Пояснительная записка

Роженко Варвара бпи205

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: $\begin{matrix} 1 & 1 \\ 2 & 2 \end{matrix}$

Структурная схема ВС с размещенной на ней разработанной программой

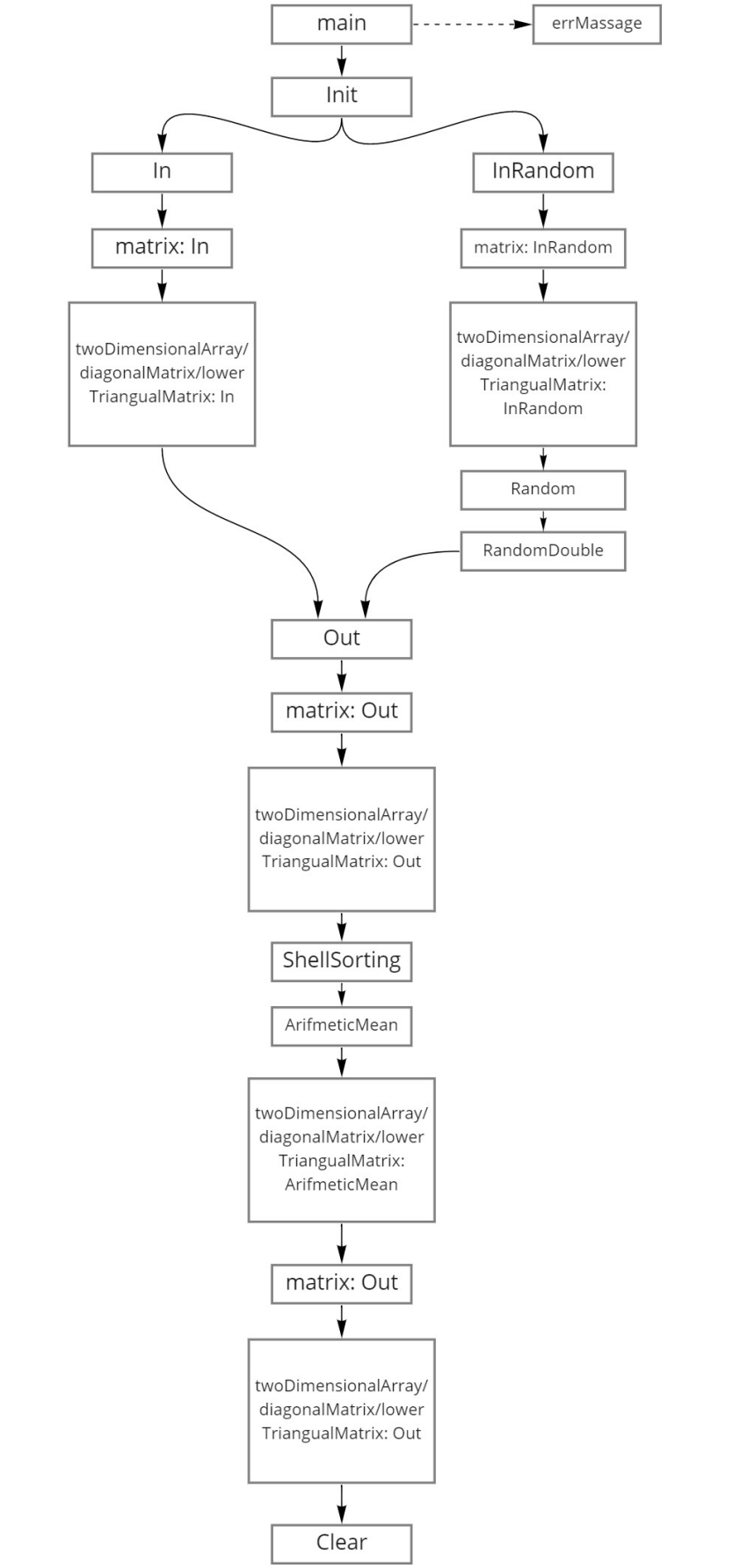
Таблица типов:

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	40008 4[0] 4[4] 40*10000[8]=40000

Память программы:

int main(int argc, char* argv[]) argc: int argv: char** c: container fileInput: FILE* size: int fileOutput: FILE*	40040 4[0] 8[4] 40008[12] 8[40020] 4[40028] 8[40032]
void Init(container &c) c: container	40008 40008[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


main
errMassage
Init
In
InRandom
matrix: In
matrix: InRandom
twoDimensionalArray/
diagonalMatrix/lower
TriangualMatrix: In
twoDimensionalArray/
diagonalMatrix/lower
TriangualMatrix:
InRandom
Random
RandomDouble
Out
matrix: Out
twoDimensionalArray/
diagonalMatrix/lower
TriangualMatrix: Out
ShellSorting
ArifmeticMean
twoDimensionalArray/
diagonalMatrix/lower
TriangualMatrix:
ArifmeticMean
matrix: Out
twoDimensionalArray/
diagonalMatrix/lower
TriangualMatrix: Out
Clear

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 outD
ata90
Start
Total time for program: 0.000172 seconds
Stop
```

входные данные:

inData

