

## Пояснительная записка

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Практическое задание 1, вариант 187 (условие задач 5, обработка данных в контейнере 14)

### Описание полученного задания

**Задание:** Разработка контейнера, содержащего квадратные матрицы с действительными числами.

**Виды матриц:** 1) обычный двумерный массив, 2) диагональная матрица, 3) нижняя треугольная матрица.

**Диагональная матрица** реализована на основе одномерного массива, содержащего элементы, стоящие на диагонали.

**Нижняя треугольная матрица** реализована на основе одномерного массива с формулой пересчета.

**Общая для всех альтернатив переменная** – размерность.

**Общая функция для всех альтернатив функция** – вычисление среднего арифметического.

**Функция обработки данных в контейнере** – упорядочивание по убыванию, используя сортировку Шелла.

**Формат ввода команды:** случайная генерация матриц `./abc -n number outputData`, где `outputData` (файл для записи результата) файлы формата `txt`) или считывание из файла `./abc -f inputData outputData`, где `inputData` (файл со входными данными) `outputData` (файл для записи результата) файлы формата `txt`).

**Формат описания матриц:** (вид матрицы) (размерность матрицы) (элементы матрицы в строку через пробел)

Виды матрицы соответствуют номерам: 1 – обычный двумерный массив, 2 – диагональная матрица, 3 – нижняя треугольная матрица.

Пример описания матрицы: 1 2 1 1 2 2 – двумерный массив размерности 2:  $\begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix}$

## Структурная схема ВС с размещенной на ней разработанной программой

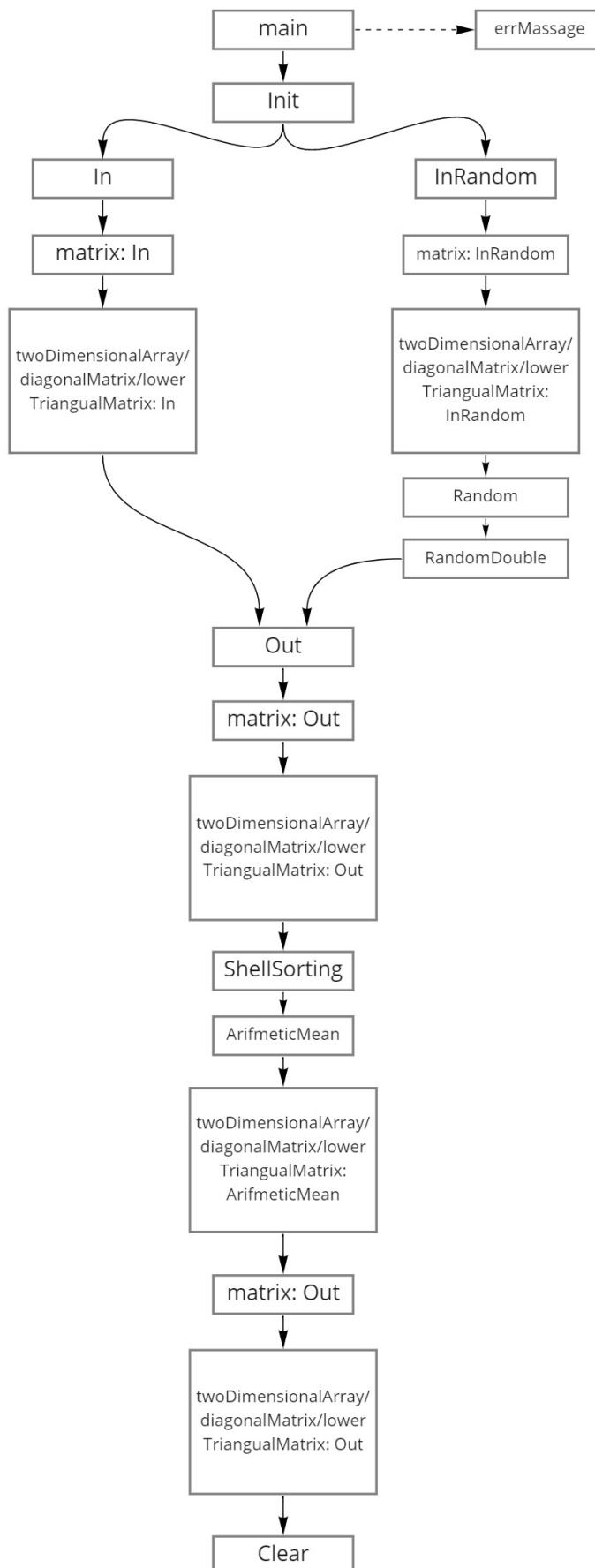
Таблица типов:

