Algorithm - assignment 2

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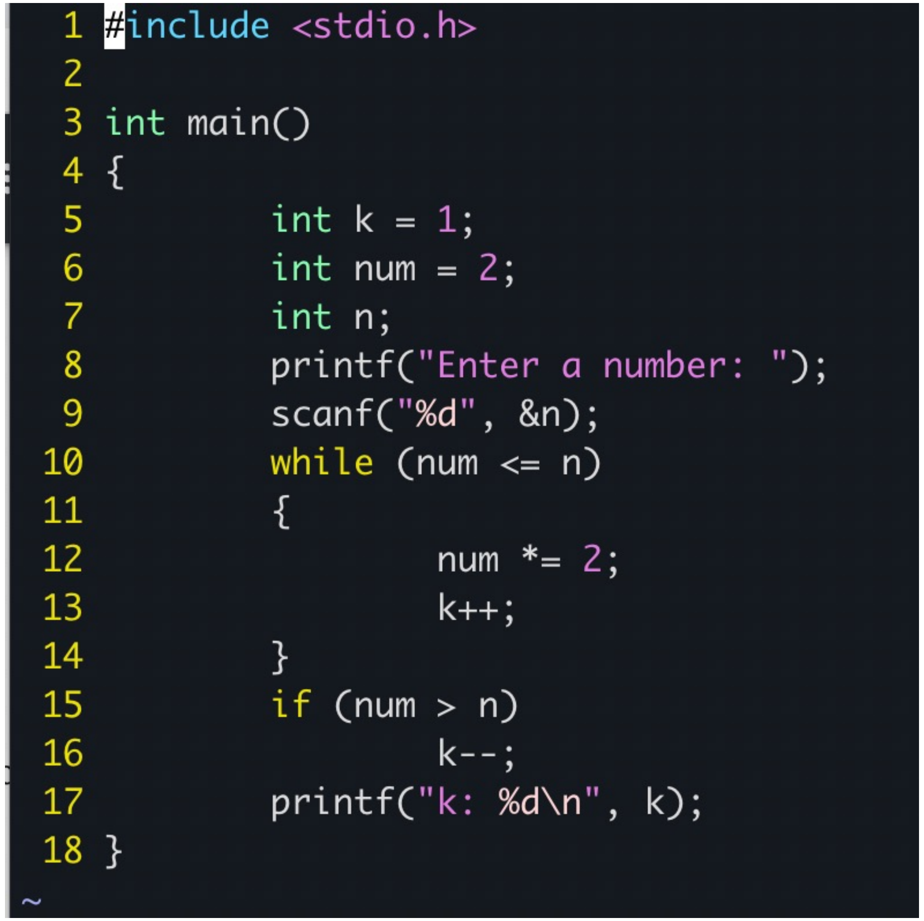
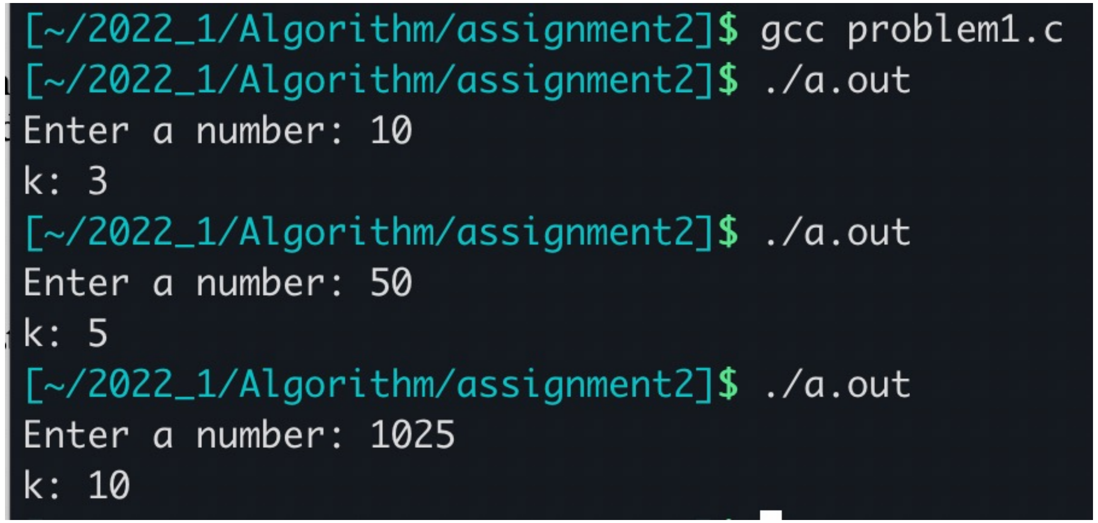
Problem 1

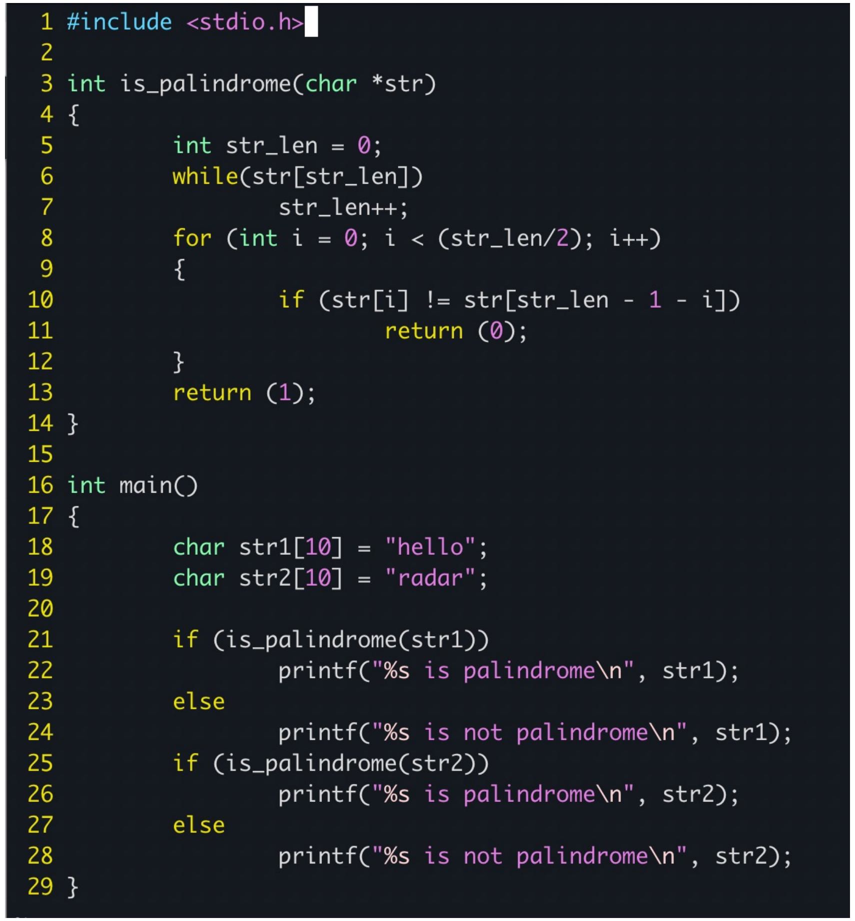


```c
#include <stdio.h>

int main()
{
        int k = 1;
        int num = 2;
        int n;
        printf("Enter a number: ");
        scanf("%d", &n);
        while (num <= n)
        {
                num *= 2;
                k++;
        }
        if (num > n)
                k--;
        printf("k: %d\n", k);
}
~
```

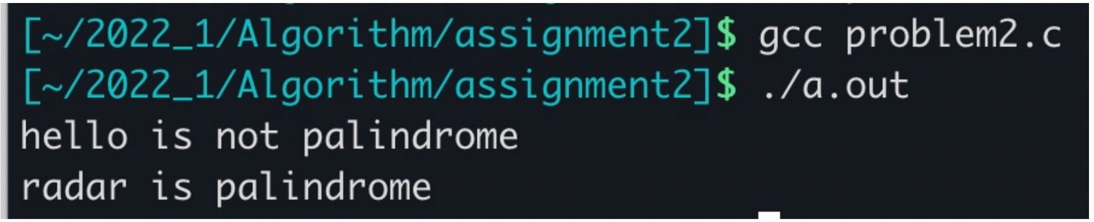


```
[~/2022_1/Algorithm/assignment2]$ gcc problem1.c
[~/2022_1/Algorithm/assignment2]$ ./a.out
Enter a number: 10
k: 3
[~/2022_1/Algorithm/assignment2]$ ./a.out
Enter a number: 50
k: 5
[~/2022_1/Algorithm/assignment2]$ ./a.out
Enter a number: 1025
k: 10
```

