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Курсовая работа
по дисциплине «Программирование»
Тема: Разработка электронной картотеки

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Содержание

Цель работы

Полное решение содержательной задачи (содержательная и формальная постановка задачи, спецификация, включая описание диалога, выбор метода решения и структур данных, разработка алгоритма, программная реализация, тестирование и отладка, документирование). Создание электронной картотеки спортсменов.

Задание

Создать электронную картотеку, хранящуюся на диске, и программу на языке Си, обеспечивающую взаимодействие с ней. Программа выполняет:

- занесение данных в электронную картотеку;
- внесение изменений (исключение, корректировка, добавление);
- поиск данных по различным признакам;
- сортировку по различным признакам;
- вывод результатов на экран и сохранение на диске.

Выбор подлежащих выполнению команд должен быть реализован с помощью основного меню и вложенных меню.

Задача должна быть структурирована и отдельные части должны быть оформлены как функции.

Исходные данные должны вводиться с клавиатуры. В процессе обработки картотека должна храниться в памяти компьютера в виде списков и массивов структур, связанных указателями. Типы списков и структур выбираются исходя из предметной области.

Картотека составляется по выбранной предметной области.

В программе должно быть реализовано простейшее меню. Выполнение программы должно быть многократным по желанию пользователя. Данные первоначально считываются из файла (файлов), в процессе работы данные вводятся с клавиатуры.

Перечень пунктов меню:

1. Вывод картотеки. (В консоль в виде таблички);

2. Поиск карточек по параметру (Выбор параметра и последующий поиск по строке);

3. Сортировка картотеки по параметру;

4. Добавление карточки спортсмена (Ввод строки в формате);

5. Редактирование карточки по ID (Последовательный ввод полей, либо пропуск);

6. Удаление карточек по параметру (Поиск подходящих строк и подтверждение их удаления);

7. Сохранение на диск;

8. Выход из программы.

Постановка задачи и описание решения

Для решения задачи необходимо написать программу, которая взаимодействует с электронной картотекой. Для этого используется структура Athlete, в которой содержится 7 полей: имя спортсмена; университет, в котором учится спортсмен; возраст; вес; рост; массив из трёх чисел (результаты выступления спортсмена); индекс результатов спортсмена (отношение суммы к весу).

Вначале программа спрашивает у пользователя из какого файла взять первичную информацию. Далее выводится главное меню (список всех команд, доступных пользователю), для этого программа обращается к функции *help()*. Список команд, которые она выводит:

!print – вывод всех карточек в виде таблице. Программа обращается к функции *print()*.

!find – поиск карточек по параметру. Программа вызывает функцию *find()*. Пользователю предлагается выбрать один из 10 параметров для сортировки, либо 0 для выхода в главное меню. Если пользователь выбрал не 0, то у него спрашивается подстрока, которая будет искаться без учёта регистра. Пользователю выводится все найденные пользователи, либо сообщение *«No matches found!»*. В первом случае пользователю предлагается

сортировать найденные данные по всем параметрам, при этом исходный список не будет меняться. Для этого используется функция *sorted()*.

!sort - сортировка карточек по параметру. Программа вызывает функцию *sort()*. Пользователю предлагается сортировать данные по любому параметру, до тех пор, пока он не введёт 0. При этом данные в памяти компьютера тоже меняют своё положение.

!add – добавление карточки. Программа вызывает функцию *add()*. Пользователю выводится формат, в котором он должен ввести данные о новом спортсмене, далее спрашивается сама строка. Программа обрабатывает данную строку и добавляет спортсмена в конец списка.

!edit – изменение конкретной карточки. Программа вызывает функцию *edit()*. Далее у пользователя спрашивается ID спортсмена, которого он хочет изменить. Если спортсмен с данным ID существует, пользователю предлагается последовательно менять поля этого спортсмена. Если пользователь не хочет менять конкретное поле, он может нажать *ENTER*.

!delete – удаление карточек по параметру. Программа вызывает функцию *delete()*. Как и в *find()* выбираются спортсмены и выводятся пользователю. Далее у пользователя спрашивается подтверждение: точно ли он хочет удалить их. Если пользователь ответит *Y*, то данные об этих пользователях удаляются, а память очищается. В конце пользователю выводится изменённый список.

!save – сохранение данных в файл. Программа вызывает функцию *save()*. У пользователя спрашивается имя файла, в который он хочет сохранить данные. После считывания строки данные сохраняются в этот файл в формате CSV.

!end – завершает выполнение программы и очищает память.

При переходе из главного меню к конкретному функционалу экран очищается, и пользователю для наглядности выводится вся табличка. В конце выполнения функции экран также очищается, и пользователь «попадает» в главное меню, где уже сразу отображён список всех возможных команд.

Описание структур

1. Структура Athlete

№	Имя переменной	Тип	Назначение
1	name	char*	Имя спортсмена
2	university	char*	Название университета
3	age	int	Возраст
4	weight	float	Вес в килограммах
5	height	int	Рост в сантиметрах
6	result	int[3]	Результаты выступления
7	index	float	Отношение результата к весу

2. Структура NodeOfList

№	Имя переменной	Тип	Назначение
1	id	int	Уникальный ID
2	data	Athlete*	Указатель на данные о спортсмене
3	next	struct NodeOfList*	Указатель на следующую вершину списка
4	prev	struct NodeOfList*	Указатель на предыдущую вершину списка

3. Структура ListOfAthlete

№	Имя переменной	Тип	Назначение
1	length	int	Уникальный ID
2	first	struct NodeOfList*	Указатель на первую вершину списка
3	last	struct NodeOfList*	Указатель на последнюю вершину списка