```
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 ou
tData10
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 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:

```
Container contains 10 elements.
0: It is two dimensional array: dimension = 2. Arithmetic mean = 1.50
1: It is diagonal matrix: dimension = 3. Arithmetic mean = 0.67
2: It is lower triangular matrix: dimension = 2. Arithmetic mean = 1.50
3: It is two dimensional array: dimension = 3. Arithmetic mean = 2.00
4: It is diagonal matrix: dimension = 5. Arithmetic mean = 0.60
5: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
6: It is two dimensional array: dimension = 3. Arithmetic mean = 2.44
7: It is diagonal matrix: dimension = 10. Arithmetic mean = 0.51
8: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
9: It is two dimensional array: dimension = 1. Arithmetic mean = 1.00


Sorted container:
Container contains 10 elements.
0: It is two dimensional array: dimension = 3. Arithmetic mean = 2.44
1: It is two dimensional array: dimension = 3. Arithmetic mean = 2.00
2: It is two dimensional array: dimension = 2. Arithmetic mean = 1.50
3: It is lower triangular matrix: dimension = 2. Arithmetic mean = 1.50
4: It is two dimensional array: dimension = 1. Arithmetic mean = 1.00
5: It is diagonal matrix: dimension = 3. Arithmetic mean = 0.67
6: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
7: It is lower triangular matrix: dimension = 4. Arithmetic mean = 0.62
8: It is diagonal matrix: dimension = 5. Arithmetic mean = 0.60
9: It is diagonal matrix: dimension = 10. Arithmetic mean = 0.51
```

3) время для 20 элементов:

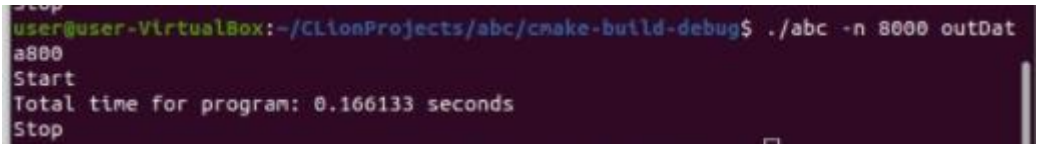
```
user@user-VirtualBox:~/CLionProjects/abc/cmake-build-debug$ ./abc -n 20 outData2
0
Start
Total time for program: 0.000667 seconds
Stop
```

выходные данные:

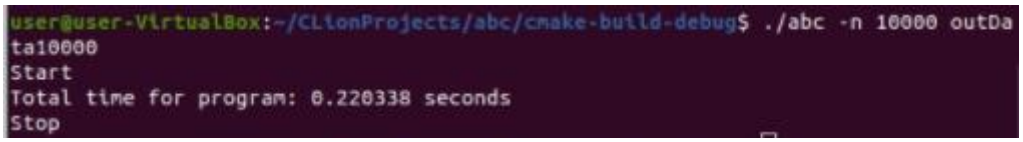
```
Container contains 20 elements.
0: It is diagonal matrix: dimension = 14. Arithmetic mean = 0.11
1: It is diagonal matrix: dimension = 13. Arithmetic mean = 0.12
2: It is lower triangular matrix: dimension = 19. Arithmetic mean = 0.79
3: It is diagonal matrix: dimension = 4. Arithmetic mean = 0.38
4: It is diagonal matrix: dimension = 9. Arithmetic mean = 0.17
5: It is diagonal matrix: dimension = 19. Arithmetic mean = 0.08
6: It is lower triangular matrix: dimension = 13. Arithmetic mean = 0.84
7: It is two dimensional array: dimension = 5. Arithmetic mean = 1.55
8: It is two dimensional array: dimension = 9. Arithmetic mean = 1.53
9: It is diagonal matrix: dimension = 7. Arithmetic mean = 0.24
10: It is diagonal matrix: dimension = 16. Arithmetic mean = 0.09
11: It is diagonal matrix: dimension = 2. Arithmetic mean = 0.86
12: It is lower triangular matrix: dimension = 18. Arithmetic mean = 0.77
13: It is lower triangular matrix: dimension = 5. Arithmetic mean = 0.85
14: It is lower triangular matrix: dimension = 6. Arithmetic mean = 0.89
15: It is two dimensional array: dimension = 2. Arithmetic mean = 1.54
16: It is diagonal matrix: dimension = 20. Arithmetic mean = 0.07
17: It is lower triangular matrix: dimension = 3. Arithmetic mean = 0.93
18: It is two dimensional array: dimension = 14. Arithmetic mean = 1.52
19: It is two dimensional array: dimension = 18. Arithmetic mean = 1.50


Sorted container:
Container contains 20 elements.
0: It is two dimensional array: dimension = 5. Arithmetic mean = 1.55
1: It is two dimensional array: dimension = 2. Arithmetic mean = 1.54
2: It is two dimensional array: dimension = 9. Arithmetic mean = 1.53
3: It is two dimensional array: dimension = 14. Arithmetic mean = 1.52
4: It is two dimensional array: dimension = 18. Arithmetic mean = 1.50
5: It is lower triangular matrix: dimension = 3. Arithmetic mean = 0.93
6: It is lower triangular matrix: dimension = 6. Arithmetic mean = 0.89
7: It is diagonal matrix: dimension = 2. Arithmetic mean = 0.86
8: It is lower triangular matrix: dimension = 5. Arithmetic mean = 0.85
9: It is lower triangular matrix: dimension = 13. Arithmetic mean = 0.84
10: It is lower triangular matrix: dimension = 19. Arithmetic mean = 0.79
11: It is lower triangular matrix: dimension = 18. Arithmetic mean = 0.77
12: It is diagonal matrix: dimension = 4. Arithmetic mean = 0.38
13: It is diagonal matrix: dimension = 7. Arithmetic mean = 0.24
14: It is diagonal matrix: dimension = 9. Arithmetic mean = 0.17
15: It is diagonal matrix: dimension = 13. Arithmetic mean = 0.12
16: It is diagonal matrix: dimension = 14. Arithmetic mean = 0.11
17: It is diagonal matrix: dimension = 16. Arithmetic mean = 0.09
18: It is diagonal matrix: dimension = 19. Arithmetic mean = 0.08
```

4) время для 8000 элементов:



5) время для 10000 элементов:



6) переполнение: