

РОССИЙСКИЙ УНИВЕРСИТЕТ ДРУЖБЫ НАРОДОВ

презентация ПО ЛАБОРАТОРНОЙ РАБОТЕ № 13

дисциплина: *Операционные системы*

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МОСКВА

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Цель работы:

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

Ход работы:

- В домашнем каталоге создали подкаталог ~/work/os/lab_prog

A screenshot of a Fedora desktop environment. At the top, there is a header bar with "Activities", "Terminal", the date "Jun 1 06:02", and system icons. Below the header is a dock with icons for Home, Search, and other applications. A terminal window titled "dabedasa@fedora:~" is open, showing the command "mkdir ~/work_os_lab_prog." followed by an "ls" command output which includes "Desktop", "Downloads", "laba903.sh~", "Pictures", "Templates", "work_os_lab_prog.", "Documents", "laba4.sh~", "Music", "Public", "Videos", and "'work\os\prog.'". The file manager window shows a sidebar with icons for Home, Desktop, Documents, Downloads, Pictures, Templates, and Videos. The main area shows a folder named "work\os\prog." with a blue selection bar at the bottom.

```
[dabedasa@fedora ~]$ mkdir ~/work_os_lab_prog.  
[dabedasa@fedora ~]$ ls  
Desktop Downloads laba903.sh~ Pictures Templates work_os_lab_prog.  
Documents laba4.sh~ Music Public Videos 'work\os\prog.'  
[dabedasa@fedora ~]$
```

"work\os\prog." selected (containing 0 items)

- Создали в нём файлы: calculate.h, calculate.c, main.c.

The screenshot shows a Fedora desktop environment. At the top, there is a header bar with 'Activities' and 'Terminal' buttons, the date 'Jun 1 06:05', and system icons for battery, volume, and network. Below the header is a dock with icons for Home, Search, Dash, and other applications. A terminal window titled 'dabedasa@fedora:~/work_os_lab_prog.' is open, displaying the following command history:

```
[dabedasa@fedora ~]$ cd ~/work_os_lab_prog.  
[dabedasa@fedora work_os_lab_prog.]$ touch calculate.h  
[dabedasa@fedora work_os_lab_prog.]$ touch calculate.c  
[dabedasa@fedora work_os_lab_prog.]$ touch main.c  
[dabedasa@fedora work_os_lab_prog.]$
```

A file manager window is visible in the background, showing a folder named 'work\os\prog.' selected, containing 0 items.

Реализация функций калькулятора в файле calculate.c:

Activities Text Editor Jun 4 15:40

Open calculate.c ~/work_os_lab_prog.

Save

ggo calculate.c

```
1 #include <stdio.h>
2 #include <math.h>
3 #include <string.h>
4 #include "calculate.h"
5 float
6 calculate(float Numeral, char operation[4])
7 {
8     float SecondNumeral;
9     if (strcmp(Operation, "+", 1) == 0)
10    {
11        printf("second term: ");
12        scanf("%f", $SecondNumeral);
13        return (Numeral + SecondNumeral);
14    }
15    else if (strcmp(Operation, "-", 1) == 0)
16    {
17        printf("subtrahend:");
18        scanf("%f", $SecondNumeral );
19        return (Numeral - SecondNumeral);
20    }
21    else if (strcmp(Operation, "*", 1) == 0)
22    {
23        printf(" factor: ")
24        scanf("%f", $SecondNumeral);
25        return (Numeral*SecondNumeral);
26    }
27    else if (strcmp(Operation, "/", 1) == 0)
28    {
```

C Tab Width: 8 Ln 1, Col 1 INS

Activities Text Editor Jun 4 15:41

Open calculate.c
~ /work_os_lab_prog.

Save

ggo calculate.c

```
29     print ("divider : ");
30     scanf("%f", $SecondNumeral);
31     if (SecondNumeral == 0)
32     {
33         print("error: division by zero!");
34         return (HUGE_VAL);
35     }
36     else
37         return (Numeral/SecondNumeral);
38     }
39 else if (strcmp(Operation, "*" , 1) == 0)
40 {
41     printf("factor: ");
42     scanf("%f", $SecondNumeral);
43     return (Numeral*SecondNumeral);
44 else if (strcmp(Operation, "/" , 1) == 0)
45 {
46     printf( "divisor: ");
47     scanf("%f", $SecondNumeral);
48     if (secondNumeral == 0)
49     {
50         print("error: division by zero! ");
51         return (HUGE_VAL);
52     }
53     else
54         return (Numeral/SecondNumeral);
55     }
56 else if (strcmp(Operation, "pow" , 3) == 0)
57     c
```