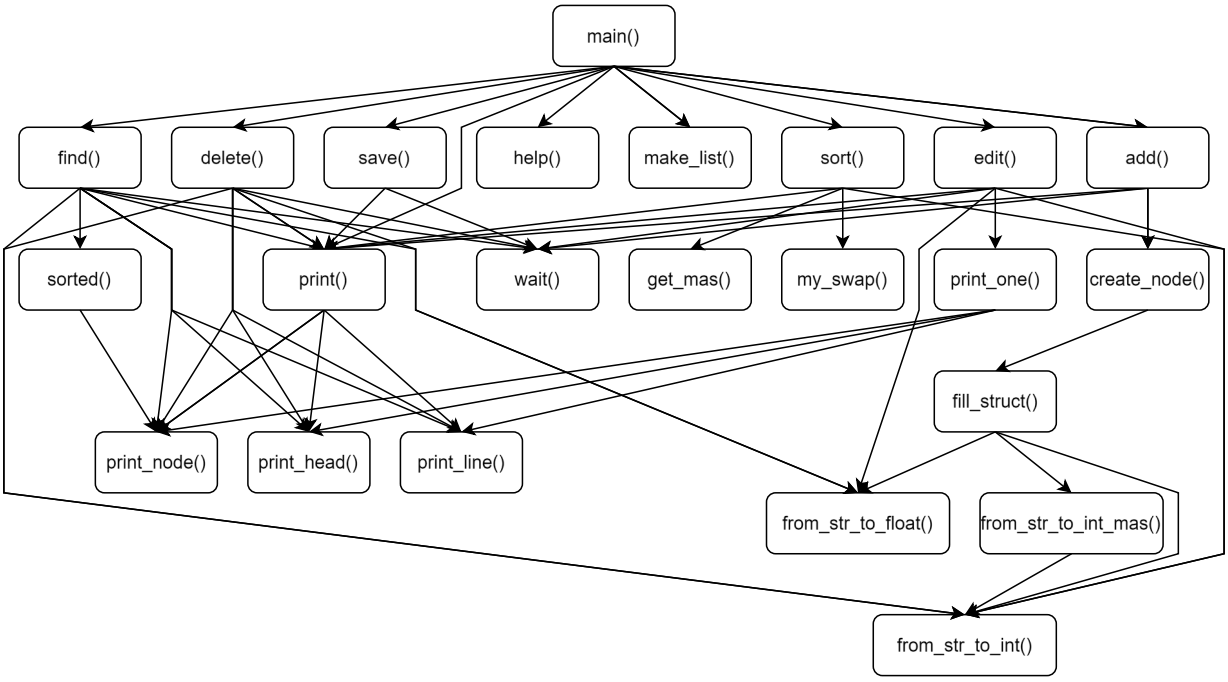
Описание функций

№	Название	Назначение
1	main	Основная функция программы. Открывает файл, инициализирует список, отвечает за взаимодействие с пользователем через меню. В конце очищает память.
2	from_str_to_int	Конвертирует строку в целочисленное значение. Если символ не цифра – возвращает 0.
3	from_str_to_float	Конвертирует строку в число с плавающей точкой. Если символ не цифра – возвращает 0.
4	from_str_to_int_mas	Конвертирует строку в массив целочисленных значений длины 3.

5	fill_struct	Извлекает данные из строки и заполняет поля структуры Athlete.
6	make_list	Создаёт список (выделяет память и возвращает указатель на него).
7	create_node	Выделяет память под новую вершину списка, заполняет его данными и возвращает указатель на него.
8	help	Отображает доступные команды пользователю в консоли.
9	wait	Приостанавливает выполнение программы до нажатия клавиши Enter.
10	print_line	Выводит линию для разделения таблицы данных в консоли.
11	print_head	Выводит поля заголовка таблицы в консоль.
12	print_node	Выводит данные одного элемента списка в консоль.
13	print_one	Выводит данные одного элемента списка с заголовком в консоль.
14	print	Выводит все элементы списка в консоль.
15	sorted	Сортировка выбранных элементов списка и вывод отсортированных данных в консоль. (не влияет на порядок основного списка)
16	find	Поиск элементов списка и вывод найденных данных в консоль с возможностью последующей сортировки этих данных.
17	get_mas	Функция проходит по всему списку и заполняет массив указателями на вершины списка. Возвращает массив указателей.
18	my_swap	Меняет два значения в списке местами.
19	sort	Сортирует элементы списка в соответствии с заданным параметром и выводит отсортированные данные в консоль.
20	add	Пользователь вводит данные нового элемента, функция создаёт новою вершину и добавляет её в конец списка.
21	edit	Пользователь вводит ID элемента, который хочет отредактировать, и новые данные. Функция находит элемент по ID и предлагает изменить его данные по отдельным полям.
22	delete	Пользователь выбирает поле для удаления и вводит критерии поиска. Функция удаляет элементы, соответствующие заданным критериям.

23	save	Пользователь выбирает имя файла, в который будут сохранены данные списка. Функция записывает все данные в файл в соответствии с форматом.

Структура вызова функций



Описание переменных

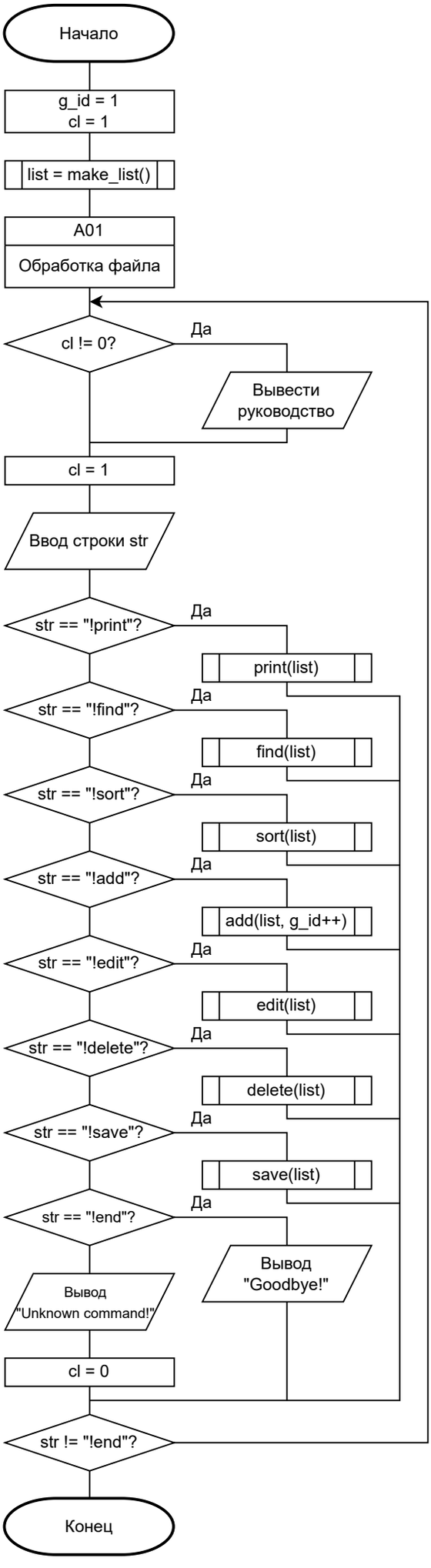
Функция *int main()*			
№	Имя переменной	Тип	Назначение
1	list	ListOfAthlete*	Список спортсменов
2	g_id	int	Глобальный ID
3	cl	int	Флаг для отображения help
4	filename	char[]	Буфер для хранения имени файла
5	str	char[]	Буфер для команд пользователя
6	text	char[]	Буфер для содержимого файла
7	cur_node	NodeOfList*	Текущий элемент в списке
8	f	FILE*	Указатель на файл
Функция *int from_str_to_int(char *str)*			
1	str	char*	Стока, которую нужно конвертировать в число
2	ans	int	Результирующее число
3	x	int	Текущая цифра

