Презентация по лабораторной работе №13

Паращенко Антонина

28 апреля 2022

РУДН, Москва, Россия

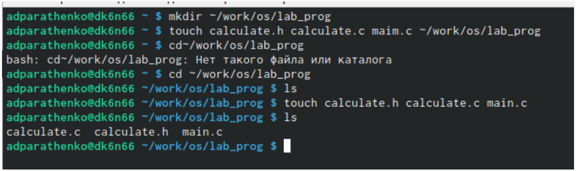
Цель работы

Цель работы

Приобрести простейшие навыки разработки,анализа,тестирования и отладки при-ложений в ОС типа UNIX/Linux на примере создания на языке программированияC калькулятора с простейшими функциями.

Ход лабораторной работы

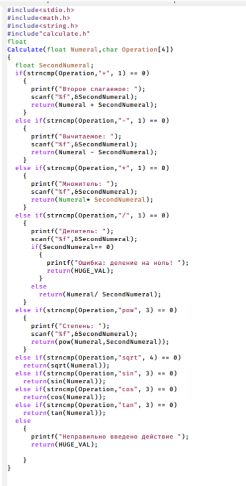
В домашнем каталоге создаём подкаталог ~/work/os/lab_prog и создаём в нём файлы: calculate.h,calculate.c,main.c



```
adparathenko@dk6n66 ~ $ mkdir ~/work/os/lab_prog
adparathenko@dk6n66 ~ $ touch calculate.h calculate.c maim.c ~/work/os/lab_prog
adparathenko@dk6n66 ~ $ cd~/work/os/lab_prog
bash: cd~/work/os/lab_prog: Нет такого файла или каталога
adparathenko@dk6n66 ~ $ cd ~/work/os/lab_prog
adparathenko@dk6n66 ~/work/os/lab_prog $ ls
adparathenko@dk6n66 ~/work/os/lab_prog $ touch calculate.h calculate.c main.c
adparathenko@dk6n66 ~/work/os/lab_prog $ ls
calculate.c  calculate.h  main.c
adparathenko@dk6n66 ~/work/os/lab_prog $ 
```

Figure 1: Консоль

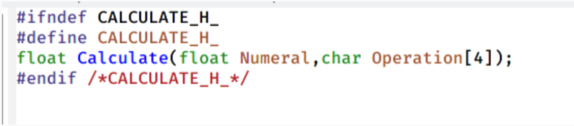
Пишем скрипт файла calculate.c



```c
#include<stdio.h>
#include<math.h>
#include<string.h>
#include"calculate.h"
float
Calculate(float Numeral,char Operation[4])
{
  float SecondNumeral;
  if(strncmp(Operation,"+", 1) == 0)
    {
      printf("Второе слагаемое: ");
      scanf("%f",&SecondNumeral);
      return(Numeral + SecondNumeral);
    }
  else if(strncmp(Operation,"-", 1) == 0)
    {
      printf("Вычитаемое: ");
      scanf("%f",&SecondNumeral);
      return(Numeral - SecondNumeral);
    }
  else if(strncmp(Operation,"*", 1) == 0)
    {
      printf("Множитель: ");
      scanf("%f",&SecondNumeral);
      return(Numeral* SecondNumeral);
    }
  else if(strncmp(Operation,"/", 1) == 0)
    {
      printf("Делитель: ");
      scanf("%f",&SecondNumeral);
      if(SecondNumeral== 0)
        {
          printf("Ошибка: деление на ноль! ");
          return(HUGE_VAL);
        }
      else
        return(Numeral/ SecondNumeral);
    }
  else if(strncmp(Operation,"pow", 3) == 0)
    {
      printf("Степень: ");
      scanf("%f",&SecondNumeral);
      return(pow(Numeral,SecondNumeral));
    }
  else if(strncmp(Operation,"sqrt", 4) == 0)
    return(sqrt(Numeral));
  else if(strncmp(Operation,"sin", 3) == 0)
    return(sin(Numeral));
  else if(strncmp(Operation,"cos", 3) == 0)
    return(cos(Numeral));
  else if(strncmp(Operation,"tan", 3) == 0)
    return(tan(Numeral));
  else
    {
      printf("Неправильно введено действие ");
      return(HUGE_VAL);

    }
}
```

