультипликатор: 2
10.00
[Inferior 1 (process 3449) exited normally]
(gdb)
```

Figure 3: Использование отладчика

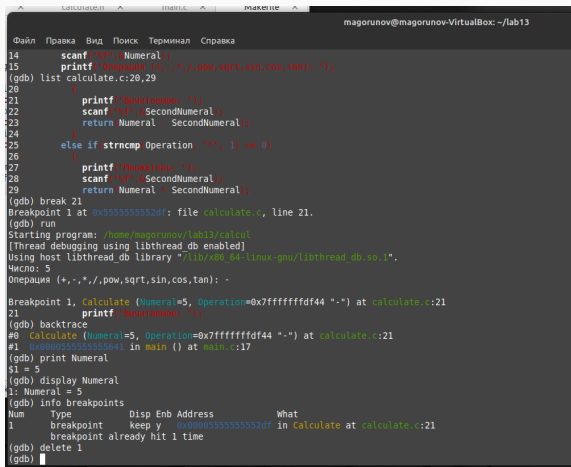
Выполнение работы



```
magorunov@magorunov-VirtualBox: ~/lab13
2 // main.c
3
4 #include <stdio.h>
5 #include "calculate.h"
6
7 int
8 main (void)
9 {
10     float Numeral;
11     (gdb) list 12,15
12     float Result;
13     printf("Numeral: ");
14     scanf("%f",&Numeral);
15     printf("Operation (+,.,*,/,pow,sqrt,sin,cos,tan): ");
16     (gdb) list calculate.c:20,29
17     {
18         printf("Numeral: ");
19         scanf("%f",&SecondNumeral);
20         return Numeral * SecondNumeral;
21     }
22     else if strcmp Operation == "+")
23     {
24         printf("Numeral: ");
25         scanf("%f",&SecondNumeral);
26         return Numeral + SecondNumeral;
27     }
28     (gdb) break 21
29 Breakpoint 1 at 0x555555552df: file calculate.c, line 21.
30 (gdb) run
31 Starting program: /home/magorunov/lab13/calcul
32 [Thread debugging using libthread_db enabled]
33 Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
34 Число: 5
35 Операция (+,.,*,/,pow,sqrt,sin,cos,tan): +
36
37 Breakpoint 1, Calculate (Numeral=5, Operation=0x7fffffffdf44 "+") at calculate.c:21
38 21     printf("Numeral: ");
39 (gdb)
```

Figure 4: Использование отладчика

Выполнение работы



```
magorunov@magorunov-VirtualBox: ~/lab13
Файл Правка Вид Поиск Терминал Справка
14 scanf("%f", &Numeral);
15 printf("Операция (+, -, *, /, pow, sqrt, sin, cos, tan): ");
(gdb) list calculate.c:20,29
20 {
21     printf("Numeral= ");
22     scanf("%f", &SecondNumeral);
23     return Numeral + SecondNumeral;
24 }
25 else if (strcmp(Operation, "+") == 0)
26 {
27     printf("Numeral= ");
28     scanf("%f", &SecondNumeral);
29     return Numeral + SecondNumeral;
(gdb) break 21
Breakpoint 1 at 0x555555552df: file calculate.c, line 21.
(gdb) run
Starting program: /home/magorunov/lab13/calculate
[Thread debugging using libthread_db enabled]
Using host libthread_db library "/lib/x86_64-linux-gnu/libthread_db.so.1".
Число: 5
Операция (+, -, *, /, pow, sqrt, sin, cos, tan): +
Breakpoint 1, Calculate (Numeral=5, Operation=0x7fffffff44 "-") at calculate.c:21
21 printf("Numeral= ");
(gdb) backtrace
#0 Calculate (Numeral=5, Operation=0x7fffffff44 "-") at calculate.c:21
#1 0x0000555555555641 in main () at main.c:17
(gdb) print Numeral
$1 = 5
(gdb) display Numeral
1: Numeral = 5
(gdb) info breakpoints
Num Type Disposition Address What
1 breakpoint keep y 0x0000555555555641 in Calculate at calculate.c:21
breakpoint already hit 1 time
(gdb) delete 1
(gdb)
```

Figure 5: Использование отладчика

Выполнение работы

```
magorunov@magorunov-VirtualBox: ~/la
Файл  Правка  Вид  Поиск  Терминал  Справка
Cannot open file: calculate.

Finished checking --- no code processed
magorunov@magorunov-VirtualBox:~/lab13$ splint calculate.c
Splint 3.1.2 --- 21 Feb 2021

calculate.h:5:37: 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:10:31: Function parameter Operation declared as manifest array
      (size constant is meaningless)
calculate.c: (in function Calculate)
calculate.c:16:7: 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:22:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:28:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:34:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:35:10: 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:38:10: Return value type double does not match declared type float:
      (HUGE_VAL)
    To allow all numeric types to match, use +relaxtypes.
calculate.c:46:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:47:13: Return value type double does not match declared type float:
      (pow(Numeral, SecondNumeral))
calculate.c:50:11: Return value type double does not match declared type float:
      (sqrt(Numeral))
calculate.c:52:11: Return value type double does not match declared type float:
      (sin(Numeral))
calculate.c:54:11: Return value type double does not match declared type float:
```

Figure 6: Использование splint

Выводы по проделанной работе

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.