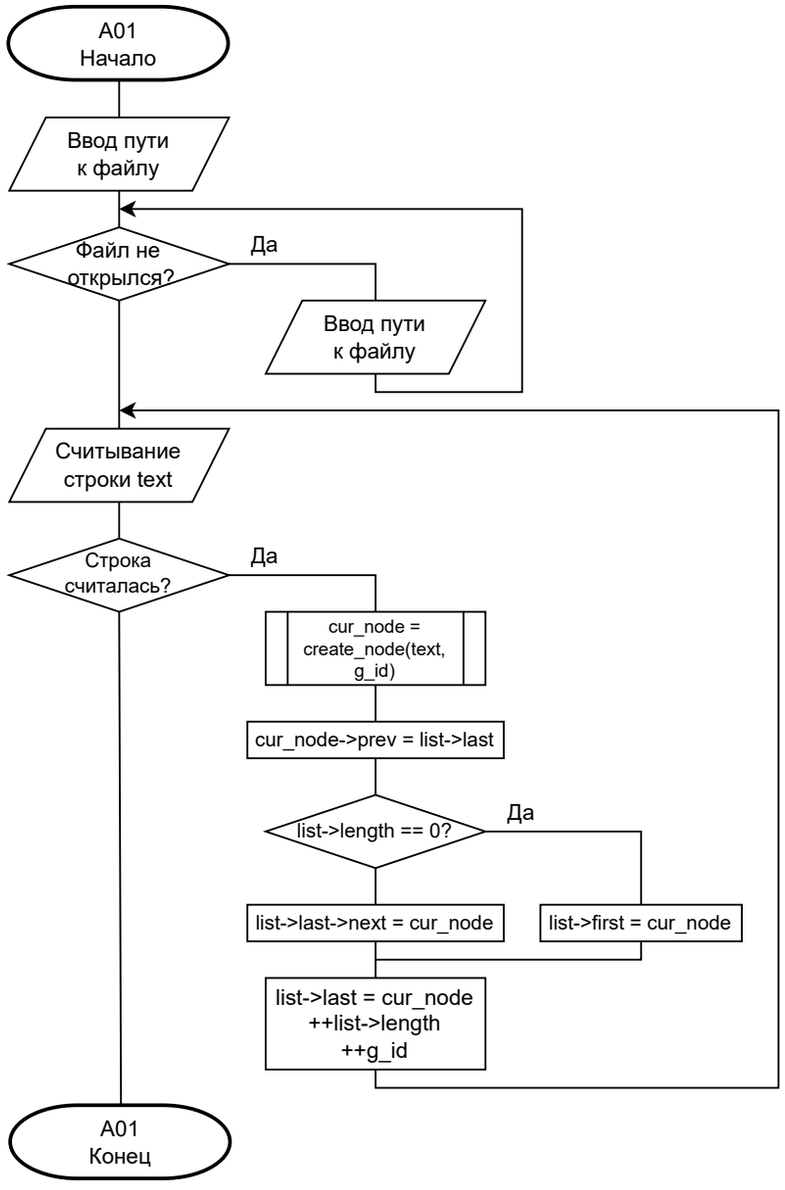
Функция *float from_str_to_float(char *str)*			
1	str	char*	Стока, которую нужно конвертировать в число с плавающей точкой
2	ans	float	Результирующее число с плавающей точкой
3	a	float	Целая часть числа
4	b	float	Дробная часть числа
5	x	float	Текущая цифра
Функция *void from_str_to_int_mas(char *str, int *mas)*			
1	str	char*	Стока, которую нужно конвертировать в массив чисел длины 3
2	mas	int*	Указатель на массив, в который будут записаны числа
3	ind	int	Текущий индекс в массиве
4	j	int	Текущий индекс в строке
Функция *Athlete *fill_struct(char *str)*			
1	str	char*	Строка, которую нужно конвертировать в сущность Athlete
2	user	Athlete*	Сущность Athlete
3	word	char*	Текущая подстрока в строке
4	pole	char*[]	Массив указателей на подстроки
5	ind	int	Текущий индекс в массиве подстрок
6	tt	int	Текущий индекс в строке
Функция *ListOfAthlete *make_list()*			
1	ph	ListOfAthlete*	Указатель на создаваемый список
Функция *NodeOfList *create_node(char *str, int g_id)*			
1	str	char*	Строка, которую нужно конвертировать в сущность Athlete
2	g_id	int	Глобальный ID
3	new_node	NodeOfList*	Указатель на создаваемую вершину
Функция *void print_node(NodeOfList *node)*			
1	node	NodeOfList*	Вершина списка, которую нужно вывести
Функция *void print_one(NodeOfList *node)*			
1	node	NodeOfList*	Вершина списка, которую нужно вывести
Функция *void print(ListOfAthlete *list)*			
1	list	ListOfAthlete*	Список, который нужно вывести
Функция *void sorted(int *mas, ListOfAthlete *list, int param)*			
1	mas	int*	Массив флагов для сортировки
2	list	ListOfAthlete*	Список спортсменов
3	param	int	Параметр, по которому сортируем
4	cur_node	NodeOfList*	Текущая вершина списка
5	min_node	NodeOfList*	Минимальная вершина списка
6	ind	int	Индекс минимальной вершины

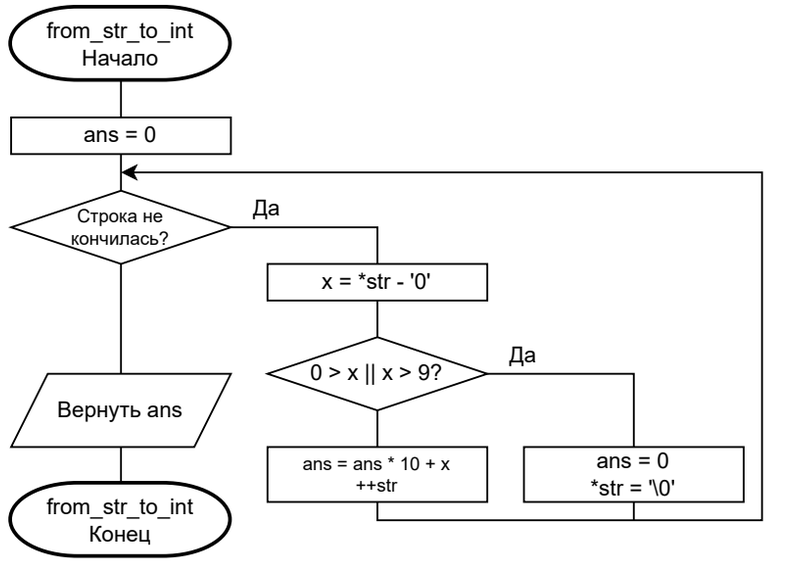
Функция *void find(ListOfAthlete *list)*			
1	list	ListOfAthlete*	Список спортсменов
2	cur_node	NodeOfList*	Текущая вершина списка
3	str	char[]	Строка, которую ищет пользователь
4	mas	int[]	Массив флагов для поиска
5	fl	int	Флаг на то, что хоть один элемент найден
6	param	int	Параметр, по которому ищем
Функция *NodeOfList **get_mas(ListOfAthlete *list)*			
1	list	ListOfAthlete*	Список спортсменов
2	cur_node	NodeOfList*	Текущая вершина списка
3	mas	NodeOfList**	Массив указателей на вершины списка
Функция *void my_swap(NodeOfList **mas, ListOfAthlete *list, int i, int j)*			
1	mas	NodeOfList**	Массив указателей на вершины списка
2	list	ListOfAthlete*	Список спортсменов
3	i	int	Индекс первого узла
4	j	int	Индекс второго узла
5	q	NodeOfList*	Вспомогательная вершина
Функция *void sort(ListOfAthlete *list)*			
1	list	ListOfAthlete*	Список спортсменов
2	mas	NodeOfList**	Массив указателей на вершины списка
3	str	char[]	Параметр в виде строки
4	n	int	Количество вершин в списке
5	param	int	Параметр, по которому сортируем
Функция *void add(ListOfAthlete *list, int g_id)*			
1	list	ListOfAthlete*	Список спортсменов
2	g_id	int	Глобальный ID
3	str	char[]	Буфер для данных о спортсмене
4	cur_node	NodeOfList*	Текущая вершина списка
Функция *void edit(ListOfAthlete *list)*			
1	list	ListOfAthlete*	Список спортсменов
2	the_node	NodeOfList*	Вершина, которую редактируем
3	id	int	ID спортсмена для редактирования
4	str	char[]	Буфер для пользовательского ввода
5	s_id	char[]	Буфер ID спортсмена в строковом виде