Problem 2

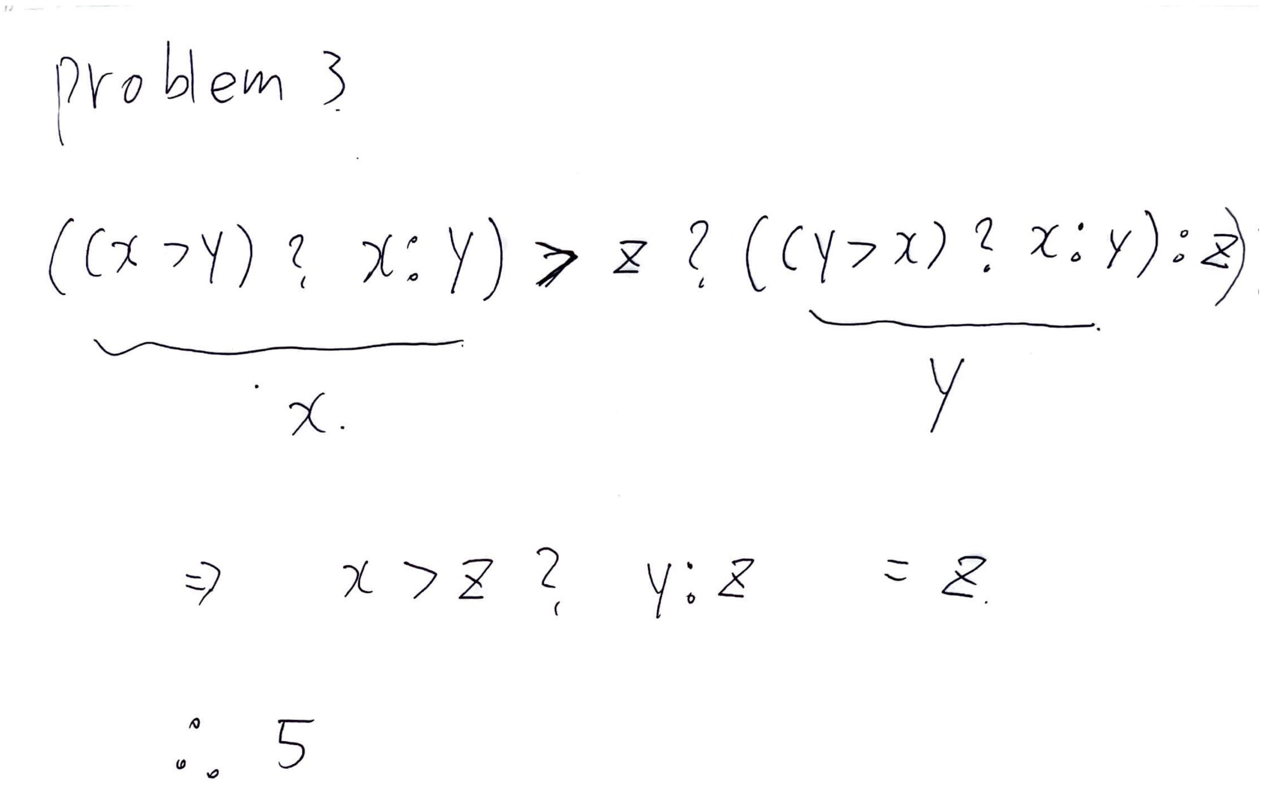


```c
#include <stdio.h>

int is_palindrome(char *str)
{
        int str_len = 0;
        while(str[str_len])
                str_len++;
        for (int i = 0; i < (str_len/2); i++)
        {
                if (str[i] != str[str_len - 1 - i])
                        return (0);
        }
        return (1);
}

int main()
{
        char str1[10] = "hello";
        char str2[10] = "radar";

        if (is_palindrome(str1))
                printf("%s is palindrome\n", str1);
        else
                printf("%s is not palindrome\n", str1);
        if (is_palindrome(str2))
                printf("%s is palindrome\n", str2);
        else
                printf("%s is not palindrome\n", str2);
}
```



```
[~/2022_1/Algorithm/assignment2]$ gcc problem2.c
[~/2022_1/Algorithm/assignment2]$ ./a.out
hello is not palindrome
radar is palindrome
```

Problem 3



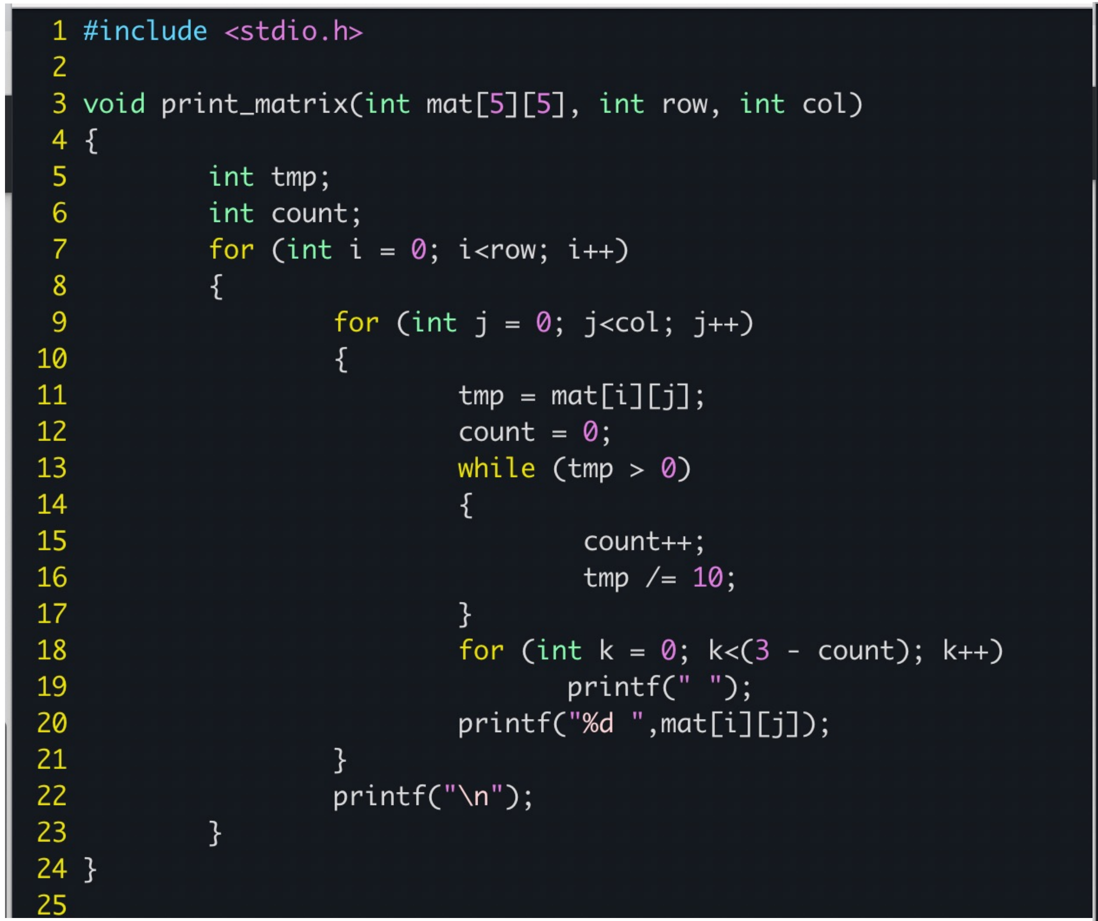
problem 3

$$\underbrace{((x>y)\ ?\ x:y)}_{x.} > z\ ?\ (\underbrace{(y>x)\ ?\ x:y}_{y}):z)$$