Figure 2: Скрипт

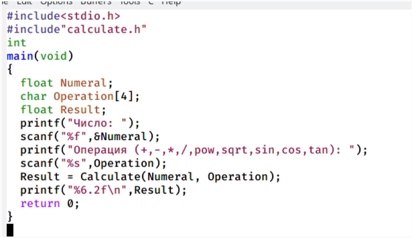
Пишем скрипт файла calculate.h



```
#ifndef CALCULATE_H_
#define CALCULATE_H_
float Calculate(float Numeral,char Operation[4]);
#endif /*CALCULATE_H_*/
```

Figure 3: Скрипт

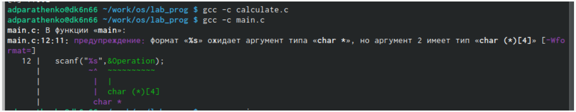
Пишем скрипт файла main.c



```c
#include<stdio.h>
#include"calculate.h"
int
main(void)
{
  float Numeral;
  char Operation[4];
  float Result;
  printf("Число: ");
  scanf("%f",&Numeral);
  printf("Операция (+,-,*,/,pow,sqrt,sin,cos,tan): ");
  scanf("%s",Operation);
  Result = Calculate(Numeral, Operation);
  printf("%6.2f\n",Result);
  return 0;
}
```

Figure 4: Скрипт

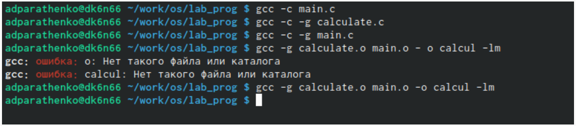
Выполняем компиляцию программы посредством gcc, исправляем ошибки и компилируем снова



```
adparathenko@dk6n66 ~/work/os/lab_prog $ gcc -c calculate.c
adparathenko@dk6n66 ~/work/os/lab_prog $ gcc -c main.c
main.c: В функции «main»:
main.c:12:11: предупреждение: формат «%s» ожидает аргумент типа «char *», но аргумент 2 имеет тип «char (*)[4]» [-Wfo
rmat=]
   12 |   scanf("%s",&Operation);
      |          ~^  ~~~~~~~~~~
      |           |  |
      |           |  char (*)[4]
      |           char *
```

Figure 5: Компиляция

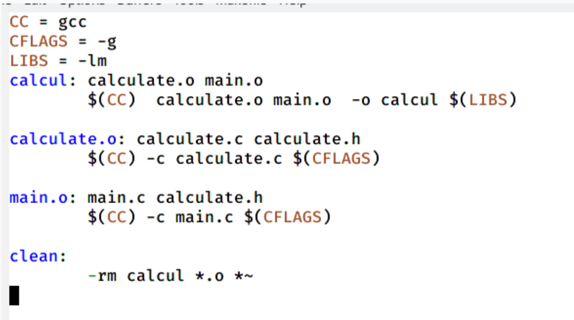
Выполняем компиляцию программы посредством gcc, исправляем ошибки и компилируем снова



```
adparathenko@dk6n66 ~/work/os/lab_prog $ gcc -c main.c
adparathenko@dk6n66 ~/work/os/lab_prog $ gcc -c -g calculate.c
adparathenko@dk6n66 ~/work/os/lab_prog $ gcc -c -g main.c
adparathenko@dk6n66 ~/work/os/lab_prog $ gcc -g calculate.o main.o - o calcul -lm
gcc: ошибка: o: Нет такого файла или каталога
gcc: ошибка: calcul: Нет такого файла или каталога
adparathenko@dk6n66 ~/work/os/lab_prog $ gcc -g calculate.o main.o -o calcul -lm
adparathenko@dk6n66 ~/work/os/lab_prog $ 
```