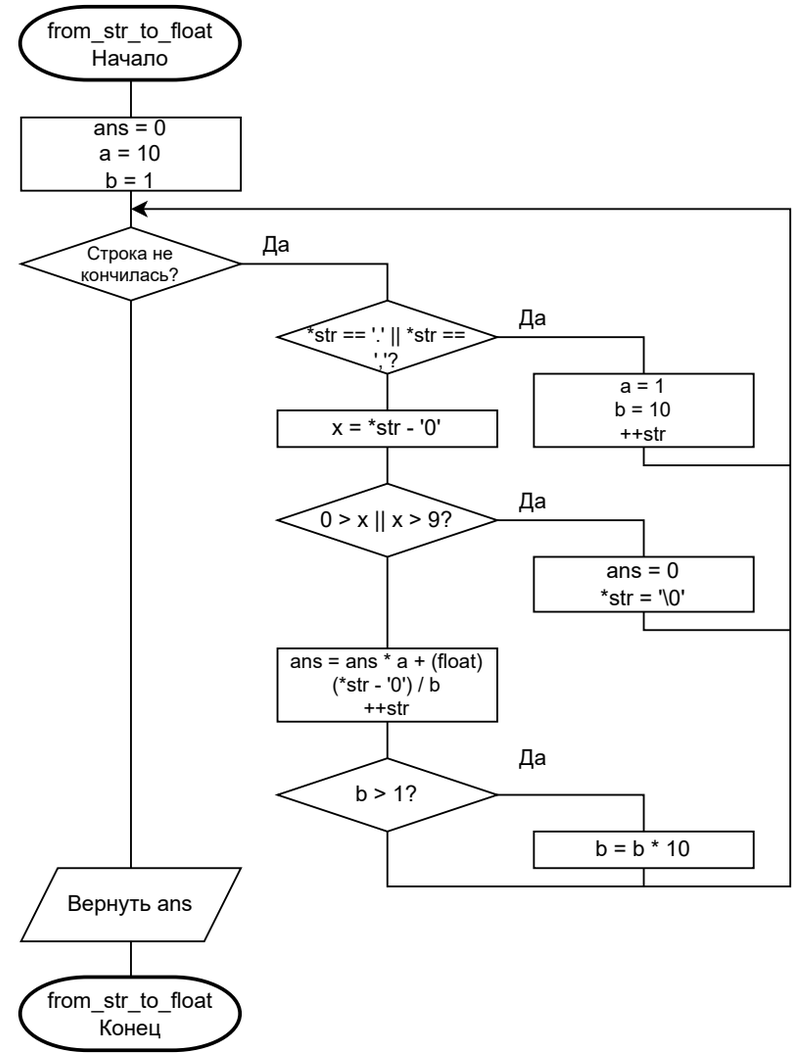
Функция *void delete(ListOfAthlete *list)*			
1	list	ListOfAthlete*	Список спортсменов
2	cur_node	NodeOfList*	Текущая вершина списка
3	prev_node	NodeOfList*	Предыдущая вершина списка
4	str	char[]	Строка, которую ищет пользователь
5	ch	char	Символ для подтверждения
6	mas	int[]	Массив флагов для удаления
7	fl	int	Флаг на то, что хоть один элемент найден
8	param	int	Параметр, по которому ищем
9	cnt	int	Количество элементов для удаления
Функция *void save(ListOfAthlete *list)*			
1	list	ListOfAthlete*	Список спортсменов
2	f	FILE*	Указатель на файл
3	filename	char[]	Буфер для имени файла

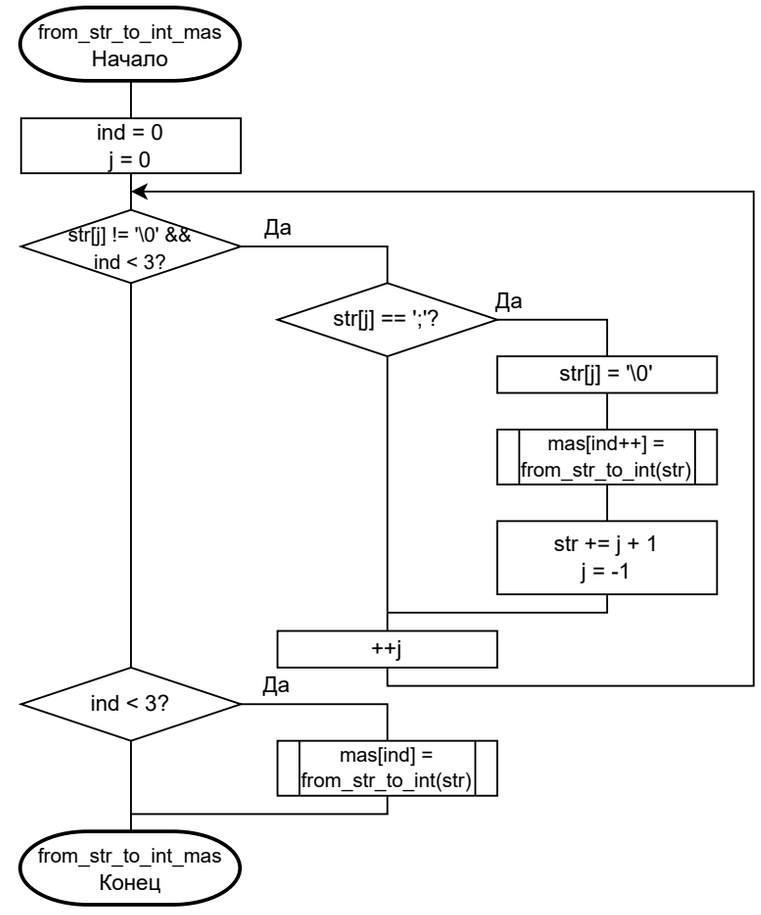
Схема алгоритма

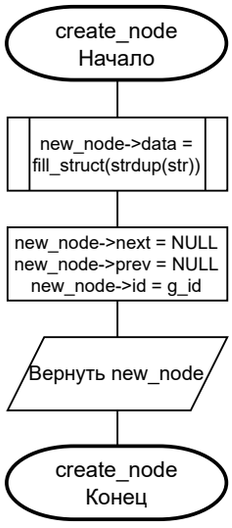


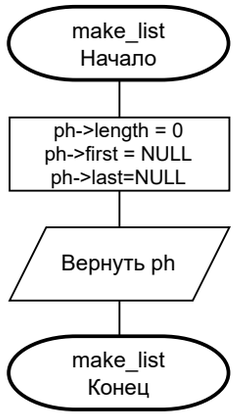


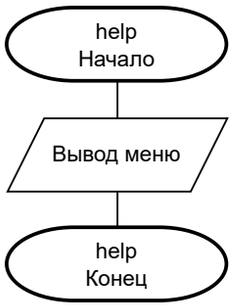


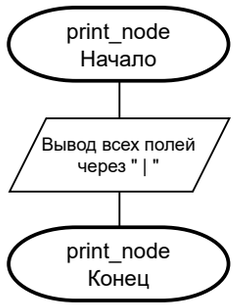

from_str_to_float
Начало
ans = 0
a = 10
b = 1
Строка не кончилась?
Да
*str == '.' || *str == ','?
Да
a = 1
b = 10
++str
x = *str - '0'
0 > x || x > 9?
Да
ans = 0
*str = '\0'
ans = ans * a + (float) (*str - '0') / b
++str
b > 1?
Да
b = b * 10
Вернуть ans
from_str_to_float
Конец