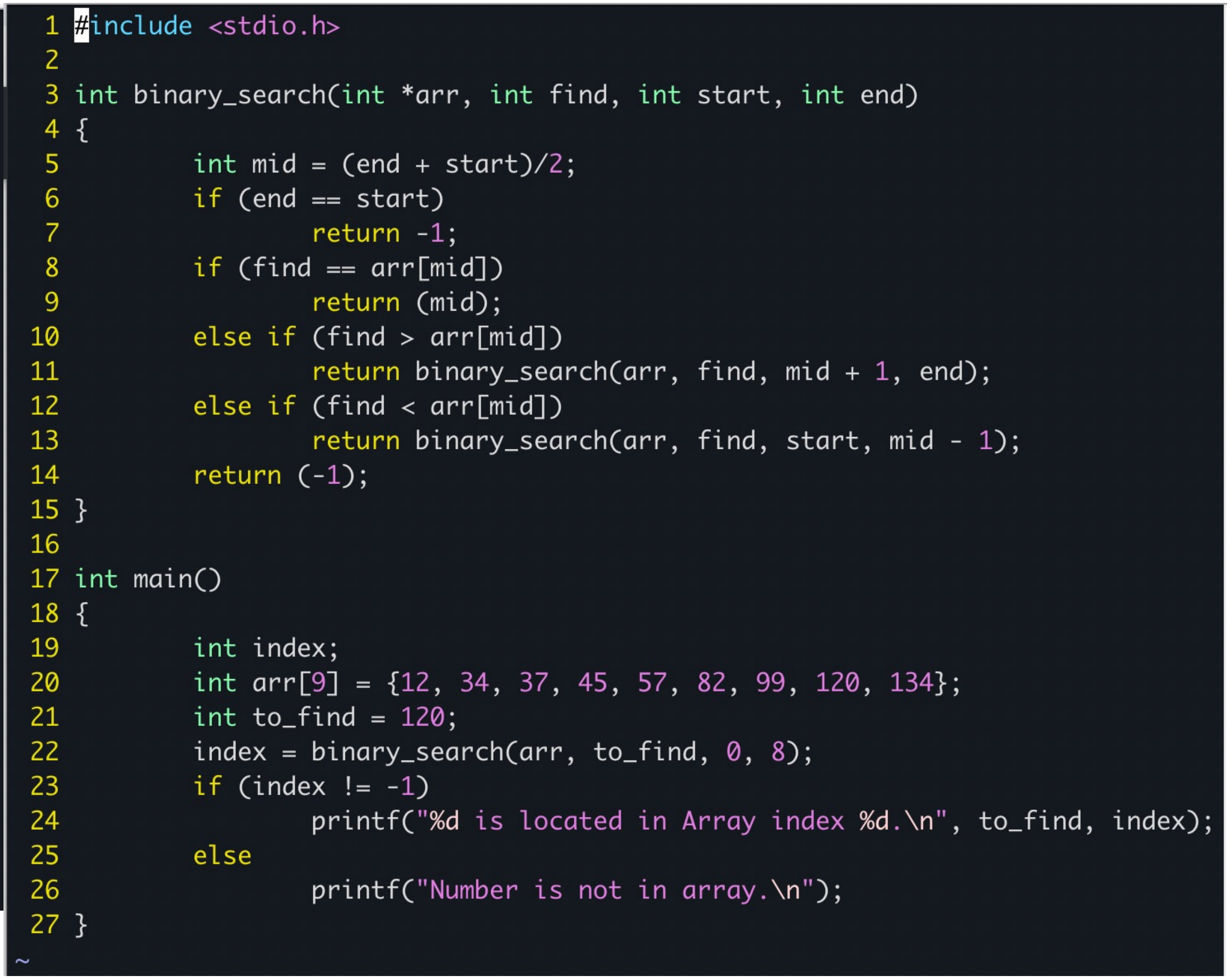
$$\Rightarrow \quad x>z\ ?\ y:z \quad = z.$$

$\therefore$ 5

Problem 4

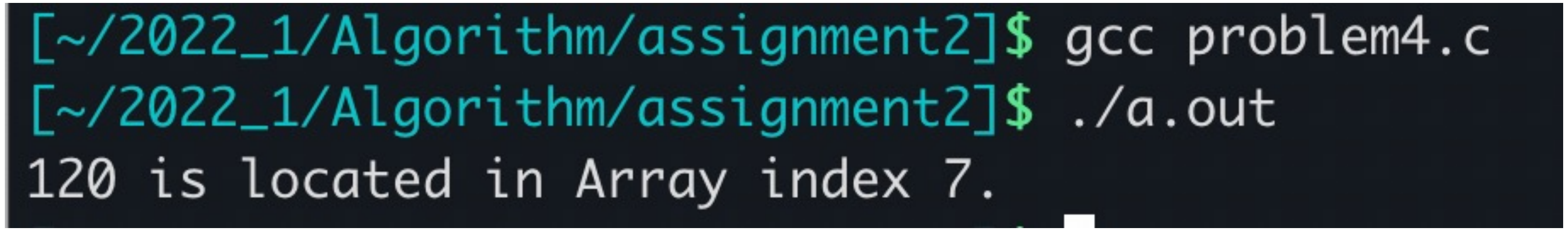


```c
#include <stdio.h>

void print_matrix(int mat[5][5], int row, int col)
{
        int tmp;
        int count;
        for (int i = 0; i<row; i++)
        {
                for (int j = 0; j<col; j++)
                {
                        tmp = mat[i][j];
                        count = 0;
                        while (tmp > 0)
                        {
                                count++;
                                tmp /= 10;
                        }
                        for (int k = 0; k<(3 - count); k++)
                               printf(" ");
                        printf("%d ",mat[i][j]);
                }
                printf("\n");
        }
}

```



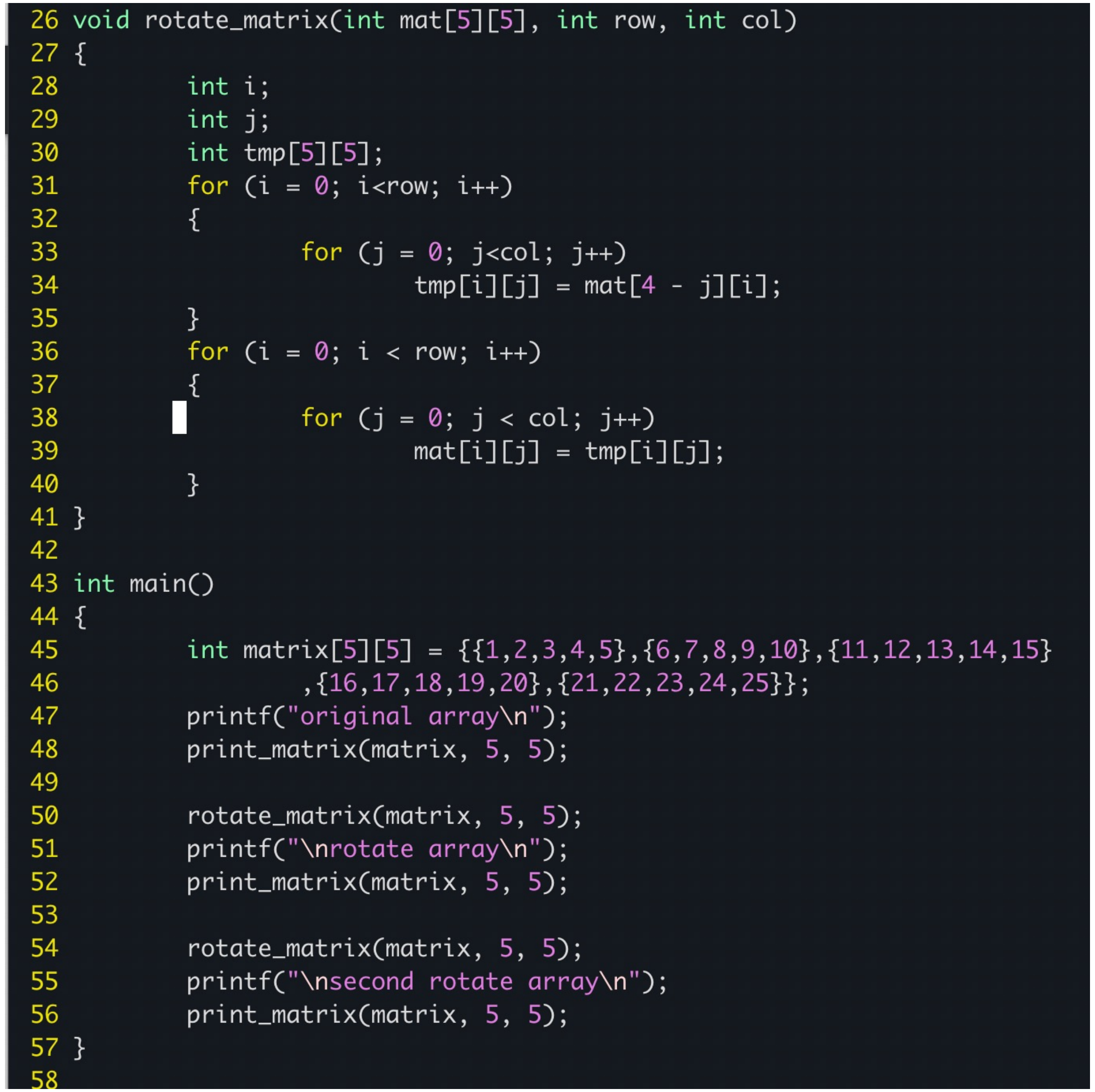
```c
#include <stdio.h>

int binary_search(int *arr, int find, int start, int end)
{
        int mid = (end + start)/2;
        if (end == start)
                return -1;
        if (find == arr[mid])
                return (mid);
        else if (find > arr[mid])
                return binary_search(arr, find, mid + 1, end);
        else if (find < arr[mid])
                return binary_search(arr, find, start, mid - 1);
        return (-1);
}

int main()
{
        int index;
        int arr[9] = {12, 34, 37, 45, 57, 82, 99, 120, 134};
        int to_find = 120;
        index = binary_search(arr, to_find, 0, 8);
        if (index != -1)
                printf("%d is located in Array index %d.\n", to_find, index);
        else
                printf("Number is not in array.\n");
}
```

