

ECEN 424 HW 3

3.62

```
/* Enumerated type creates set of constants numbered 0 and upward */

typedef enum { MODE_A, MODE_B, MODE_C, MODE_D, MODE_E } mode_t;

long switch3(long *p1, long *p2, mode_t action) {
    long result = 0;
    switch (action) {
        case MODE_A:
            result = *p2;
            *p2 = *p1;
            break;

        case MODE_B:
            *p1 = *p1 + *p2;
            result = *p1;
            break;

        case MODE_C:
            result = *p2;
            break;

        case MODE_D:
            *p1 = *p2;

        case MODE_E:
            result = 27;
            break;

        default:
            result = 12;
    }

    return result;
}
```

```

HW3 > 3_62.s
1      .file    "3_62.c"
2      .text
3      .globl   switch3
4      .type    switch3, @function
5      switch3:
6      .LFB0:
7      .cfi_startproc
8      endbr64
9      cmpl     $4, %edx
10     ja      .L9
11     movl     %edx, %edx
12     leaq     .L4(%rip), %rcx
13     movslq   (%rcx,%rdx,4), %rax
14     addq     %rcx, %rax
15     notrack  jmp *%rax
16     .section .rodata
17     .align 4
18     .align 4
19     .L4:
20     .long     .L8-.L4
21     .long     .L7-.L4
22     .long     .L6-.L4
23     .long     .L5-.L4
24     .long     .L3-.L4
25     .text
26     .L3:
27     movl     $27, %eax
28     ret
29     .L8:
30     movq     (%rsi), %rax
31     movq     (%rdi), %rdx
32     movq     %rdx, (%rsi)
33     ret
34     .L7:
35     movq     (%rsi), %rax
36     addq     (%rdi), %rax
37     movq     %rax, (%rdi)
38     ret
39     .L6:
40     movq     (%rsi), %rax
41     ret
42     .L5:
43     movq     (%rsi), %rax
44     movq     %rax, (%rdi)
45     movl     $27, %eax
46     ret
47     .L9:
48     movl     $12, %eax
49     ret
50     .cfi_endproc
51     .LFE0:
52     .size     switch3, .-switch3
53     .ident     "GCC: (Ubuntu 11.3.0-1ubuntu1~22.04) 11.3.0"
54     .section   .note.GNU-stack,"",@progbits
55     .section   .note.gnu.property,"a"
56     .align 8
57     .long     1f - 0f
58     .long     4f - 1f
59     .long     5
60     0:
61     .string   "GNU"
62     1:
63     .align 8
64     .long     0xc0000002
65     .long     3f - 2f
66     2:
67     .long     0x3
68     3:
69     .align 8
70     4:
71

```

gcc -S -m64 -O1 3_62.c, linux

3.63

```
long switch_prob(long x, long n)
{
    long result;
    result = x;
    switch (n) {
    case 60:
    case 62:
        result = x * 8;
        break;
    case 63:
        result = x;
        result = result >> 3;
        break;
    case 64:
        result = x;
        result = result << 4;
        result = result - x;
        x = result;
    case 65:
        x = x * x;
    default:
        result = x + 75;
    }
    return result;
}
```

```

.file    "3_63.c"
.text
.globl   switch_prob
.type    switch_prob, @function
switch_prob:
.LFB0:
.cfi_startproc
endbr64
subq     $60, %rsi
cmpq     $5, %rsi
ja       .L2
leaq     .L4(%rip), %rdx
movslq   (%rdx,%rsi,4), %rax
addq     %rdx, %rax
notrack  jmp *%rax|
.section    .rodata
.align 4
.align 4
.L4:
.long    .L7-.L4
.long    .L2-.L4
.long    .L7-.L4
.long    .L6-.L4
.long    .L5-.L4
.long    .L3-.L4
.text
.L7:
leaq     0(,%rdi,8), %rax
ret
.L6:
movq     %rdi, %rax
sarq     $3, %rax
ret
.L5:
movq     %rdi, %rax
salq     $4, %rax
subq     %rdi, %rax
movq     %rax, %rdi
.L3:
imulq    %rdi, %rdi
.L2:
leaq     75(%rdi), %rax
ret
.cfi_endproc
.LFE0:
.size    switch_prob, .-switch_prob
.ident   "GCC: (Ubuntu 11.3.0-1ubuntu1~22.04) 11.3.0"
.section    .note.GNU-stack,"",@progbits
.section    .note.gnu.property,"a"
.align 8
.long    1f - 0f
.long    4f - 1f
.long    5
0:
.string   "GNU"
1:
.align 8
.long    0xc0000002
.long    3f - 2f
2:
.long    0x3
3:
.align 8
4:

```

gcc -S -m64 -O1 3_63.c, linux

3.65

- A) %rdx
- B) %rax
- C) M = 15

```
void transpose_optimized(long A[M][M]) {  
    int i, j;  
    long *row, *col;  
  
    for (i = 0; i < M; i++) {  
        row = &A[i][0]; // row = A[i]  
        col = &A[0][j]; // col = A[j]  
        for (j = 0; j < M; j++) {  
            long t = *row;  
            *row = *col;  
            *col = t;  
            row++;  
            col += M; // col = &A[j][i]  
        }  
    }  
}
```

D)

HW3 > 3_65.s

```
1  .file "3_65.c"
2  .text
3  .p2align 4
4  .globl transpose_optimized
5  .type transpose_optimized, @function
6  transpose_optimized:
7  .LFB0:
8  .cfi_startproc
9  endbr64
10 movq %rdi, %rdx
11 leaq 128(%rdi), %r8
12 .L3:
13 xorl %eax, %eax
14 .L2:
15 movq (%rdx,%rax), %rcx
16 movq 32(%rdi,%rax,4), %rsi
17 movq %rsi, (%rdx,%rax)
18 movq %rcx, 32(%rdi,%rax,4)
19 addq $8, %rax
20 cmpq $32, %rax
21 jne .L2
22 addq $32, %rdx
23 cmpq %r8, %rdx
24 jne .L3
25 ret
26 .cfi_endproc
27 .LFE0:
28 .size transpose_optimized, .-transpose_optimized
29 .ident "GCC: (Ubuntu 11.3.0-1ubuntu1~22.04) 11.3.0"
30 .section .note.GNU-stack,"",@progbits
31 .section .note.gnu.property,"a"
32 .align 8
33 .long 1f - 0f
34 .long 4f - 1f
35 .long 5
36 0:
37 .string "GNU"
38 1:
39 .align 8
40 .long 0xc0000002
41 .long 3f - 2f
42 2:
43 .long 0x3
44 3:
45 .align 8
46 4:
47
```

gcc -S -m64 -O2 3_65.c, linux

3.70

A)

e1.p, offset = 0

e1.y, offset = 8

e2.x, offset = 0

e2.next, offset = 8

B) 16 bytes

C) void proc(union ele *up) {

up->e2.x = (*(up->e2.next).e1.p) - *(up->e2.next).e1.y;

}