Figure 6: Компиляция

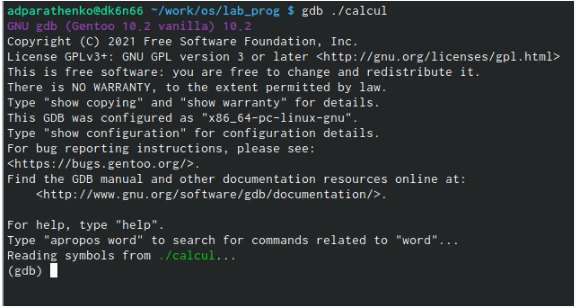
Создаём Makefile, который выполняет компиляцию программы посредством gcc вместо ручного ввода.



```
CC = gcc
CFLAGS = -g
LIBS = -lm
calcul: calculate.o main.o
        $(CC)  calculate.o main.o  -o calcul $(LIBS)

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

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

clean:
        -rm calcul *.o *~
```

Figure 7: Скрипт кода

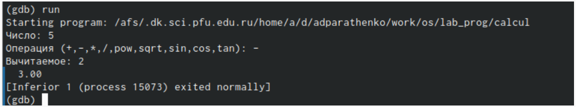
Запускаем отладчик GDB,загрузив в него программу для отладки.



```
adparathenko@dk6n66 ~/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 8: Отладка файла

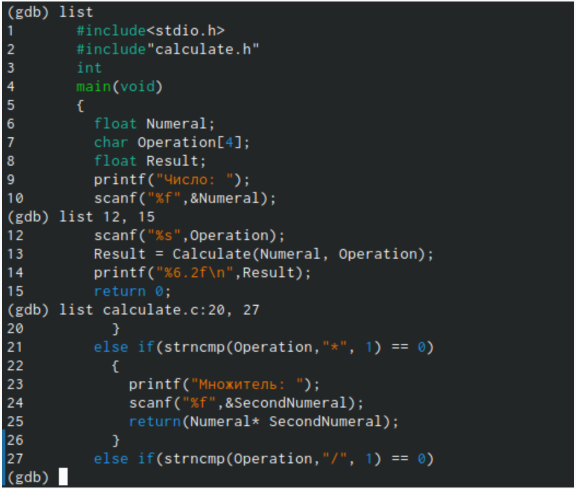
Запускаем программу внутри отладчика с помощью команды run (рис. 9)



```
(gdb) run
Starting program: /afs/.dk.sci.pfu.edu.ru/home/a/d/adparathenko/work/os/lab_prog/calcul
Число: 5
Операция (+,-,*,/,pow,sqrt,sin,cos,tan): -
Вычитаемое: 2
  3.00
[Inferior 1 (process 15073) exited normally]
(gdb) 
```

Figure 9: Запуск программы

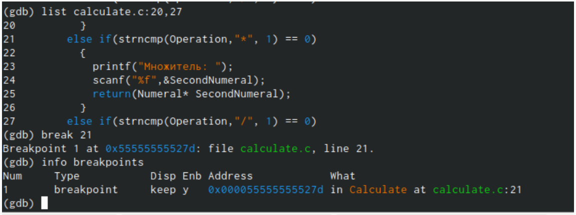
Для просмотра исходного код используем команду list.



```
(gdb) list
1       #include<stdio.h>
2       #include"calculate.h"
3       int
4       main(void)
5       {
6         float Numeral;
7         char Operation[4];
8         float Result;
9         printf("Число: ");
10        scanf("%f",&Numeral);
(gdb) list 12, 15
12        scanf("%s",Operation);
13        Result = Calculate(Numeral, Operation);
14        printf("%6.2f\n",Result);
15        return 0;
(gdb) list calculate.c:20, 27
20          }
21        else if(strncmp(Operation,"*", 1) == 0)
22          {
23            printf("Множитель: ");
24            scanf("%f",&SecondNumeral);
25            return(Numeral* SecondNumeral);
26          }
27        else if(strncmp(Operation,"/", 1) == 0)
(gdb) 
```

Figure 10: Просмотр файла

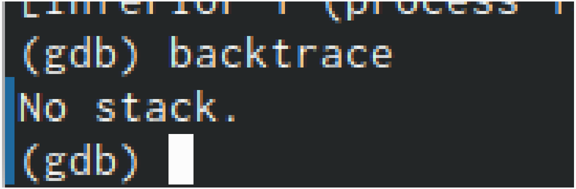
Устанавливаем точку останова