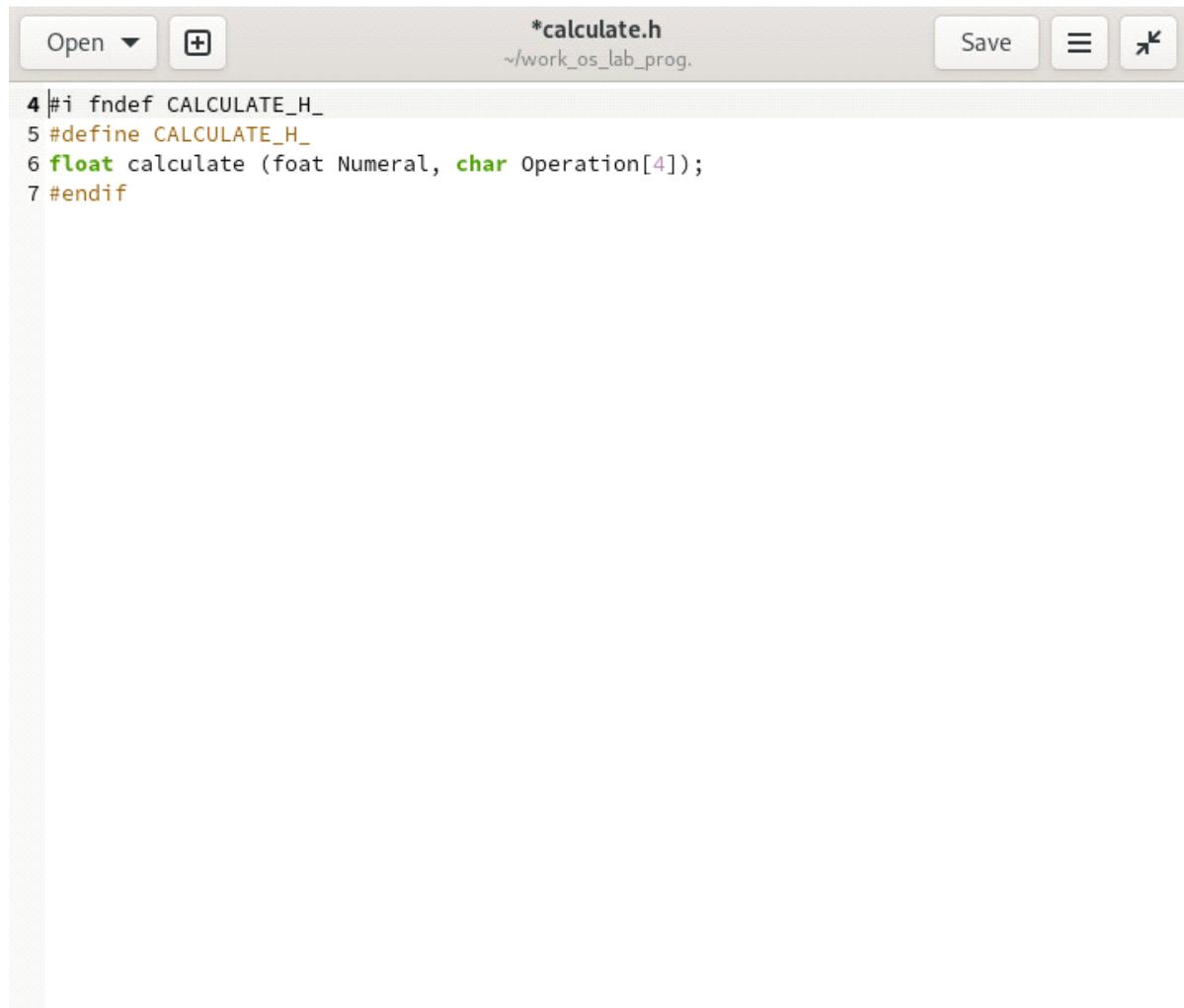
C ▾ Tab Width: 8 ▾ Ln 1, Col 1 ▾ INS

The screenshot shows a desktop environment with a terminal window and a text editor window. The terminal window at the bottom has a command-line interface with some text output. The text editor window is titled 'calculate.c' and is displaying C code. The code handles various arithmetic operations and mathematical functions based on user input. It includes logic for addition, subtraction, multiplication, division, power calculation, square root, sine, cosine, and tangent.

```
Activities Text Editor Jun 4 15:41
Open + calculate.c ~/work_os_lab_prog.
ggo x calculate.c x
52     }
53 else
54     return (Numeral/SecondNumeral);
55 }
56 else if (strncmp(Operation, "pow", 3) == 0)
57 {
58     printf("power: ");
59     scanf("%f", $SecondNumeral);
60     return(pow(Numeral, SecondNumberal));
61 }
62 else if (strncmp(Operation, "sqrt", 4)== 0)
63 return (sqrt(Numeral));
64 else if (strncmp(Operation, "sin", 3) == 0)
65 return (sin(Numeral));
66 else if (strncmp(Operation, "cos", 3) == 0)
67 return (cos(Numeral));
68 else if (strncmp(Operation, "tan", 3) == 0)
69 return (tan(Numeral));
70 else
71 {
72     printf("action entered incorrectly");
73     return (HUGE_VAL);
74 }
75 }
76
77
78
79
```