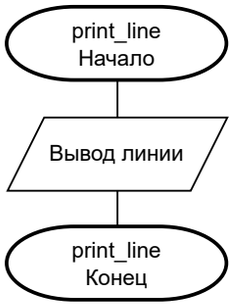

from_str_to_int_mas
Начало
ind = 0
j = 0
str[j] != '\0' && ind < 3?
Да
str[j] == ';'?
Да
str[j] = '\0'
mas[ind++] = from_str_to_int(str)
str += j + 1
j = -1
++j
ind < 3?
Да
mas[ind] = from_str_to_int(str)
from_str_to_int_mas
Конец

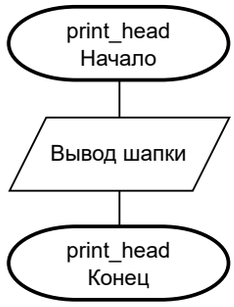

create_node
Начало
new_node->data = fill_struct(strdup(str))
new_node->next = NULL
new_node->prev = NULL
new_node->id = g_id
Вернуть new_node
create_node
Конец

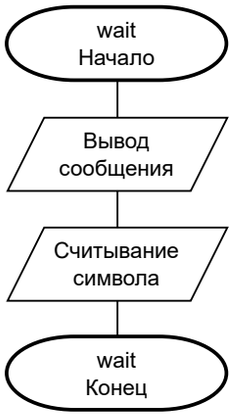

make_list
Начало
ph->length = 0
ph->first = NULL
ph->last=NULL
Вернуть ph
make_list
Конец

