

```

#define SIZE 10
#include <stdlib.h>
#include <stdio.h>

long red[SIZE][SIZE];
long *blue;
long *green[SIZE];
int n;

void setred(int i, int j, long val)
{
    red[i][j]=val;
}

void setblue(int i, int j, long val)
{
    blue[i*n+j]=val;
}

void setgreen(int i, int j, long val)
{
    green[i][j]=val;
}

```

```

void init(int i, int j, long val) {

    int x,y;

    blue=(long *)calloc(n*n,sizeof(long));

    for (x=0; x<SIZE; x++)
    {
        green[x]=calloc(SIZE,sizeof(long));
        for (y=0; y<SIZE; y++)
        {
            red[x][y]=rand();
            green[x][y]=rand();
            blue[x*n+y]=rand();
        }
    }
}

```

```
#define SIZE 10
#include <stdlib.h>
#include <stdio.h>
█
long red[SIZE][SIZE];
long *blue;
long *green[SIZE];
int n;

void setred(int i, int j, long val)
{
    red[i][j]=val;
}

void setblue(int i, int j, long val)
{
    blue[i*n+j]=val;
}

void setgreen(int i, int j, long val)
{
    green[i][j]=val;
}
```

```
void foo(int i, int j, long val) {
    setred(i,j,val);
    setgreen(i,j,val);
    setblue(i,j,val);
}

int main( int argc, const char* argv[] ) {
    int i,j,val;

    n=atoi(argv[1]);
    i=atoi(argv[2]);
    j=atoi(argv[3]);
    val=atoi(argv[4]);

    init(i,j,val);
    foo(i,j,val);█
}
```

0000000004004d0 <main>:

```
4004d0: 41 54          push    %r12
4004d2: ba 0a 00 00 00 mov     $0xa,%edx
4004d7: 55            push    %rbp
4004d8: 53            push    %rbx
4004d9: 48 8b 7e 08    mov     0x8(%rsi),%rdi
4004dd: 48 89 f3       mov     %rsi,%rbx
4004e0: 31 f6         xor     %esi,%esi
4004e2: e8 c9 ff ff ff callq   4004b0 <strtol@plt>
4004e7: 48 8b 7b 10    mov     0x10(%rbx),%rdi
4004eb: ba 0a 00 00 00 mov     $0xa,%edx
4004f0: 31 f6         xor     %esi,%esi
4004f2: 89 05 88 0b 20 00 mov     %eax,0x200b88(%rip)
4004f8: e8 b3 ff ff ff callq   4004b0 <strtol@plt>
4004fd: 48 8b 7b 18    mov     0x18(%rbx),%rdi
400501: ba 0a 00 00 00 mov     $0xa,%edx
400506: 31 f6         xor     %esi,%esi
400508: 49 89 c4       mov     %rax,%r12
40050b: e8 a0 ff ff ff callq   4004b0 <strtol@plt>
400510: 48 8b 7b 20    mov     0x20(%rbx),%rdi
400514: ba 0a 00 00 00 mov     $0xa,%edx
400519: 31 f6         xor     %esi,%esi
40051b: 48 89 c5       mov     %rax,%rbp
40051e: e8 8d ff ff ff callq   4004b0 <strtol@plt>
400523: 48 63 d8       movslq  %eax,%rbx
400526: 89 ee         mov     %ebp,%esi
400528: 44 89 e7       mov     %r12d,%edi
40052b: 48 89 da       mov     %rbx,%rdx
40052e: e8 8d 01 00 00 callq   4006c0 <init>
```

```
void foo(int i, int j, long val) {
    setred(i,j,val);
    setgreen(i,j,val);
    setblue(i,j,val);
}

int main( int argc, const char* argv[] ) {
    int i,j,val;

    n=atoi(argv[1]);
    i=atoi(argv[2]);
    j=atoi(argv[3]);
    val=atoi(argv[4]);

    init(i,j,val);
    foo(i,j,val);
}
```

```

40052e: e8 8d 01 00 00      callq 4006c0 <init>
400533: 49 63 c4            movslq %r12d,%rax
400536: 48 63 d5            movslq %ebp,%rdx
400539: 44 0f af 25 3f 0b 20 imul   0x200b3f(%rip),%r12d
400540: 00
400541: 48 8d 0c 80         lea    (%rax,%rax,4),%rcx
400545: 48 8b 04 c5 c0 13 60 mov     0x6013c0(,%rax,8),%rax
40054c: 00
40054d: 48 8d 0c 4a         lea    (%rdx,%rcx,2),%rcx
400551: 48 89 1c cd a0 10 60 mov     %rbx,0x6010a0(,%rcx,8)
400558: 00
400559: 48 89 1c d0         mov     %rbx,(%rax,%rdx,8)
40055d: 48 8b 05 ac 0e 20 00 mov     0x200eac(%rip),%rax
400564: 44 01 e5            add     %r12d,%ebp
400567: 48 63 ed            movslq %ebp,%rbp
40056a: 48 89 1c e8         mov     %rbx,(%rax,%rbp,8)
40056e: 5b                 pop     %rbx
40056f: 5d                 pop     %rbp
400570: 41 5c              pop     %r12
400572: c3                 retq