C ▼ Tab Width: 8 ▼ Ln 1, Col 1 ▼ INS

Интерфейсный файл calculate.h, описывающий формат вызова функции-калькулятора:



The screenshot shows a code editor window with the following details:

- Toolbar:** Includes "Open" (with a dropdown arrow), a plus sign icon, "Save", and other standard editor icons.
- File Path:** *calculate.h
~/work_os_lab_prog.
- Code Content:**

```
4 #i fndef CALCULATE_H_
5 #define CALCULATE_H_
6 float calculate (float Numeral, char Operation[4]);
7 #endif
```

Основной файл main.c, реализующий интерфейс пользователя к калькулятору:

The screenshot shows a desktop environment with a terminal window and a text editor window. The terminal window has tabs for 'ggo', 'calculate.c', 'calculate.h', and 'main.c'. The text editor window is open to 'main.c' and contains the following C code:

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

The text editor interface includes tabs for 'main.c', 'calculate.c', 'calculate.h', and 'ggo'. It also features standard text editor controls like 'Save', 'Open', and 'Close'. The status bar at the bottom shows 'C ▾ Tab Width: 8 ▾ Ln 1, Col 1 ▾ INS'.

- Выполнили компиляцию программы посредством gcc:
- В файле main.c допущена ошибка в строке «scanf("%s",&Operation);», не нужен &.
- Создали Makefile со следующим содержанием:

Activities Terminal Jun 3 01:56

dabedasa@fedora:~

```
[dabedasa@fedora ~]$ touch makefile
[dabedasa@fedora ~]$ ls
Desktop      laba4.sh~    Music       Templates      'work\os\prog.'
Documents    laba903.sh~   Pictures    Videos
Downloads    makefile     Public      work_os_lab_prog.
[dabedasa@fedora ~]$
```

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end

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The screenshot shows a terminal window titled "Text Editor" running on a Linux desktop. The window title bar includes "Activities", the application name, the date and time "Jun 3 02:10", and system icons for volume and screen brightness. The main area of the window displays a makefile with the following content:

```
1 CC = gcc
2 CFLAGS =
3 LIBS = -lm
4 calcul: calculate.o main.o
5         gcc calculate.o main.o -o calcul $(LIBS)
6 calculate.o: calculate.c calculate.h
7         gcc -c calculate.c $(CFLAGS)
8 main.o: main.c calculate.h
9         gcc -c main.c $(CFLAGS)
10 clean: -rm calcul *.o *-
11
```

At the bottom of the window, there are status indicators: "Makefile" (selected), "Tab Width: 8", "Ln 10, Col 25", and "INS".

В содержании файла указаны флаги компиляции, тип компилятора и файлы, которые должен собрать сборщик.

- Выполнили отладку программы calcul. Для отладки используем gdb.

The screenshot shows a terminal window titled "makefile" running on a Fedora 10.2-9.fc35 system. The user has run the command "gdb ./calcul". The GDB prompt "(gdb)" is visible at the bottom of the window. The terminal output is as follows:

```
dabedasa@fedora:~/work_os_lab_prog.— 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"...
./calcul: No such file or directory.
(gdb)
```

At the bottom of the terminal window, there are status indicators: "Makefile", "Tab Width: 8", "Ln 10, Col 25", and "INS".

- С помощью утилиты `splint` проанализировали коды файлов `calculate.c` и `main.c`.

Activities Terminal Jun 4 15:04

dabedasa@fedora:~/work_os_lab_prog.

```
[dabedasa@fedora work_os_lab_prog.]$ splint main.c
Splint 3.1.2 --- 23 Jul 2021

calculate.h:3:38: 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:6:20: Parse Error. (For help on parse errors, see splint -help
                  parseerrors.)
*** Cannot continue.
[dabedasa@fedora work_os_lab_prog.]$
```

The screenshot shows a terminal window titled "dabedasa@fedora:~/work_os_lab_prog." with two tabs. The active tab displays the output of the command "splint calculate.c". The output shows several warnings from the Splint tool version 3.1.2, dated July 23, 2021. The warnings are as follows:

```
[dabedasa@fedora work_os_lab_prog.]$ splint calculate.c
Splint 3.1.2 --- 23 Jul 2021

calculate.h:3:38: 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:6:31: Function parameter operation declared as manifest array (size
    constant is meaningless)
calculate.c: (in function calculate)
calculate.c:9:16: Unrecognized identifier: Operation
    Identifier used in code has not been declared. (Use -unrecog to inhibit
    warning)
calculate.c:12:18: Unrecognized identifier: $SecondNumeral
calculate.c:12:6: 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:13:24: Variable SecondNumeral used before definition
    An rvalue is used that may not be initialized to a value on some execution
    path. (Use -usedef to inhibit warning)
calculate.c:18:5: Return value (type int) ignored: scanf("%f", $Sec...
calculate.c:19:23: Variable SecondNumeral used before definition
calculate.c:24:10: Parse Error. (For help on parse errors, see splint -help)
```

Вывод:

Мы 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.