int	4
double	8
enum	4
struct twoDimensionalArray dimension: int tdaElements: double**	12 4[0] 8[4]
struct diagonalMatrix dimension: int tdaElements: double*	12 4[0] 8[4]
struct lowerTriangularMatrix dimension: int tdaElements: double*	12 4[0] 8[4]
struct matrix k: enum union: tda twoDimensionalArray dm diagonalMatrix ltm lowerTriangularMatrix	16 4[0]  12[4] 12[4] 12[4]
struct container max_len: enum len: int *cont[max_len]: matrix	160008 4[0] 4[4] 16*10000[8]=160000

Память программы:

int main(int argc, char* argv[]) argc: int argv: char** c: container fileInput: FILE* size: int fileOutput: FILE*	160040 4[0] 8[4] 160008[12] 8[160020] 4[160028] 8[160032]
void Init(container &c) c: container	160008 160008[0]
matrix* In(FILE *file) file: FILE* k: int m: matrix*	20 8[0] 4[8] 8[12]
matrix* InRandom() k: int m: matrix*	12 4[0] 8[4]

## Stack



## Характеристики программы

Число интерфейсных модулей: 6

Число модулей реализации: 5+main.cpp

Общее число строк кода: 558

## Время выполнения программы для различных тестовых наборов данных

1) время:

```
user@user-VirtualBox:~/CLionProjects/abc/cmake-build-debug$ ./abc -f inData outData90
Start
Total time for program: 0.000172 seconds
Stop
```

входные данные:

```
1 1 2 1.4 2 3 4
2 2 2 1 2
3 3 3 1 2 3 4 5 6
```

выходные данные:

```
1 Container contains 3 elements.
2 0: It is two dimensional array: dimension = 2. Arithmetic mean = 2.60
3 1: It is diagonal matrix: dimension = 2. Arithmetic mean = 0.75
4 2: It is lower triangular matrix: dimension = 3. Arithmetic mean = 2.33
5
6
7 Sorted container:
8 Container contains 3 elements.
9 0: It is two dimensional array: dimension = 2. Arithmetic mean = 2.60
10 1: It is lower triangular matrix: dimension = 3. Arithmetic mean = 2.33
11 2: It is diagonal matrix: dimension = 2. Arithmetic mean = 0.75
```

2) время:

```
user@user-VirtualBox:~/CLionProjects/abc/cmake-build-debug$ ./abc -f inData10 outData10
Start
Total time for program: 0.000240 seconds
Stop
```

входные данные:

```
1 1 2 1 2 1 2
2 2 3 1 2 3
3 3 2 1 2 3
4 1 3 1 1 1 2 2 2 3 3 3
5 2 5 1 2 3 4 5
6 3 4 1 1 1 1 1 1 1 1 1
7 1 3 1 10 1 2 6 2 0 0 0
8 2 10 1 2 3 4 5 6 3 8 9 10
9 3 4 1 1 1 1 1 1 1 1 1 1
10 1 1 1
```

выходные данные:

```

1 Container contains 10 elements.
2 0: It is two dimensional array: dimension = 2. Arithmetic mean = 1.50
3 1: It is diagonal matrix: dimension = 3. Arithmetic mean = 0.67
4 2: It is lower triangular matrix: dimension = 2. Arithmetic mean = 1.50
5 3: It is two dimensional array: dimension = 3. Arithmetic mean = 2.00
6 4: It is diagonal matrix: dimension = 5. Arithmetic mean = 0.60
7 5: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
8 6: It is two dimensional array: dimension = 3. Arithmetic mean = 2.44
9 7: It is diagonal matrix: dimension = 10. Arithmetic mean = 0.51
10 8: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
11 9: It is two dimensional array: dimension = 1. Arithmetic mean = 1.00
12
13
14 Sorted container:
15 Container contains 10 elements.
16 0: It is two dimensional array: dimension = 3. Arithmetic mean = 2.44
17 1: It is two dimensional array: dimension = 3. Arithmetic mean = 2.00
18 2: It is two dimensional array: dimension = 2. Arithmetic mean = 1.50
19 3: It is lower triangular matrix: dimension = 2. Arithmetic mean = 1.50
20 4: It is two dimensional array: dimension = 1. Arithmetic mean = 1.00
21 5: It is diagonal matrix: dimension = 3. Arithmetic mean = 0.67
22 6: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
23 7: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
24 8: It is diagonal matrix: dimension = 5. Arithmetic mean = 0.60
25 9: It is diagonal matrix: dimension = 10. Arithmetic mean = 0.51