```

```

(gdb) break *0x400533
Breakpoint 1 at 0x400533
(gdb) run 10 2 3 4

```

```

(gdb) i r
rax      0x38a5d054
rbx      0x4          4
rcx      0x7ffff7dd40c4
rdx      0x7ffff7dd4134
rsi      0x7fffffffffd8c
rdi      0x7ffff7dd46e0
rbp      0x3          0x3
rsp      0x7ffffffffffe0
r8       0x7ffff7dd4130
r9       0x7ffff7dd4140
r10      0x6          6
r11      0x7ffff7a47b30
r12      0x2          2
r13      0x7ffffffffffe0d0
r14      0x0          0
r15      0x0          0
rip      0x400533 0x4005

```

```

40052e: e8 8d 01 00 00      callq 4006c0 <init>
400533: 49 63 c4            movslq %r12d,%rax
400536: 48 63 d5            movslq %ebp,%rdx
400539: 44 0f af 25 3f 0b 20 imul   0x200b3f(%rip),%r12d
400540: 00
400541: 48 8d 0c 80         lea    (%rax,%rax,4),%rcx
400545: 48 8b 04 c5 c0 13 60 mov     0x6013c0(,%rax,8),%rax
40054c: 00
40054d: 48 8d 0c 4a         lea    (%rdx,%rcx,2),%rcx
400551: 48 89 1c cd a0 10 60 mov     %rbx,0x6010a0(,%rcx,8)
400558: 00
400559: 48 89 1c d0         mov     %rbx,(%rax,%rdx,8)
40055d: 48 8b 05 ac 0e 20 00 mov     0x200eac(%rip),%rax
400564: 44 01 e5            add     %r12d,%ebp
400567: 48 63 ed            movslq %ebp,%rbp
40056a: 48 89 1c e8         mov     %rbx,(%rax,%rbp,8)
40056e: 5b                 pop     %rbx
40056f: 5d                 pop     %rbp
400570: 41 5c              pop     %r12
400572: c3                 retq

```

```

(gdb) break *0x400533
Breakpoint 1 at 0x400533
(gdb) run 10 2 3 4

```

```

(gdb) i r
rax      0x38a5d054
rbx      0x4      4
rcx      0x7ffff7dd40c4
rdx      0x7ffff7dd4134
rsi      0x7fffffffffd8c
rdi      0x7ffff7dd46e0
rbp      0x3      0x3
rsp      0x7ffffffffffe0
r8       0x7ffff7dd4130
r9       0x7ffff7dd4140
r10      0x6      6
r11      0x7ffff7a47b30
r12      0x2      2
r13      0x7ffffffffffe0d0
r14      0x0      0
r15      0x0      0
rip      0x400533 0x4005

```

```
struct node_t {
    int key;
    int value;
    struct node_t *left;
    struct node_t *right;
} * groot;

void search_node (struct node_t *nodestradamus, int key)
{
    if (nodestradamus)
    {
        if (key == nodestradamus->key)
        {
            printf("%d\n", nodestradamus->value);
            return;
        }
        else
        {
            if (key > nodestradamus->key)
                search_node(nodestradamus->right, key);
            else
                search_node(nodestradamus->left, key);
            return;
        }
    }
    printf("Not found in the tree!\n");
}
```

```

struct node_t {
    int key;
    int value;
    struct node_t *left;
    struct node_t *right;
} * groot;

void search_node (struct node_t *nodestradamus, int key)
{
    if (nodestradamus)
    {
        if (key == nodestradamus->key)
        {
            printf("%d\n", nodestradamus->value);
            return;
        }
        else
        {
            if (key > nodestradamus->key)
                search_node(nodestradamus->right, key);
            else
                search_node(nodestradamus->left, key);
            return;
        }
    }
    printf("Not found in the tree!\n");
}

```

```

00000000004006b0 <search_node>:
4006b0:    eb 1a                jmp     4006cc <search_node+0x1c>
4006b2:    66 0f 1f 44 00 00    nopw   0x0(%rax,%rax,1)
4006b8:    8b 07                mov     (%rdi),%eax
4006ba:    39 f0                cmp     %esi,%eax
4006bc:    74 22                je      4006e0 <search_node+0x30>
4006be:    48 8b 57 08          mov     0x8(%rdi),%rdx
4006c2:    39 c6                cmp     %eax,%esi
4006c4:    48 0f 4f 57 10       cmovg   0x10(%rdi),%rdx
4006c9:    48 89 d7             mov     %rdx,%rdi
4006cc:    48 85 ff             test    %rdi,%rdi
4006cf:    75 e7                jne     4006b8 <search_node+0x8>
4006d1:    bf e4 07 40 00       mov     $0x4007e4,%edi
4006d6:    e9 a5 fd ff ff       jmpq    400480 <puts@plt>
4006db:    0f 1f 44 00 00       nopl    0x0(%rax,%rax,1)
4006e0:    8b 77 04             mov     0x4(%rdi),%esi
4006e3:    31 c0                xor     %eax,%eax
4006e5:    bf e0 07 40 00       mov     $0x4007e0,%edi
4006ea:    e9 a1 fd ff ff       jmpq    400490 <printf@plt>
4006ef:    90                   nop