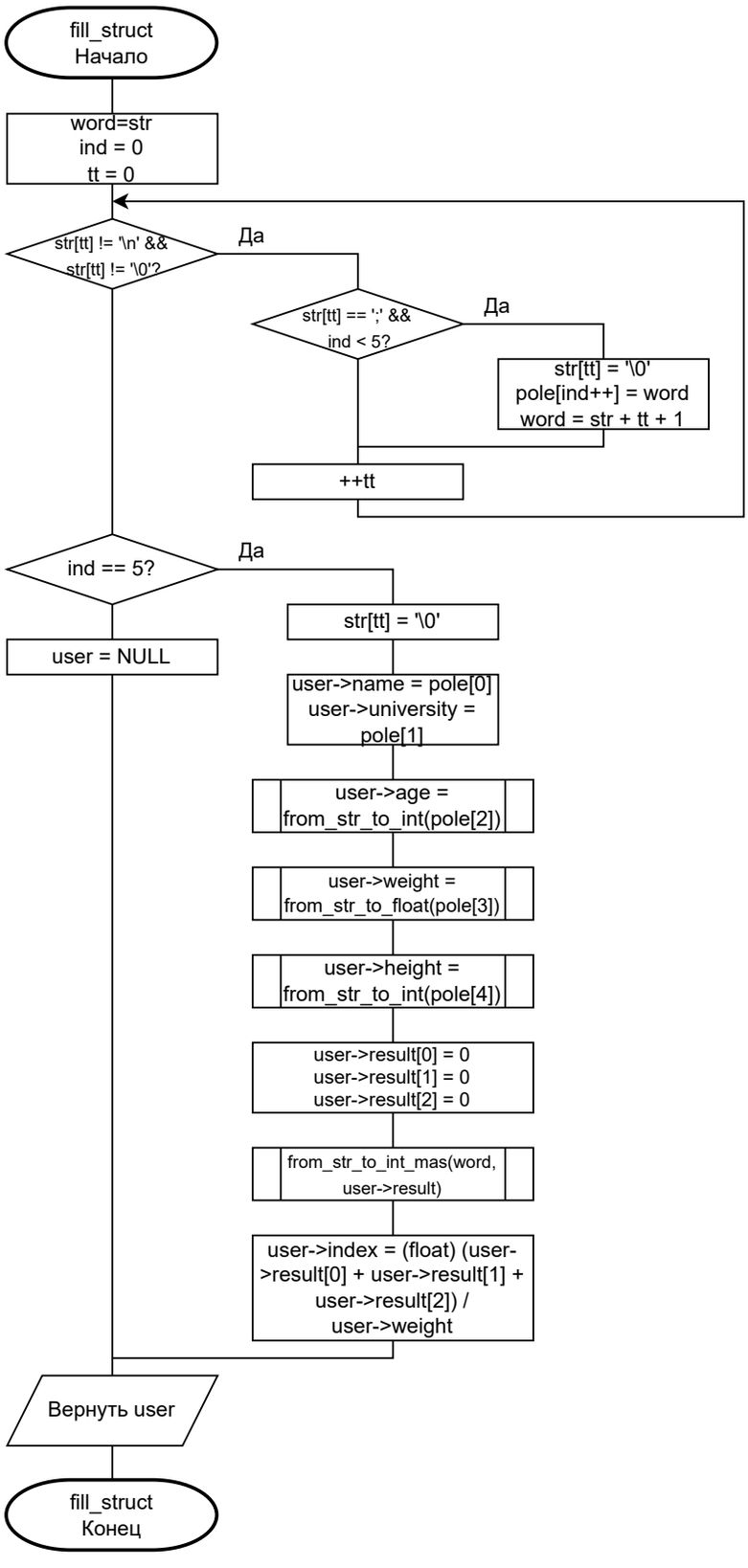

help
Начало
Вывод меню
help
Конец

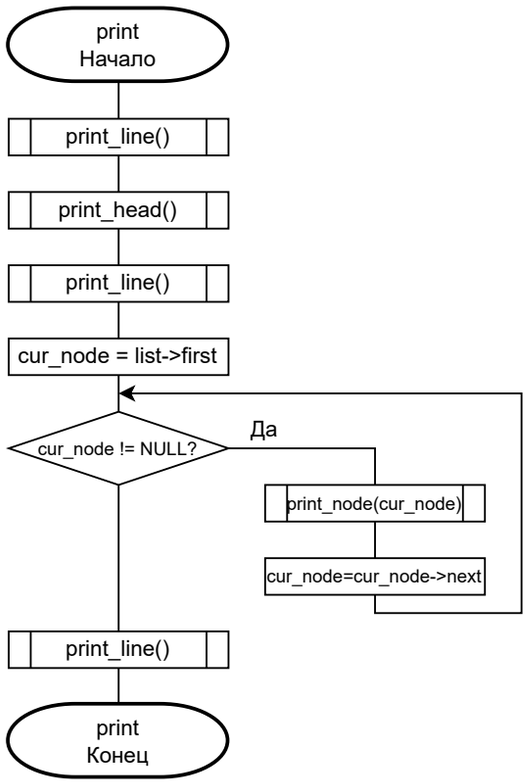

print_node
Начало
Вывод всех полей через " | "
print_node
Конец

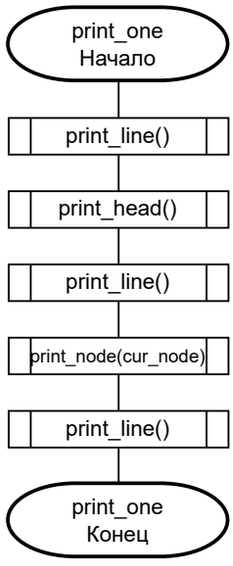

print_line
Начало
Вывод линии
print_line
Конец

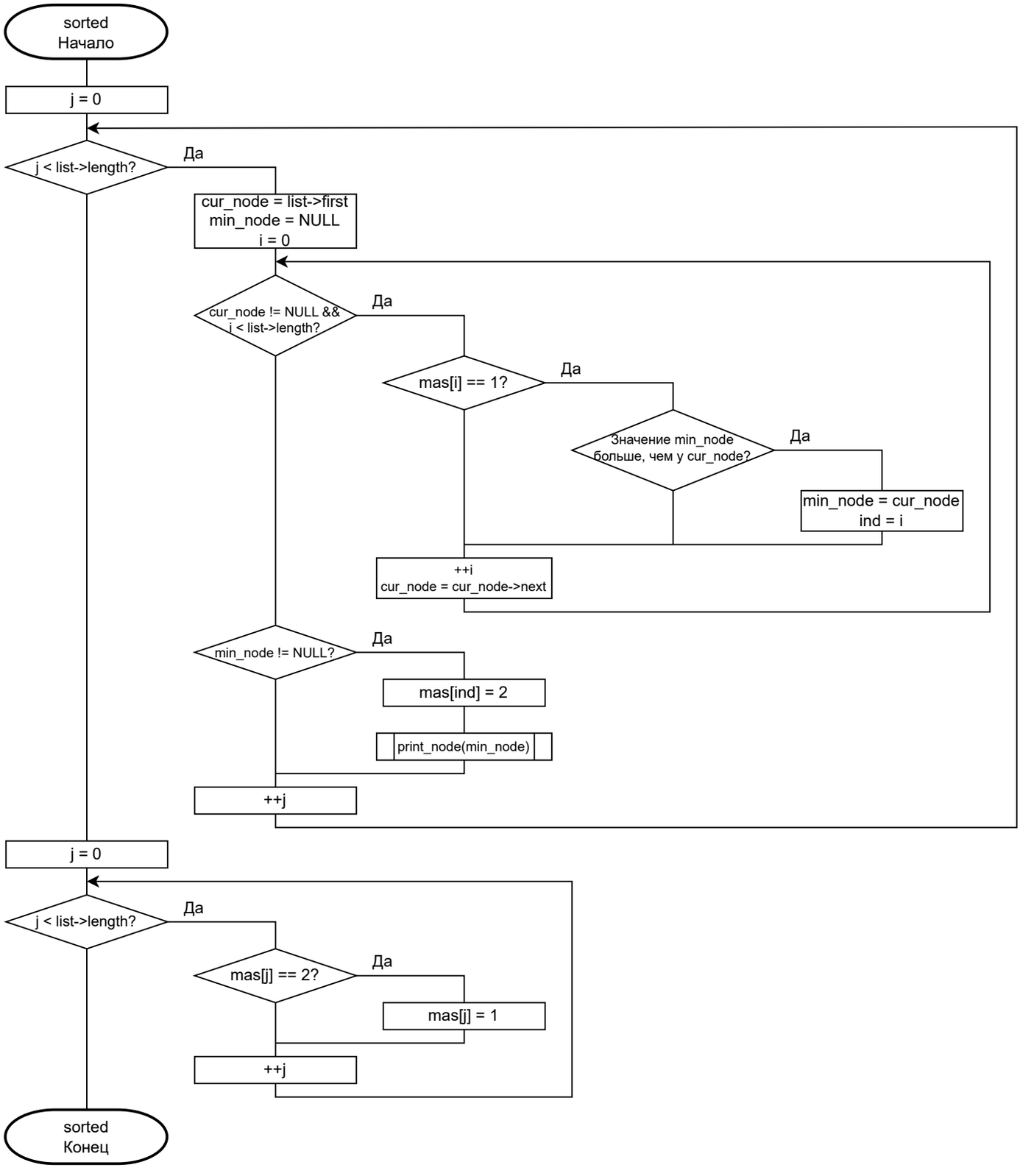

print_head
Начало
Вывод шапки
print_head
Конец

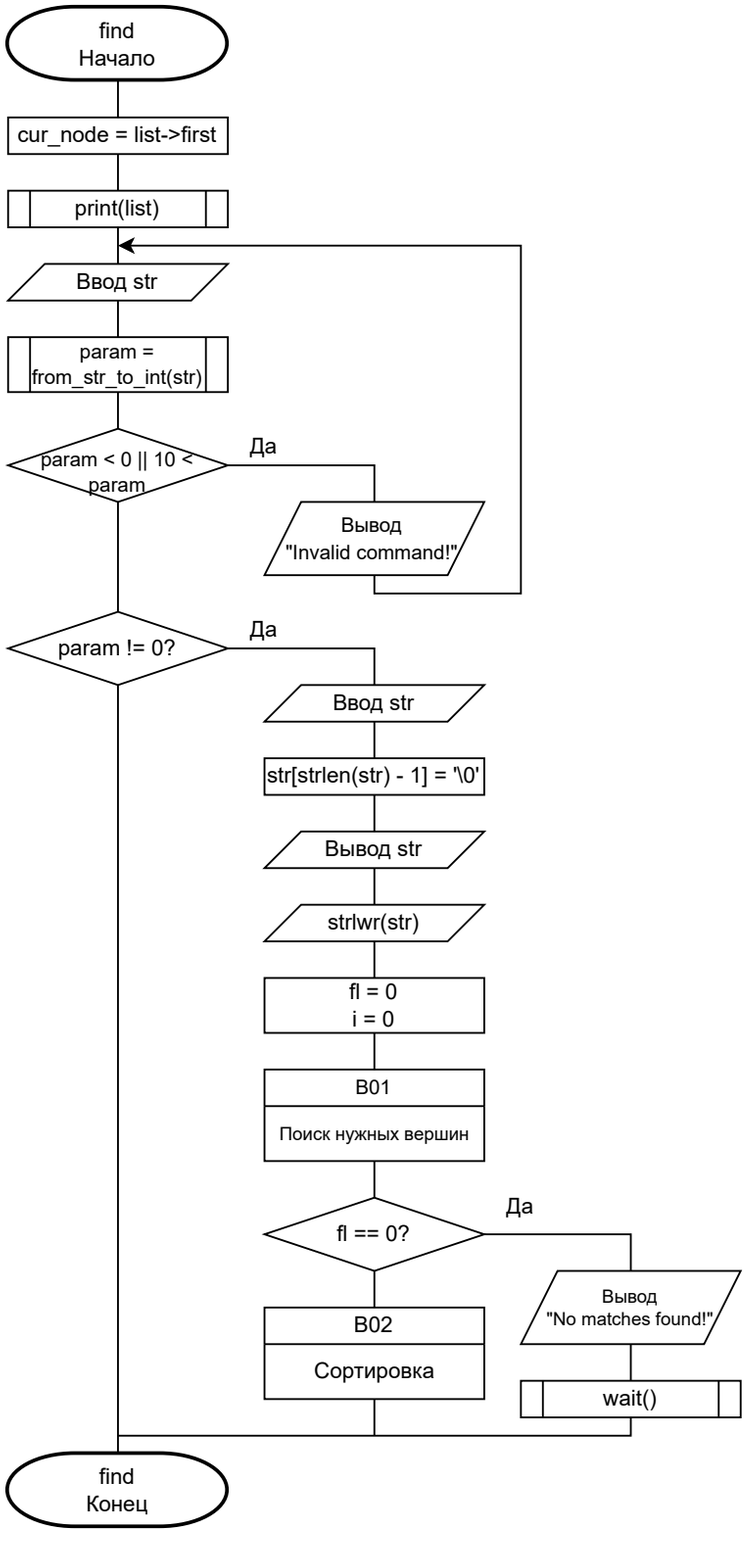

wait
Начало
Вывод сообщения
Считывание символа
wait
Конец

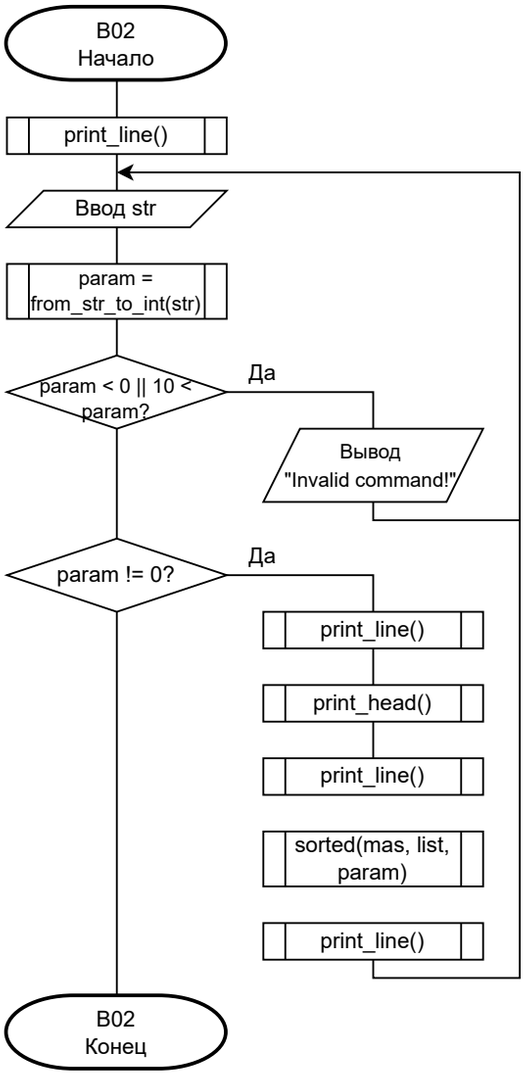

fill_struct
Начало
word=str
ind = 0
tt = 0
str[tt] != '\n' &&
str[tt] != '\0'?
Да
str[tt] == ';' &&
ind < 5?
Да
str[tt] = '\0'
pole[ind++] = word
word = str + tt + 1
++tt
ind == 5?
Да
user = NULL
str[tt] = '\0'
user->name = pole[0]
user->university =
pole[1]
user->age =
from_str_to_int(pole[2])
user->weight =
from_str_to_float(pole[3])
user->height =
from_str_to_int(pole[4])
user->result[0] = 0
user->result[1] = 0
user->result[2] = 0
from_str_to_int_mas(word,
user->result)
user->index = (float) (user-
>result[0] + user->result[1] +
user->result[2]) /
user->weight
Вернуть user
fill_struct
Конец

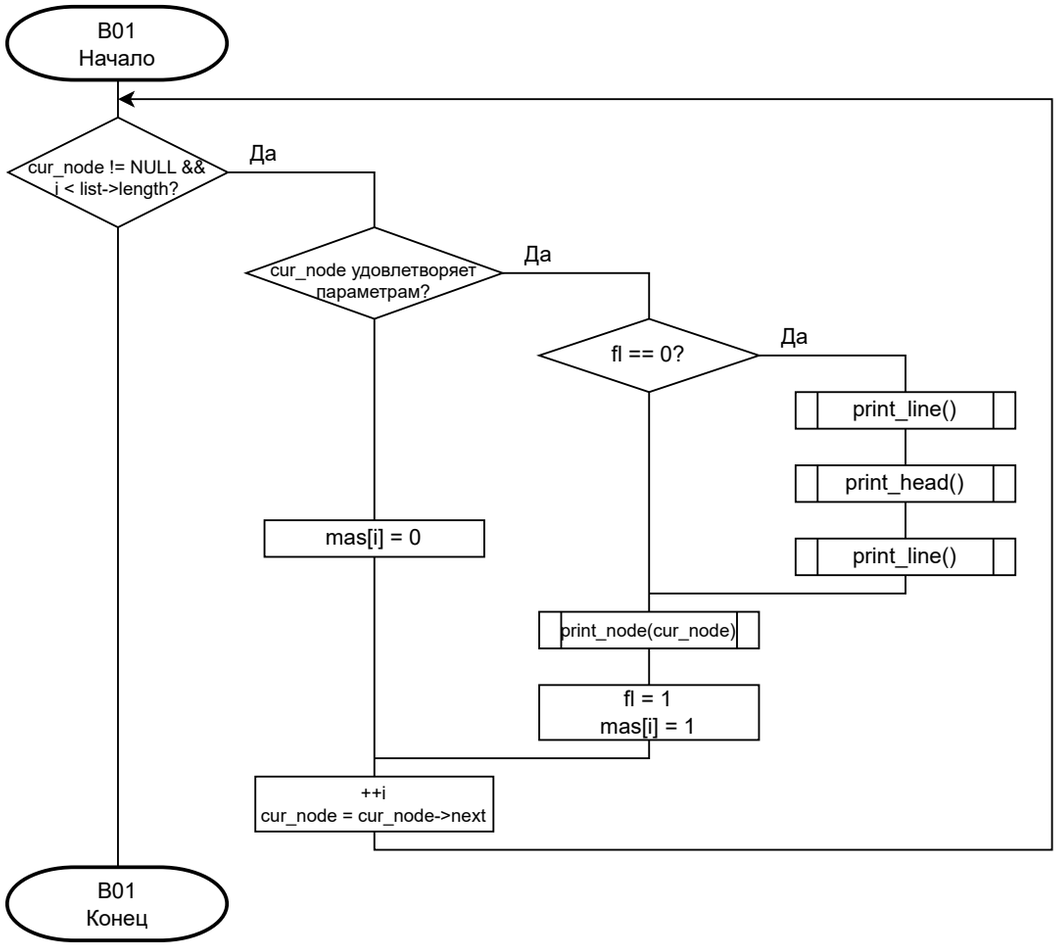

print
Начало
print_line()
print_head()
print_line()
cur_node = list->first
cur_node != NULL?
Да
print_node(cur_node)
cur_node=cur_node->next
print_line()
print
Конец