```
(gdb) list calculate.c:20,27
20          }
21        else if(strncmp(Operation,"*", 1) == 0)
22          {
23            printf("Множитель: ");
24            scanf("%f",&SecondNumeral);
25            return(Numeral* SecondNumeral);
26          }
27        else if(strncmp(Operation,"/", 1) == 0)
(gdb) break 21
Breakpoint 1 at 0x55555555527d: file calculate.c, line 21.
(gdb) info breakpoints
Num     Type           Disp Enb Address            What
1       breakpoint     keep y   0x000055555555527d in Calculate at calculate.c:21
(gdb) █
```

Figure 11: Тоска останова

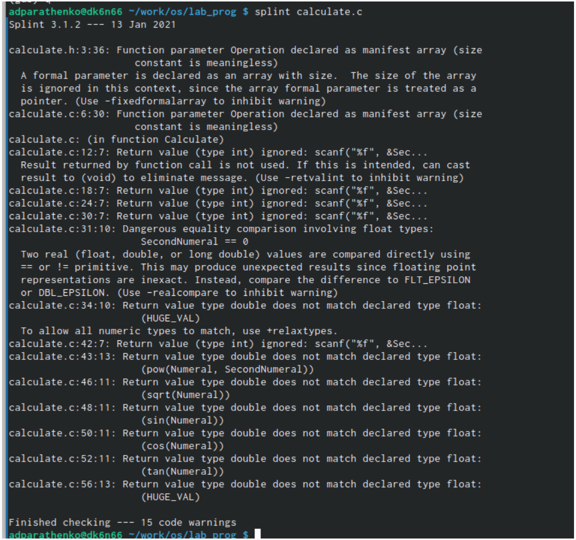
С помощью команды backtrace смотрим весь стек вызываемых функций



```
[Inferior 1 (process 1
(gdb) backtrace
No stack.
(gdb) 
```

Figure 12: Запуск файла

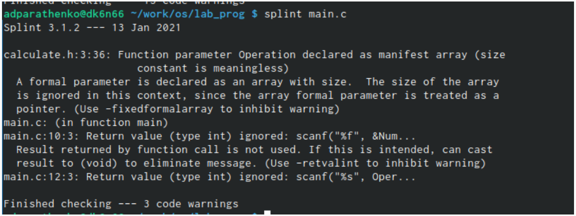
С помощью утилиты splint анализируем коды файлов



```
adparathenko@dk6n66 ~/work/os/lab_prog $ splint calculate.c
Splint 3.1.2 --- 13 Jan 2021

calculate.h:3:36: 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:6:30: Function parameter Operation declared as manifest array (size
                     constant is meaningless)
calculate.c: (in function Calculate)
calculate.c:12:7: 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:18:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:24:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:30:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:31:10: 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:34:10: Return value type double does not match declared type float:
                      (HUGE_VAL)
  To allow all numeric types to match, use +relaxtypes.
calculate.c:42:7: Return value (type int) ignored: scanf("%f", &Sec...
calculate.c:43:13: Return value type double does not match declared type float:
                      (pow(Numeral, SecondNumeral))
calculate.c:46:11: Return value type double does not match declared type float:
                      (sqrt(Numeral))
calculate.c:48:11: Return value type double does not match declared type float:
                      (sin(Numeral))
calculate.c:50:11: Return value type double does not match declared type float:
                      (cos(Numeral))
calculate.c:52:11: Return value type double does not match declared type float:
                      (tan(Numeral))
calculate.c:56:13: Return value type double does not match declared type float:
                      (HUGE_VAL)

Finished checking --- 15 code warnings
adparathenko@dk6n66 ~/work/os/lab_prog $
```

Figure 13: calculate.c

С помощью утилиты splint анализируем коды файлов



```
Finished checking --- 15 code warnings
adparathenko@dk6n66 ~/work/os/lab_prog $ splint main.c
Splint 3.1.2 --- 13 Jan 2021

calculate.h:3:36: 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:10:3: 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:12:3: Return value (type int) ignored: scanf("%s", Oper...

Finished checking --- 3 code warnings
adparathenko@dk6n66 ~/work/os/lab_prog $
```

Figure 14: main.c

Вывод

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.