ICS Homework 7

November 12,2020

1 Function Matching

Functions given below have same functionality(assume overflow will never happen). The functions' generated assembly codes are also given, but are misordered. Place pair the functions and the assemply codes and fill in the table. For function inputs, assume x in %edi, y in %esi, z in %edx. For local variable, assume i in -0x4(%rbp).

```
1  int A(int x, int y, int z) {
2      int i = 0;
3      return (x>0)?y + x * z : y;
4  }
5
6  int B(int x, int y, int z) {
7      int i = 0;
8      while (x > 0) {
9          x--;
10         y+= z;
11     }
12     return y;
13 }
14
15 int C(int x, int y, int z) {
16     int i = 0;
17     do {
18         x--;
19         if (x < 0) break;
20         y += z;
21     } while (1);
22     return y;
23 }
24
25 int D(int x, int y, int z) {
26     int i = 0;
27     for (; i < x; i++) {
28         y += z;
29     }
30     return y;
31 }
```

```
asm_1:
    movl    $0x0,-0x4(%rbp)
.L1:
    subl    $0x1,%edi
    cmpl    $0x0,%edi
    js      .L2
    add     %edx,%esi
    jmp     .L1
.L2:
    mov     %esi,%eax
    ret

asm_2:
    movl    $0x0,-0x4(%rbp)
    cmpl    $0x0,%edi
    jle     .L3
    imul    %edx,%edi
    mov     %esi,%eax
    add     %edi,%eax
    jmp     .L4
.L3:
    mov     %esi,%eax
.L4:
    ret

asm_3:
    movl    $0x0,-0x4(%rbp)
    jmp     .L6
.L5:
    add     %edx,%esi
    addl    $0x1,-0x4(%rbp)
.L6:
    mov     -0x4(%rbp),%eax
    cmp     %edi,%eax
    jl      .L5
    mov     %esi,%eax
    ret

asm_4:
    movl    $0x0,-0x4(%rbp)
    jmp     .L8
.L7:
    subl    $0x1,%edi
    add     %edx,%esi
.L8:
```

x-1
x>0 break
x≤0 break
x · z
y+x·z
y
y+z
i<x
x-1
y+z

```
46      cmpl    $0x0,%edi    x>0
47      jg      .L7
48      mov     %esi,%eax
49      ret
```

Assembly Code	Function Name
asm_1	C
asm_2	A
asm_3	D
asm_4	B

2 Conditional Move

The generated assembly code of function A in Q1 use jump operations. Please use conditional move operations instead to achieve the same functionality.

```
1  A:
2       movl    $0x0,-0x4(%rbp)
3       mov     %edi,%ebx
4       imul    %edx,%ebx
5       add     %esi,%ebx
6       // fill in your assembly code here
7       movl    %esi, %eax
8       cmpl    $0x0, %edi
9       cmovg   %ebx, %edi
10      ret
```

```
int A(int x, int y, int z) {
    int i = 0;
    return (x>0)?y + x * z : y;
}
```

3 Jump Table

Read the assembly code and jump table given below, Fill in the missing part of the C code.
For function inputs, assume x in %edi, y in %esi, z in %edx. For local variable, assume result in -0x4(%rbp).

```
1  int switcher(int x, int y, int z) {
2      int result = 0;
3      switch (x) {
4          (1) case17:              .L3
5              result = x - y;
6              break;
7          (2) case19: case21:      .L1
```

```
            result = (3)___;
        (4):
            result = (5)___;
            break;
        (6):
            result = y;
            break;
        default:
            result = (7)___;
            break;
    }
    return result;
}
```

```
switcher:
    movl    $0x0,-0x4(%rbp)
    mov     %edi,%eax
    sub     $0x11,%eax
    cmp     $0x6, %eax
    ja      .L5
    mov     %eax, %eax
    jmp     *.L6(,%rax,8)
.L1
    mov     %edx,-0x4(%rbp)
.L2
    add     %edi,-0x4(%rbp)
    jmp     .L7
.L3
    mov     %edi,%eax
    sub     %esi,%eax
    mov     %eax,-0x4(%rbp)
    jmp     .L7
.L4
    mov     %esi,-0x4(%rbp)
    jmp     .L7
.L5
    addl    0x14,-0x4(%rbp)
.L7
    mov     -0x4(%rbp),%eax
    ret
```

```
.L6:
    .quad   .L3
    .quad   .L2
```

```
4       .quad   .L1    19
5       .quad   .L4    20
6       .quad   .L1    21
7       .quad   .L5    22
8       .quad   .L4    23
```