```

[(gdb) i r

rax	0x6020b0	6299824
rbx	0x0	0
rcx	0x6021b0	6300080
rdx	0x6021b0	6300080
rsi	0x59	89
rdi	0x6021b0	6300080
rbp	0x0	0x0
rsp	0x7fffffffdfc8	0x7fffffffdfc8
r8	0x0	0
r9	0x18	24
r10	0x2	2
r11	0x246	582
r12	0x4005b7	4195767
r13	0x7fffffffef0	140737488347376
r14	0x0	0
r15	0x0	0
rip	0x4006b0	0x4006b0 <search_node>

00000000004006b0 <search_node>:

4006b0:	eb 1a	jmp	4006cc <search_node+0x1c>
4006b2:	66 0f 1f 44 00 00	nopw	0x0(%rax,%rax,1)
4006b8:	8b 07	mov	(%rdi),%eax
4006ba:	39 f0	cmp	%esi,%eax
4006bc:	74 22	je	4006e0 <search_node+0x30>
4006be:	48 8b 57 08	mov	0x8(%rdi),%rdx
4006c2:	39 c6	cmp	%eax,%esi
4006c4:	48 0f 4f 57 10	cmovg	0x10(%rdi),%rdx
4006c9:	48 89 d7	mov	%rdx,%rdi
4006cc:	48 85 ff	test	%rdi,%rdi
4006cf:	75 e7	jne	4006b8 <search_node+0x8>
4006d1:	bf e4 07 40 00	mov	\$0x4007e4,%edi
4006d6:	e9 a5 fd ff ff	jmpq	400480 <puts@plt>
4006db:	0f 1f 44 00 00	nopl	0x0(%rax,%rax,1)
4006e0:	8b 77 04	mov	0x4(%rdi),%esi
4006e3:	31 c0	xor	%eax,%eax
4006e5:	bf e0 07 40 00	mov	\$0x4007e0,%edi
4006ea:	e9 a1 fd ff ff	jmpq	400490 <printf@plt>
4006ef:	90	nop	

search_node(groot, 89);

0x602030:	0xd	0x00	0x00	0x00	0x03	0x00	0x00	0x00
0x602038:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602040:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602048:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602050:	0x2b	0x00	0x00	0x00	0x04	0x00	0x00	0x00
0x602058:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602060:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602068:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602070:	0x2b	0x00	0x00	0x00	0x02	0x00	0x00	0x00
0x602078:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602080:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602088:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602090:	0x22	0x00	0x00	0x00	0x56	0x00	0x00	0x00
0x602098:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6020a0:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6020a8:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6020b0:	0x22	0x00	0x00	0x00	0x2b	0x00	0x00	0x00
0x6020b8:	0x30	0x20	0x60	0x00	0x00	0x00	0x00	0x00
0x6020c0:	0x70	0x20	0x60	0x00	0x00	0x00	0x00	0x00
0x6020c8:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6020d0:	0x3a	0x00	0x00	0x00	0x08	0x00	0x00	0x00
0x6020d8:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6020e0:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6020e8:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6020f0:	0x3a	0x00	0x00	0x00	0x04	0x00	0x00	0x00
0x6020f8:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602100:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602108:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602110:	0x59	0x00	0x00	0x00	0x02	0x00	0x00	0x00
0x602118:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602120:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602128:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602130:	0x59	0x00	0x00	0x00	0x01	0x00	0x00	0x00
0x602138:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602140:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602148:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602150:	0x47	0x00	0x00	0x00	0x58	0x00	0x00	0x00
0x602158:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602160:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602168:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602170:	0x47	0x00	0x00	0x00	0x2c	0x00	0x00	0x00
0x602178:	0xf0	0x20	0x60	0x00	0x00	0x00	0x00	0x00

```
(gdb) i r
rax      0x6020b0 6299824
rbx      0x0      0
rcx      0x6021b0 6300080
rdx      0x6021b0 6300080
rsi      0x59      89
rdi      0x6021b0 6300080
rbp      0x0      0x0
rsp      0x7fffffffdfef 0x7fffffffdfef
r8       0x0      0
r9       0x18      24
r10      0x2       2
r11      0x246     582
r12      0x4005b7 4195767
r13      0x7fffffffef0 140737488347376
r14      0x0      0
r15      0x0      0
rip      0x4006b0 0x4006b0 <search_node>
```

0x602180:	0x30	0x21	0x60	0x00	0x00	0x00	0x00	0x00
0x602188:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x602190:	0x31	0x00	0x00	0x00	0x54	0x00	0x00	0x00
0x602198:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6021a0:	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6021a8:	0x21	0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x6021b0:	0x31	0x00	0x00	0x00	0x2a	0x00	0x00	0x00
0x6021b8:	0xb0	0x20	0x60	0x00	0x00	0x00	0x00	0x00
0x6021c0:	0x70	0x21	0x60	0x00	0x00	0x00	0x00	0x00