```

3) время для 20 элементов:

```

Stop
user@user-VirtualBox: ~/CLionProjects/abc/cmake-build-debug$ ./abc -n 20 outData2
0
Start
Total time for program: 0.000667 seconds
Stop

```

выходные данные:

```

1 Container contains 20 elements.
2 0: It is diagonal matrix: dimension = 14. Arithmetic mean = 0.11
3 1: It is diagonal matrix: dimension = 13. Arithmetic mean = 0.12
4 2: It is lower triangular matrix: dimension = 19. Arithmetic mean = 0.79
5 3: It is diagonal matrix: dimension = 4. Arithmetic mean = 0.38
6 4: It is diagonal matrix: dimension = 9. Arithmetic mean = 0.17
7 5: It is diagonal matrix: dimension = 19. Arithmetic mean = 0.08
8 6: It is lower triangular matrix: dimension = 13. Arithmetic mean = 0.84
9 7: It is two dimensional array: dimension = 5. Arithmetic mean = 1.55
10 8: It is two dimensional array: dimension = 9. Arithmetic mean = 1.53
11 9: It is diagonal matrix: dimension = 7. Arithmetic mean = 0.24
12 10: It is diagonal matrix: dimension = 16. Arithmetic mean = 0.09
13 11: It is diagonal matrix: dimension = 2. Arithmetic mean = 0.86
14 12: It is lower triangular matrix: dimension = 18. Arithmetic mean = 0.77
15 13: It is lower triangular matrix: dimension = 5. Arithmetic mean = 0.85
16 14: It is lower triangular matrix: dimension = 6. Arithmetic mean = 0.89
17 15: It is two dimensional array: dimension = 2. Arithmetic mean = 1.54
18 16: It is diagonal matrix: dimension = 20. Arithmetic mean = 0.07
19 17: It is lower triangular matrix: dimension = 3. Arithmetic mean = 0.93
20 18: It is two dimensional array: dimension = 14. Arithmetic mean = 1.52
21 19: It is two dimensional array: dimension = 18. Arithmetic mean = 1.50
22
23
24 Sorted container:
25 Container contains 20 elements.
26 0: It is two dimensional array: dimension = 5. Arithmetic mean = 1.55
27 1: It is two dimensional array: dimension = 2. Arithmetic mean = 1.54
28 2: It is two dimensional array: dimension = 9. Arithmetic mean = 1.53
29 3: It is two dimensional array: dimension = 14. Arithmetic mean = 1.52
30 4: It is two dimensional array: dimension = 18. Arithmetic mean = 1.50
31 5: It is lower triangular matrix: dimension = 3. Arithmetic mean = 0.93
32 6: It is lower triangular matrix: dimension = 6. Arithmetic mean = 0.89
33 7: It is diagonal matrix: dimension = 2. Arithmetic mean = 0.86
34 8: It is lower triangular matrix: dimension = 5. Arithmetic mean = 0.85
35 9: It is lower triangular matrix: dimension = 13. Arithmetic mean = 0.84
36 10: It is lower triangular matrix: dimension = 19. Arithmetic mean = 0.79
37 11: It is lower triangular matrix: dimension = 18. Arithmetic mean = 0.77
38 12: It is diagonal matrix: dimension = 4. Arithmetic mean = 0.38
39 13: It is diagonal matrix: dimension = 7. Arithmetic mean = 0.24
40 14: It is diagonal matrix: dimension = 9. Arithmetic mean = 0.17
41 15: It is diagonal matrix: dimension = 13. Arithmetic mean = 0.12
42 16: It is diagonal matrix: dimension = 14. Arithmetic mean = 0.11
43 17: It is diagonal matrix: dimension = 16. Arithmetic mean = 0.09
44 18: It is diagonal matrix: dimension = 19. Arithmetic mean = 0.08

```

4) время для 8000 элементов:

```
Stop  
user@user-VirtualBox:~/CLionProjects/abc/cmake-build-debug$ ./abc -n 8000 outData  
a8000  
Start  
Total time for program: 0.166133 seconds  
Stop
```

5) время для 10000 элементов:

```
user@user-VirtualBox:~/CLionProjects/abc/cmake-build-debug$ ./abc -n 10000 outData  
ta10000  
Start  
Total time for program: 0.220338 seconds  
Stop
```

6) переполнение:

```
user@user-VirtualBox:~/CLionProjects/abc/cmake-build-debug$ ./abc -n 10001 outData  
ta10001  
Start  
incorrect number of matrixes = 10001. Set 0 < number <= 10000
```