Problem 4 - result

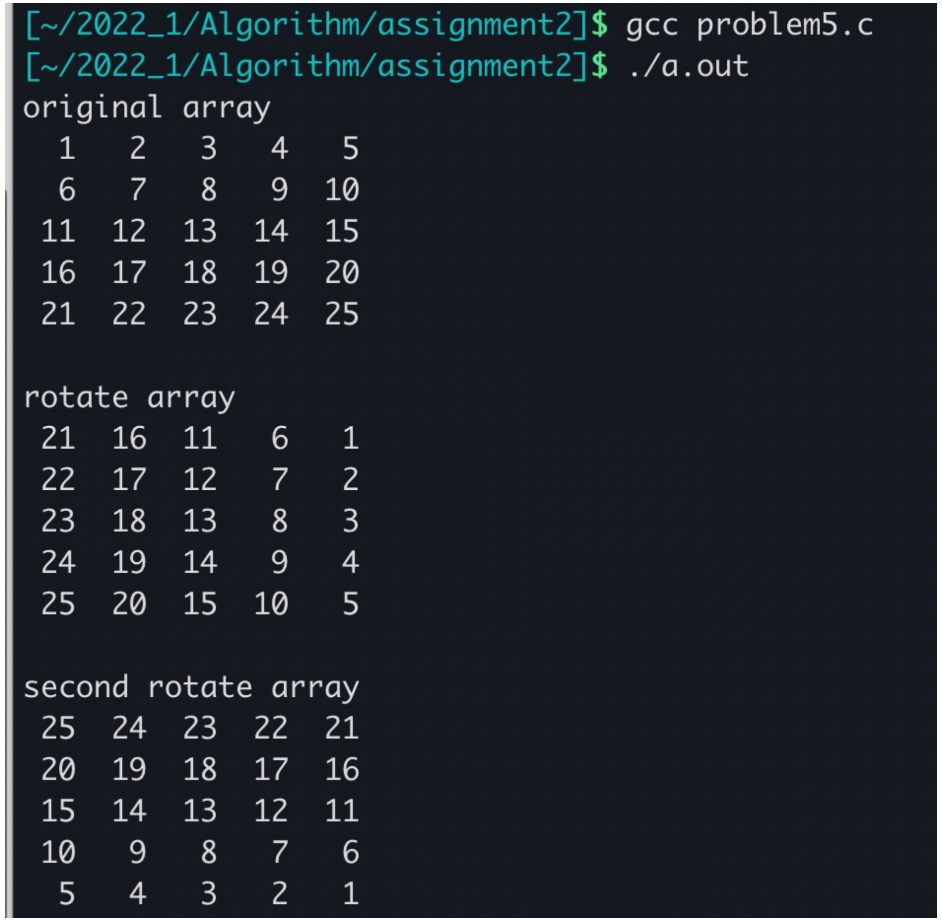


```
[~/2022_1/Algorithm/assignment2]$ gcc problem4.c
[~/2022_1/Algorithm/assignment2]$ ./a.out
120 is located in Array index 7.
```

Problem 5

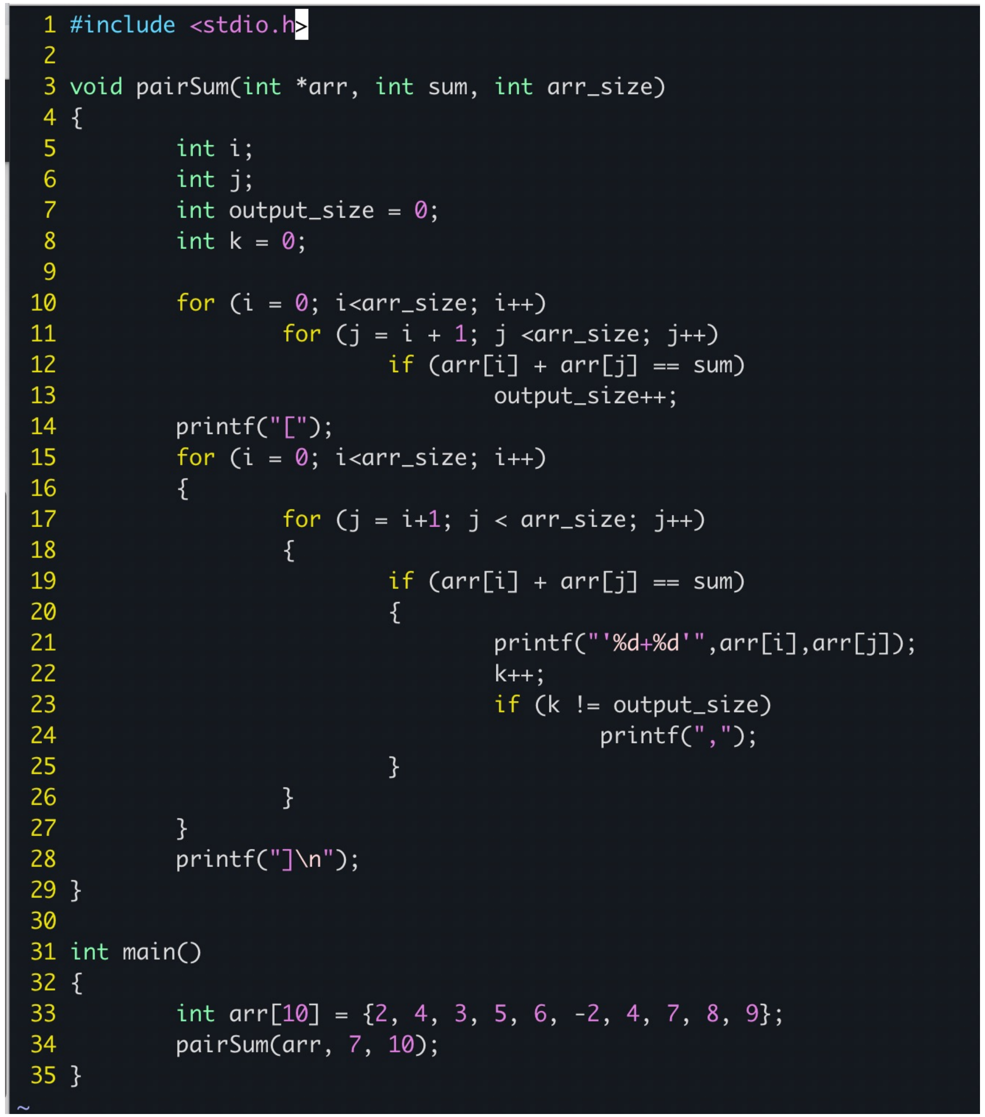


```c
void rotate_matrix(int mat[5][5], int row, int col)
{
        int i;
        int j;
        int tmp[5][5];
        for (i = 0; i<row; i++)
        {
                for (j = 0; j<col; j++)
                        tmp[i][j] = mat[4 - j][i];
        }
        for (i = 0; i < row; i++)
        {
                for (j = 0; j < col; j++)
                        mat[i][j] = tmp[i][j];
        }
}

int main()
{
        int matrix[5][5] = {{1,2,3,4,5},{6,7,8,9,10},{11,12,13,14,15}
                ,{16,17,18,19,20},{21,22,23,24,25}};
        printf("original array\n");
        print_matrix(matrix, 5, 5);

        rotate_matrix(matrix, 5, 5);
        printf("\nrotate array\n");
        print_matrix(matrix, 5, 5);

        rotate_matrix(matrix, 5, 5);
        printf("\nsecond rotate array\n");
        print_matrix(matrix, 5, 5);
}

```

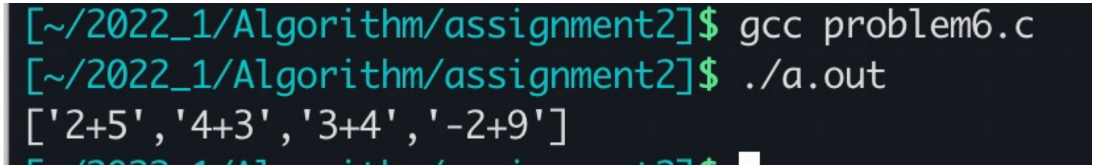


```
[~/2022_1/Algorithm/assignment2]$ gcc problem5.c
[~/2022_1/Algorithm/assignment2]$ ./a.out
original array
  1   2   3   4   5
  6   7   8   9  10
 11  12  13  14  15
 16  17  18  19  20
 21  22  23  24  25

rotate array
 21  16  11   6   1
 22  17  12   7   2
 23  18  13   8   3
 24  19  14   9   4
 25  20  15  10   5

second rotate array
 25  24  23  22  21
 20  19  18  17  16
 15  14  13  12  11
 10   9   8   7   6
  5   4   3   2   1
```

Problem 6

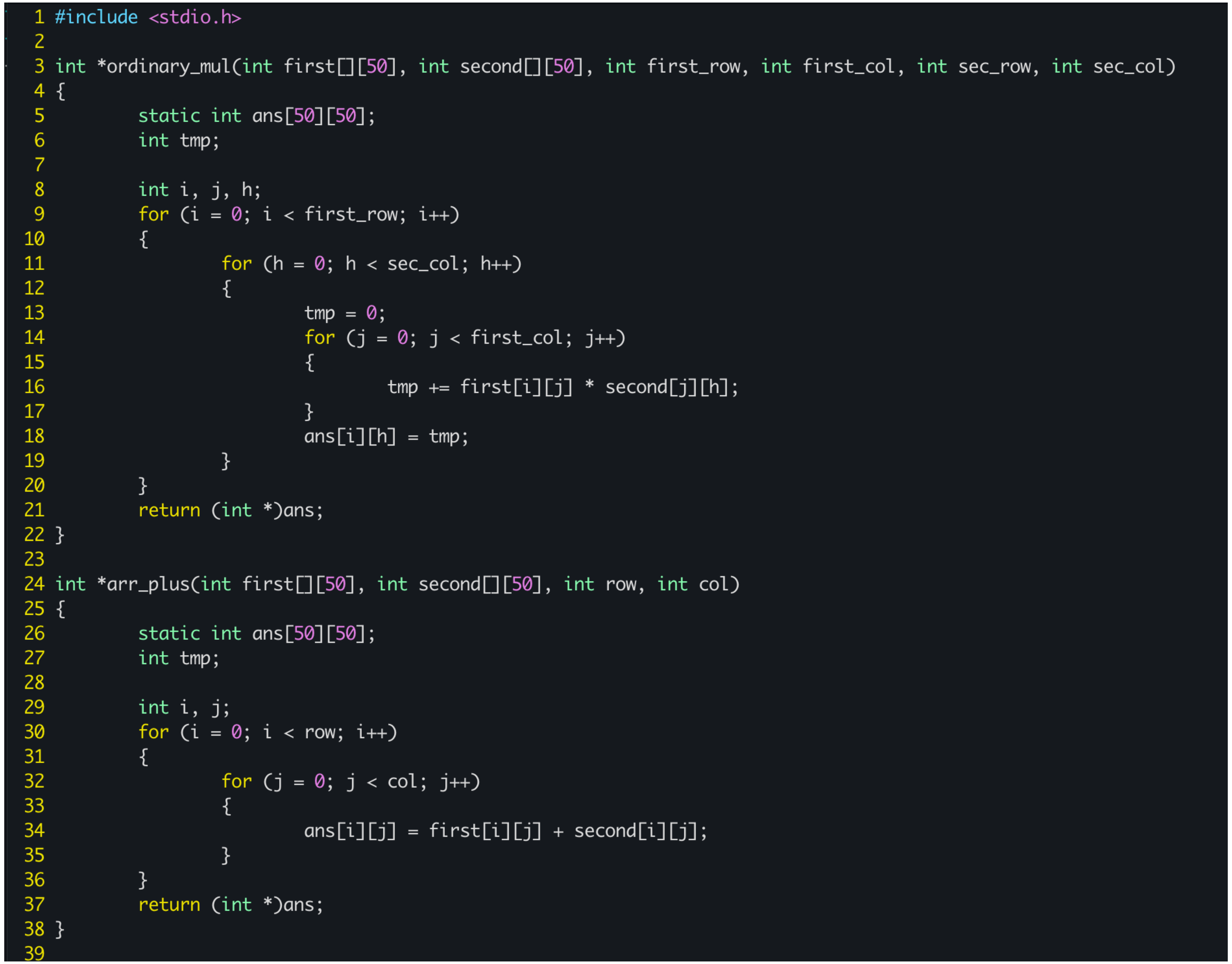


```c
#include <stdio.h>

void pairSum(int *arr, int sum, int arr_size)
{
        int i;
        int j;
        int output_size = 0;
        int k = 0;

        for (i = 0; i<arr_size; i++)
                for (j = i + 1; j <arr_size; j++)
                        if (arr[i] + arr[j] == sum)
                                output_size++;
        printf("[");
        for (i = 0; i<arr_size; i++)
        {
                for (j = i+1; j < arr_size; j++)
                {
                        if (arr[i] + arr[j] == sum)
                        {
                                printf("'%d+%d'",arr[i],arr[j]);
                                k++;
                                if (k != output_size)
                                        printf(",");
                        }
                }
        }
        printf("]\n");
}

int main()
{
        int arr[10] = {2, 4, 3, 5, 6, -2, 4, 7, 8, 9};
        pairSum(arr, 7, 10);
}
~
```



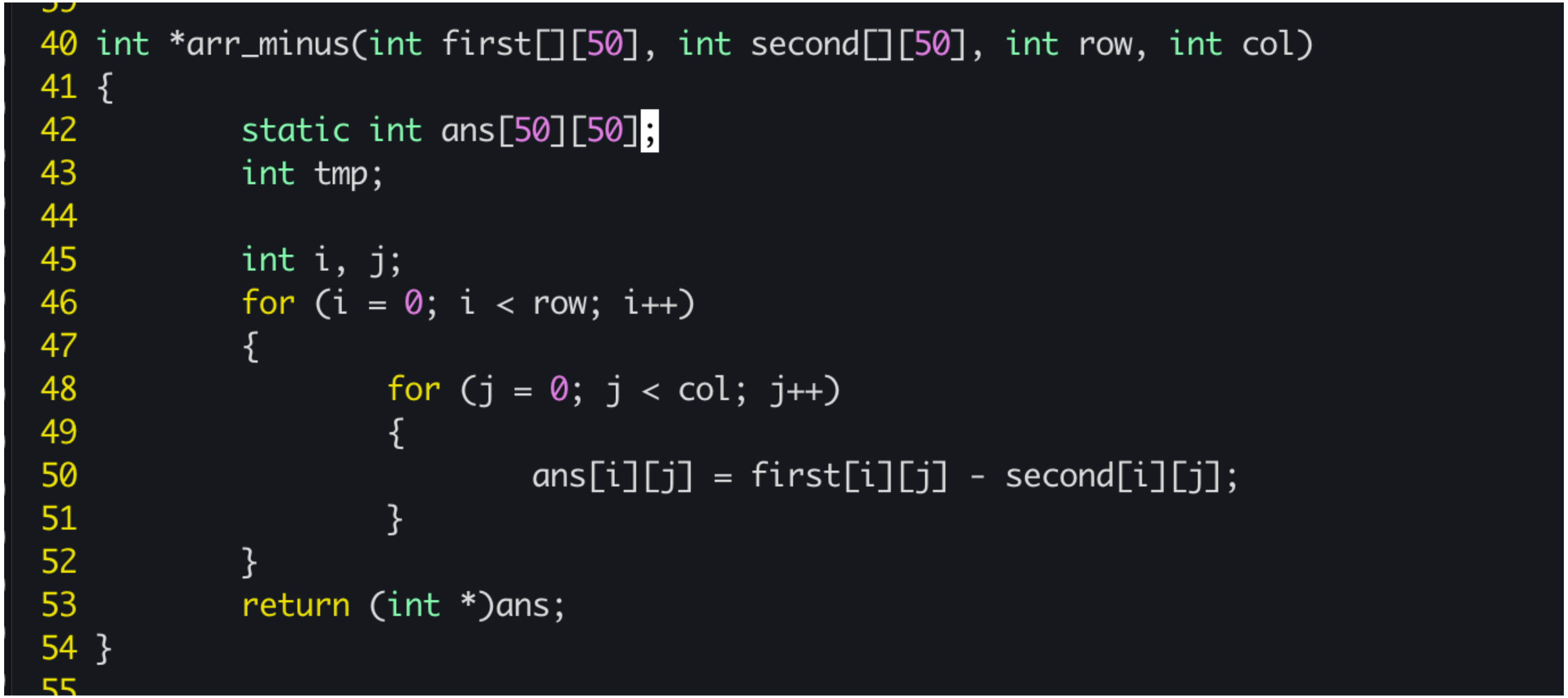
```
[~/2022_1/Algorithm/assignment2]$ gcc problem6.c
[~/2022_1/Algorithm/assignment2]$ ./a.out
['2+5','4+3','3+4','-2+9']
```

