Лабораторная работа 6
Пономарев Абдурашитов вариант 1

Задание 1

Л6.1. Задание на лабораторную работу

Задание 1. Вычислите для заданных целых x, y

$(№ - 1)\%3 + 1$	**Вариант**
1	$f(x) = \begin{cases} x/2, & x\%2 = 0 \\ 3x + 1, & x\%2 \neq 0 \end{cases}$

```
Terminal  Help
ex1.cpp
6 > ex1.cpp > ...
#include <stdio.h>
int main(){
    int x = 10, y=0;

    asm
    (R"(
        movl %[X], %[Y]
        imull $3, %[Y]
        incl %[Y]
        shrl $1, %[X]
        cmovncl %[X], %[Y]
    )"  : [Y]"+r"(y)
        : [X]"rm"(x)
        : "cc"
    );
    printf("%d\n", y);
    return 0;
}
```

```
alex@alex-home ~/__my/lol/lab_ass/6 master ± g++ -m32 ex1.cpp
alex@alex-home ~/__my/lol/lab_ass/6 master ± ./a.out
5
alex@alex-home ~/__my/lol/lab_ass/6 master ±
```

Задание 2. Вычислите для заданного вещественного x

$(№ - 1)\%11 + 1$	**Вариант**
1	$y(x) = \begin{cases} 2 \cdot (x/3) + 15, & x \geqslant 0 \\ 0, & x < 0 \end{cases}$

ex2.cpp

```cpp
#include <stdio.h>
int main(){
    double c = 3,d=2,f=15, x=102, y=0;

    asm(R"(
        fldl %[X]
        fldl %[d]
        fmulp
        fldl %[c]
        fdivrp
        fldl %[f]
        faddp

        fldl %[X]
        fldz
        fcomi

        fcmovbe %%st(2), %%st(0)

        fstpl %[Y]
        )" : [Y]"=m"(y)
           : [X]"rm"(x), [c]"m"(c), [d]"m"(d), [f]"m"(f)
           : "cc"
    );
    printf("%f\n", y);
    return 0;
}
```

```
alex@alex-home ~/__my/lol/lab_ass/6 master ± g++ -m32 ex2.cpp
alex@alex-home ~/__my/lol/lab_ass/6 master ± ./a.out
83.000000
```

Задание 3. Задайте с клавиатуры N и напечатайте первые N членов последовательности (целой).

$(№ - 1)\%2 + 1$	**Вариант**
1	Числа Фибоначчи: $\varphi_0 = \varphi_1 = 1, \varphi_{i+1} = \varphi_i + \varphi_{i-1}$

```
6 > ASM ex3.s
  1    .data
  2    N: .int 1
  3    an1: .int 1
  4    an0: .int 1
  5    N1: .int 1
  6    input:
  7    .string "%d"
  8    msg:
  9    .string "Enter N "
 10    output:
 11    .string "fi(%d)=%d\n"
 12    error:
 13    .string "error\n"
 14    .global main
```

```
alex@alex-home ~/__my/lol/lab_ass/6 master ± g++ -m32 ex3.s
alex@alex-home ~/__my/lol/lab_ass/6 master ± ./a.out
Enter N 9
fi(0)=1
fi(1)=2
fi(2)=3
fi(3)=5
fi(4)=8
fi(5)=13
fi(6)=21
fi(7)=34
fi(8)=55
fi(9)=89
alex@alex-home ~/__my/lol/lab_ass/6 master ± ./a.out
Enter N 1
fi(0)=1
fi(1)=2
alex@alex-home ~/__my/lol/lab_ass/6 master ± ./a.out
Enter N -10
error
```

```
14  .global main
15  main:
16      subl $20, %esp
17      movl $msg, (%esp)
18      call printf
19      leal 16(%esp), %eax
20      movl %eax, 4(%esp)
21      movl $input, (%esp)
22      call scanf
23      movl 16(%esp), %eax
24      movl %eax, N
25      addl $20, %esp
26
27      cmpl $0,N
28      jnge less_then_zero
29      jmp zeroo
30      next:
31
32      start:
33          cmpl $0, N
34          je exit
35
36          movl an1,%ecx
37          movl an1,%eax
38          movl an0,%edx
39          addl %eax,%edx
40          movl %edx,an1
41          movl %ecx,an0
42          pushl an1
43          pushl N1
44          pushl $output
45          call printf
46          addl $12, %esp
47
48          addl $-1, N
49          addl $1,  N1
50          jmp start
51          ret
52
53      less_then_zero:
54          pushl $error
55          call printf
56          addl $4, %esp
57          jmp exit
58
59      zeroo:
60          pushl $1
61          pushl $0
62          pushl $output
63          call printf
64          addl $12, %esp
65          jmp next
66
67      exit:
68          ret
69
```

Задание 4. Найдите с заданной точностью ε сумму ряда (если это возможно). Если ряд расходится, выведите сообщение об этом.

$(№ - 1)\%5 + 1$	**МП-30**	**МП-34**	**МП-35**
1	$S = \sum_{i=1}^{\infty} (-1)^i \frac{1}{i}$	$S = \sum_{i=2}^{\infty} (-1)^i \frac{i+1}{i^3-1}$	$S = \sum_{i=1}^{\infty} e^{-i}$
2	$S = \sum_{i=0}^{\infty} (-1)^i \frac{1}{2^i}$	$S = \sum_{i=1}^{\infty} (-1)^i \frac{1}{i^2}$	$S = \sum_{i=1}^{\infty} (-1)^i \frac{1}{\sqrt{i}}$
3	$S = \sum_{i=1}^{\infty} \frac{1}{i}$	$S = \sum_{i=2}^{\infty} \frac{i-1}{i^3+1}$	$S = \sum_{i=1}^{\infty} (-1)^i e^{-i}$
4	$S = \sum_{i=0}^{\infty} \frac{1}{2^i}$	$S = \sum_{i=1}^{\infty} \frac{1}{i^2}$	$S = \sum_{i=1}^{\infty} \frac{1}{\sqrt{i}}$
5	$S = \sum_{i=0}^{\infty} (-1)^{2i} \frac{1}{2^i}$	$S = \sum_{i=1}^{\infty} \frac{\sin(i)}{i}$	$S = \sum_{i=1}^{\infty} \frac{\sin(i)}{i^2}$

ex4.s

```
6 > ex4.s
1   .data
2       output:
3           .string "S = %f\n"
4       epsilon:
5           .double 0.2
6       i:
7           .double 1
8       S:
9           .double -1
10      a:
11          .double -1
12      one:
13          .double 1
14      sign:
15          .double -1
16  .globl main
17      main:
18          start:
19              fldl one
20              fldl i
21              faddp
22              fstpl (i)
23
24              fldl sign
25              fchs
26              fstpl (sign)
27
28              fldl i
29              fldl sign
30              fdivp
31              fstpl (a)
32
33              fldl a
34              fabs
35              fldl epsilon
36              fabs
37              fsubrp
38              ftst
39              fstsw %ax
40              sahf
41              jbe end
42
43              fldl S
44              fldl a
45              faddp
46              fstpl (S)
47              jmp start
48
49          end:
50              pushl (S+4)
51              pushl (S)
52              push $output
53              call printf
54              add $12, %esp
55              ret
56
```

```
alex@alex-home ~/__my/lol/lab_ass/6 master ± g++ -m32 ex4.cpp
alex@alex-home ~/__my/lol/lab_ass/6 master ± ./a.out
S = -0.583333
alex@alex-home ~/__my/lol/lab_ass/6 master ± g++ -m32 ex4.s
alex@alex-home ~/__my/lol/lab_ass/6 master ± ./a.out
S = -0.583333
alex@alex-home ~/__my/lol/lab_ass/6 master ±
```

Задание 5. Бонус (+2 балла). Реализуйте умножение двух целых чисел без знака ($x \cdot y$) «в столбик» (то есть не как сумму $\underbrace{x + \ldots + x}_{y \text{ раз}}$), не используя mul/imul и команды сопроцессора.

ex5.cpp

```cpp
#include "stdio.h"

int main()
{
    int x = 4, y = -5;
    int result;
    int strong_x = x;
    int strong_y = y;

    asm (R"(
        xor %%eax, %%eax
        for:
            cmp $0, %[X]
            jz goToEnd
            shr $1, %[X]
            jnc checkEven
            add %[Y], %%eax
        checkEven:
            add %[Y], %[Y]
            jnz for
            dec %%eax
        goToEnd:
            movl %%eax, %[result]
    )"  : [result]"=m" (result),[X]"+r" (x),[Y]"+r"(y)
        :: "cc", "%eax"
    );

    printf("%d * %d = %d\n", strong_x, strong_y, result);
    return 0;
}
```

```
alex@alex-home ~/__my/lol/lab_ass/6  master ± ./a.out
4 * -5 = -20
alex@alex-home ~/__my/lol/lab_ass/6  master ±
```