Problem 7



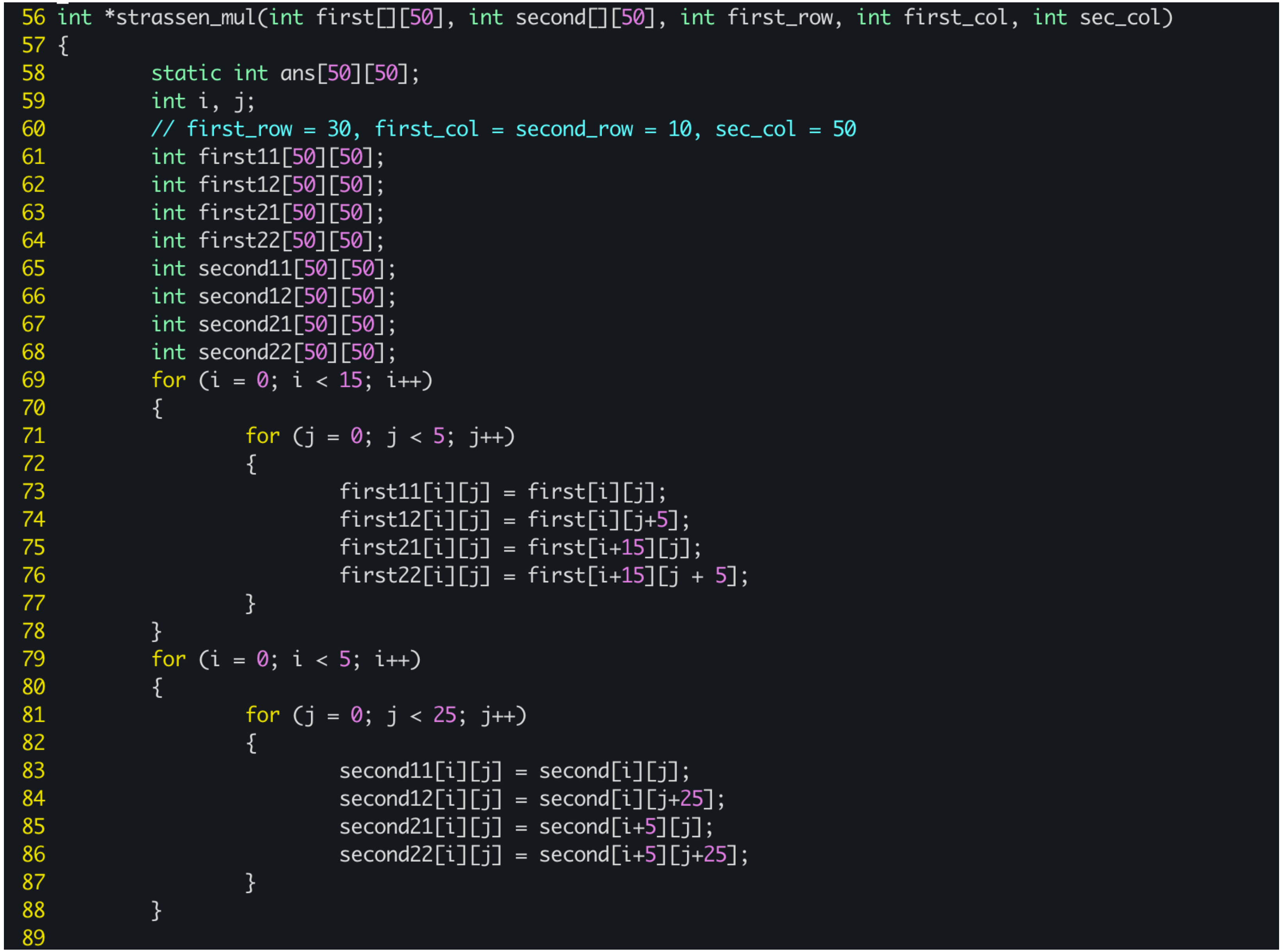
```c
#include <stdio.h>

int *ordinary_mul(int first[][50], int second[][50], int first_row, int first_col, int sec_row, int sec_col)
{
        static int ans[50][50];
        int tmp;

        int i, j, h;
        for (i = 0; i < first_row; i++)
        {
                for (h = 0; h < sec_col; h++)
                {
                        tmp = 0;
                        for (j = 0; j < first_col; j++)
                        {
                                tmp += first[i][j] * second[j][h];
                        }
                        ans[i][h] = tmp;
                }
        }
        return (int *)ans;
}

int *arr_plus(int first[][50], int second[][50], int row, int col)
{
        static int ans[50][50];
        int tmp;

        int i, j;
        for (i = 0; i < row; i++)
        {
                for (j = 0; j < col; j++)
                {
                        ans[i][j] = first[i][j] + second[i][j];
                }
        }
        return (int *)ans;
}

```

Problem 7



```
int *arr_minus(int first[][50], int second[][50], int row, int col)
{
        static int ans[50][50];
        int tmp;

        int i, j;
        for (i = 0; i < row; i++)
        {
                for (j = 0; j < col; j++)
                {
                        ans[i][j] = first[i][j] - second[i][j];
                }
        }
        return (int *)ans;
}
```

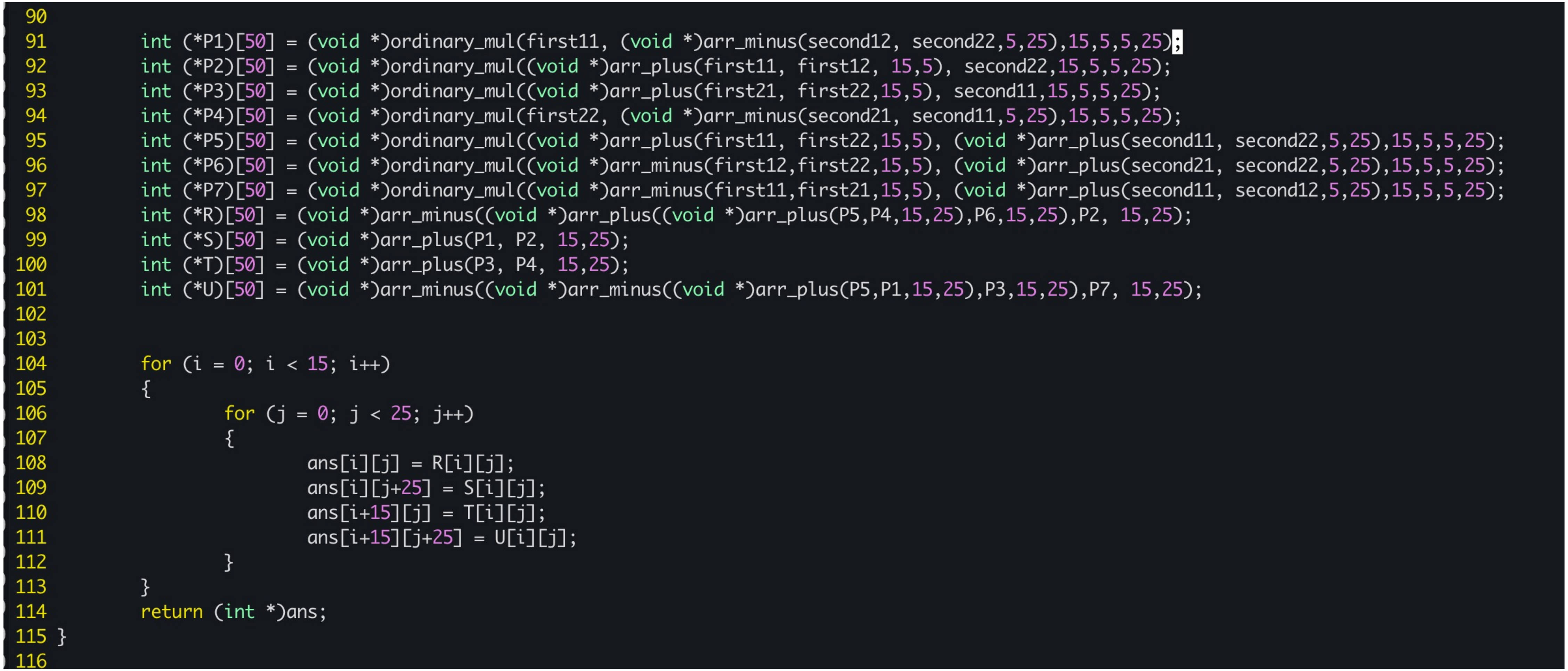
Problem 7



```c
int *strassen_mul(int first[][50], int second[][50], int first_row, int first_col, int sec_col)
{
        static int ans[50][50];
        int i, j;
        // first_row = 30, first_col = second_row = 10, sec_col = 50
        int first11[50][50];
        int first12[50][50];
        int first21[50][50];
        int first22[50][50];
        int second11[50][50];
        int second12[50][50];
        int second21[50][50];
        int second22[50][50];
        for (i = 0; i < 15; i++)
        {
                for (j = 0; j < 5; j++)
                {
                        first11[i][j] = first[i][j];
                        first12[i][j] = first[i][j+5];
                        first21[i][j] = first[i+15][j];
                        first22[i][j] = first[i+15][j + 5];
                }
        }
        for (i = 0; i < 5; i++)
        {
                for (j = 0; j < 25; j++)
                {
                        second11[i][j] = second[i][j];
                        second12[i][j] = second[i][j+25];
                        second21[i][j] = second[i+5][j];
                        second22[i][j] = second[i+5][j+25];
                }
        }

```

Problem 7



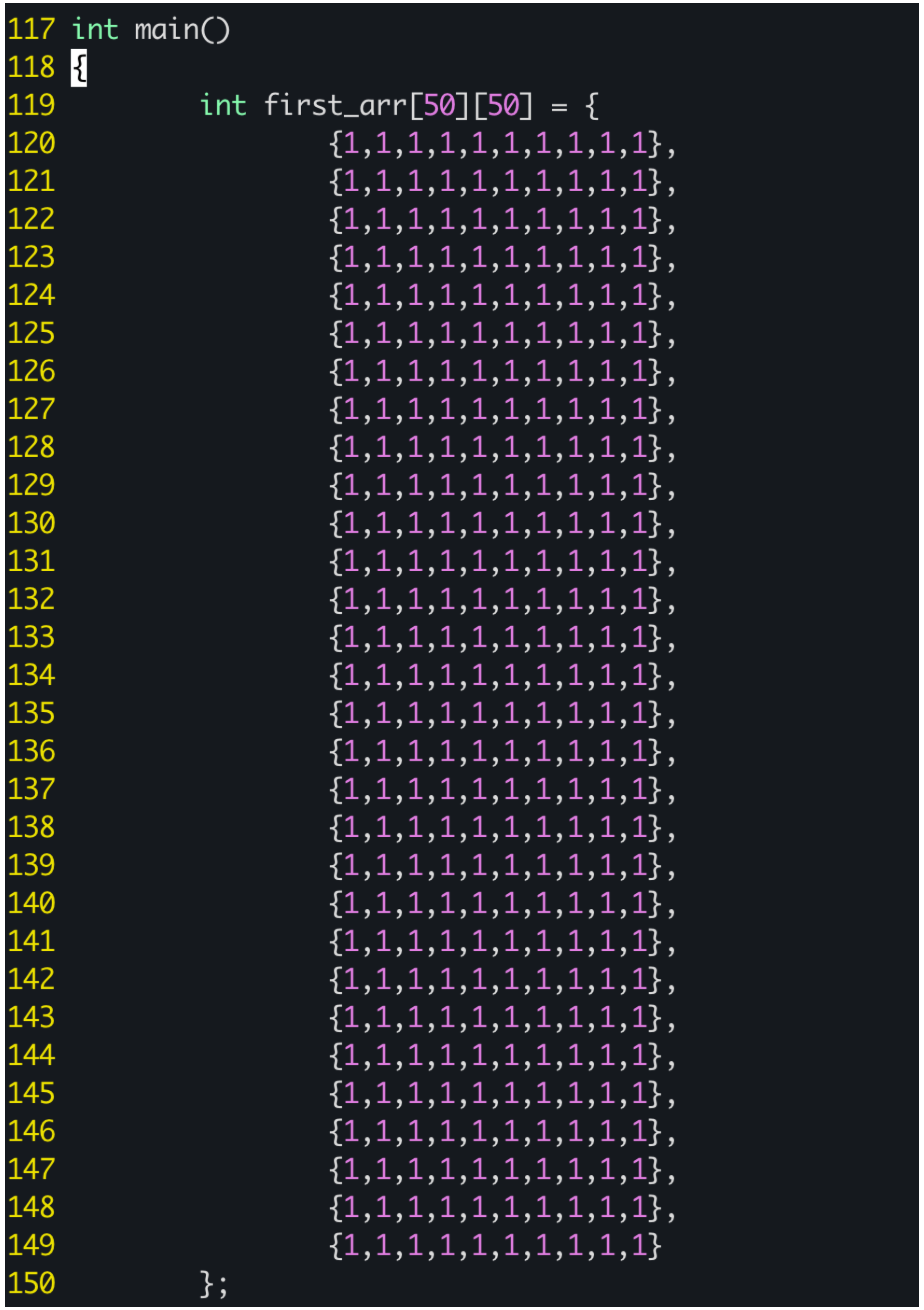
```

        int (*P1)[50] = (void *)ordinary_mul(first11, (void *)arr_minus(second12, second22,5,25),15,5,5,25);
        int (*P2)[50] = (void *)ordinary_mul((void *)arr_plus(first11, first12, 15,5), second22,15,5,5,25);
        int (*P3)[50] = (void *)ordinary_mul((void *)arr_plus(first21, first22,15,5), second11,15,5,5,25);
        int (*P4)[50] = (void *)ordinary_mul(first22, (void *)arr_minus(second21, second11,5,25),15,5,5,25);
        int (*P5)[50] = (void *)ordinary_mul((void *)arr_plus(first11, first22,15,5), (void *)arr_plus(second11, second22,5,25),15,5,5,25);
        int (*P6)[50] = (void *)ordinary_mul((void *)arr_minus(first12,first22,15,5), (void *)arr_plus(second21, second22,5,25),15,5,5,25);
        int (*P7)[50] = (void *)ordinary_mul((void *)arr_minus(first11,first21,15,5), (void *)arr_plus(second11, second12,5,25),15,5,5,25);
        int (*R)[50] = (void *)arr_minus((void *)arr_plus((void *)arr_plus(P5,P4,15,25),P6,15,25),P2, 15,25);
        int (*S)[50] = (void *)arr_plus(P1, P2, 15,25);
        int (*T)[50] = (void *)arr_plus(P3, P4, 15,25);
        int (*U)[50] = (void *)arr_minus((void *)arr_minus((void *)arr_plus(P5,P1,15,25),P3,15,25),P7, 15,25);


        for (i = 0; i < 15; i++)
        {
                for (j = 0; j < 25; j++)
                {
                        ans[i][j] = R[i][j];
                        ans[i][j+25] = S[i][j];
                        ans[i+15][j] = T[i][j];
                        ans[i+15][j+25] = U[i][j];
                }
        }
        return (int *)ans;
}

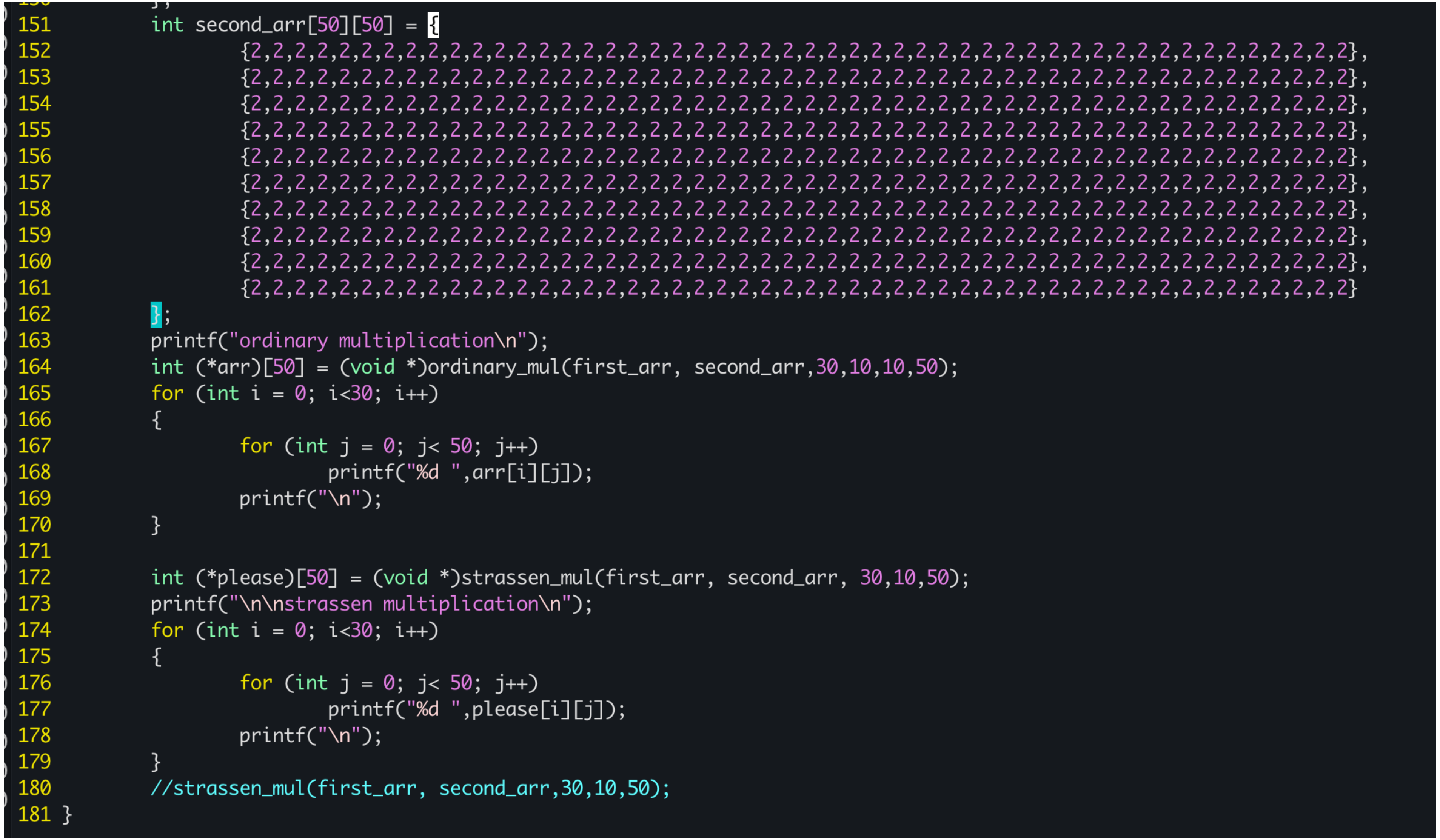
```

Problem 7



```
int main()
{
        int first_arr[50][50] = {
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1},
                {1,1,1,1,1,1,1,1,1,1}
        };
```

Problem 7



```
        };
        int second_arr[50][50] = {
                {2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2},
                {2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2},
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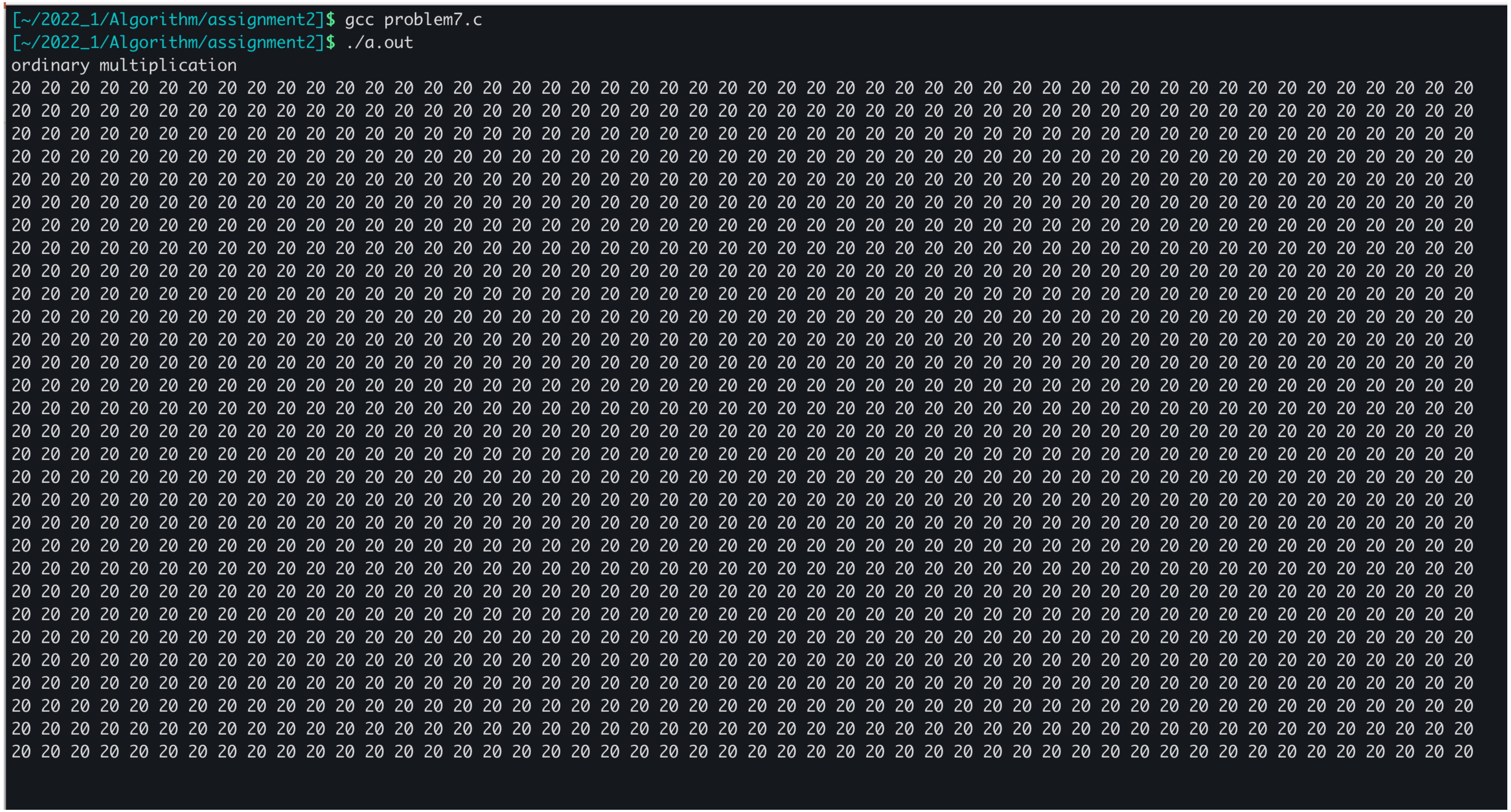
                {2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2,2}
        };
        printf("ordinary multiplication\n");
        int (*arr)[50] = (void *)ordinary_mul(first_arr, second_arr,30,10,10,50);
        for (int i = 0; i<30; i++)
        {
                for (int j = 0; j< 50; j++)
                        printf("%d ",arr[i][j]);
                printf("\n");
        }

        int (*please)[50] = (void *)strassen_mul(first_arr, second_arr, 30,10,50);
        printf("\n\nstrassen multiplication\n");
        for (int i = 0; i<30; i++)
        {
                for (int j = 0; j< 50; j++)
                        printf("%d ",please[i][j]);
                printf("\n");
        }
        //strassen_mul(first_arr, second_arr,30,10,50);
}
```

Problem 7



```
[~/2022_1/Algorithm/assignment2]$ gcc problem7.c
[~/2022_1/Algorithm/assignment2]$ ./a.out
ordinary multiplication
20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
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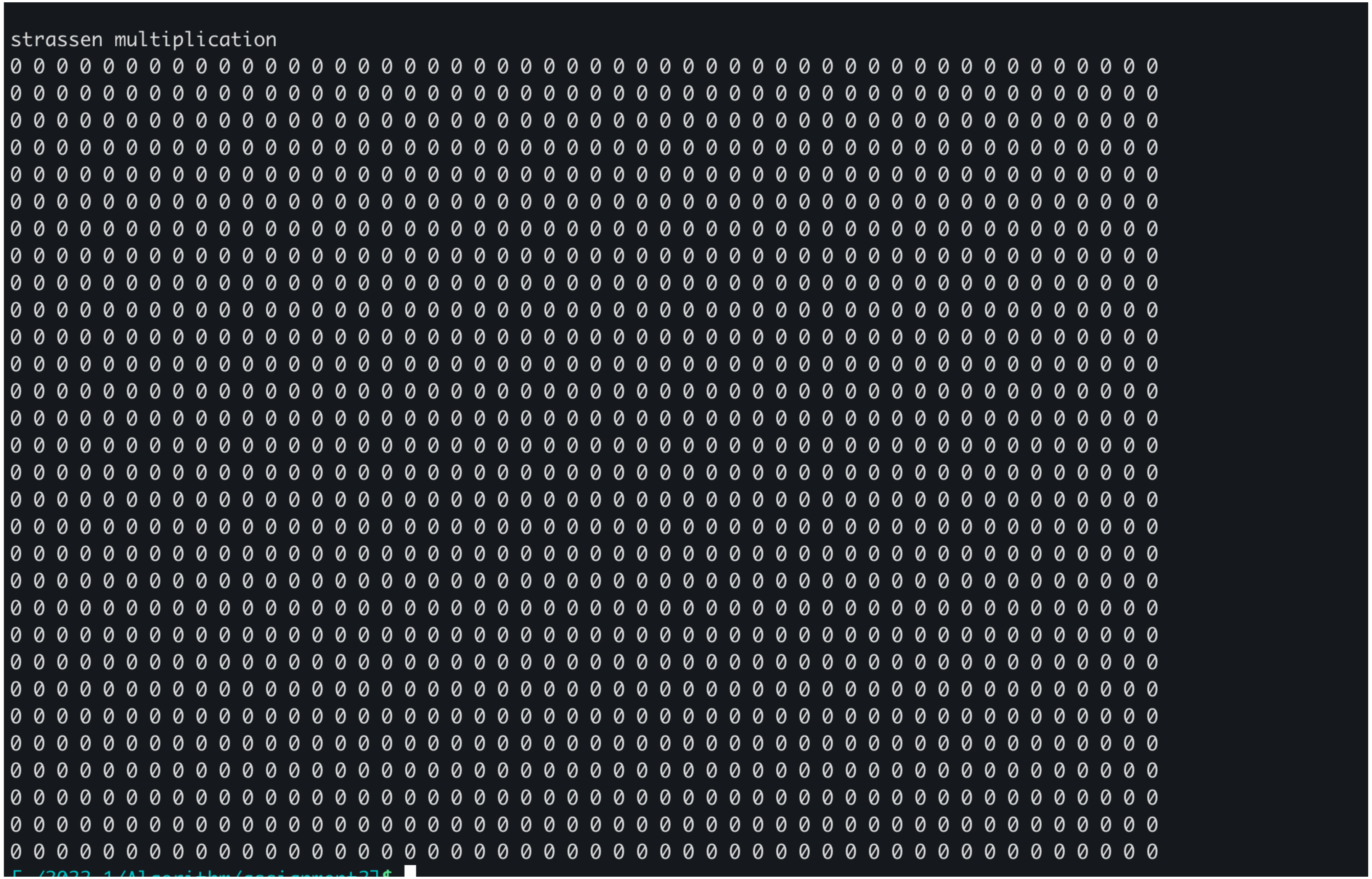

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Problem 7

- Runtime comparison failed because the Strassen method did not work properly.