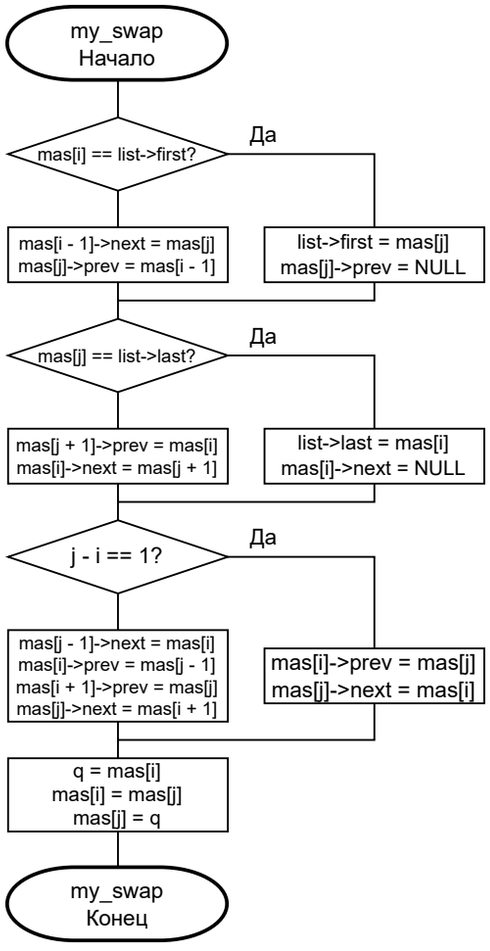

print_one
Начало
print_line()
print_head()
print_line()
print_node(cur_node)
print_line()
print_one
Конец

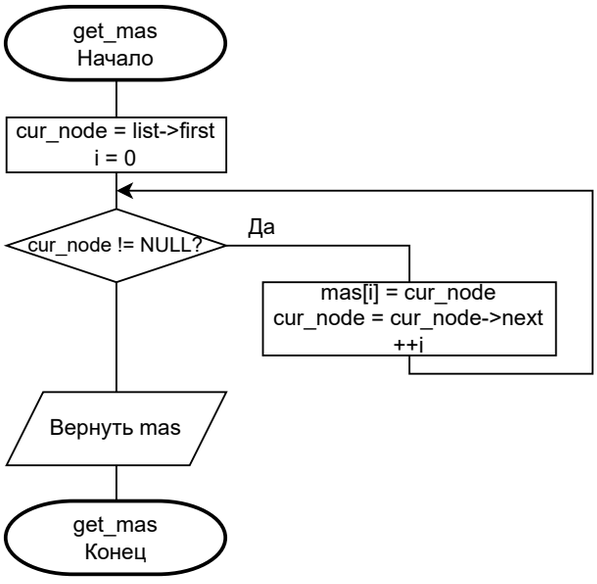

sorted
Начало
j = 0
j < list->length?
Да
cur_node = list->first
min_node = NULL
i = 0
cur_node != NULL &&
i < list->length?
Да
mas[i] == 1?
Да
Значение min_node
больше, чем у cur_node?
Да
min_node = cur_node
ind = i
++i
cur_node = cur_node->next
min_node != NULL?
Да
mas[ind] = 2
print_node(min_node)
++j
j = 0
j < list->length?
Да
mas[j] == 2?
Да
mas[j] = 1
++j
sorted
Конец

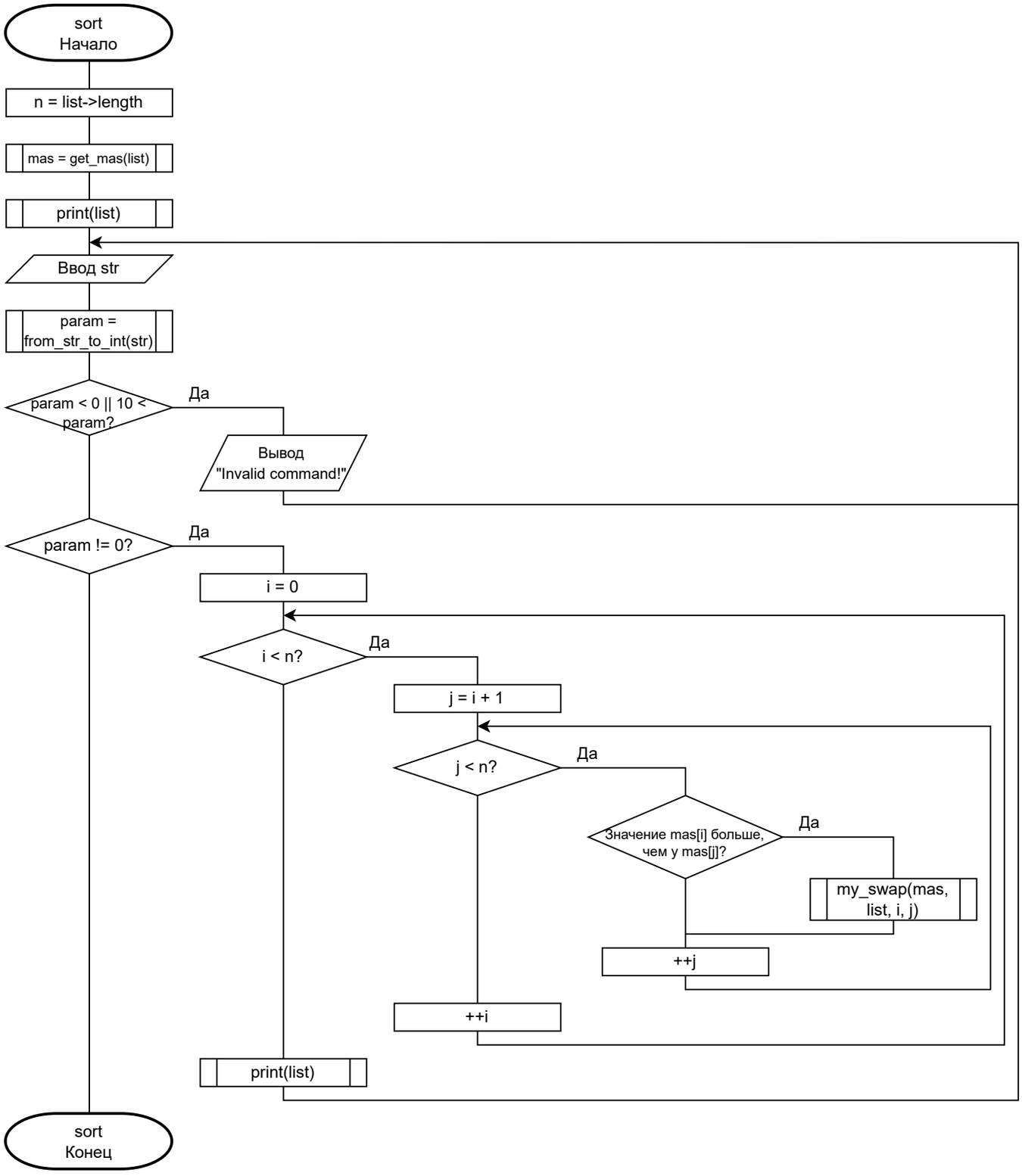

find
Начало
cur_node = list->first
print(list)
Ввод str
param =
from_str_to_int(str)
param < 0 || 10 <
param
Да
Вывод
"Invalid command!"
param != 0?
Да
Ввод str
str[strlen(str) - 1] = '\0'
Вывод str
strlwr(str)
fl = 0
i = 0
B01
Поиск нужных вершин
fl == 0?
Да
Вывод
"No matches found!"
B02
Сортировка
wait()
find
Конец

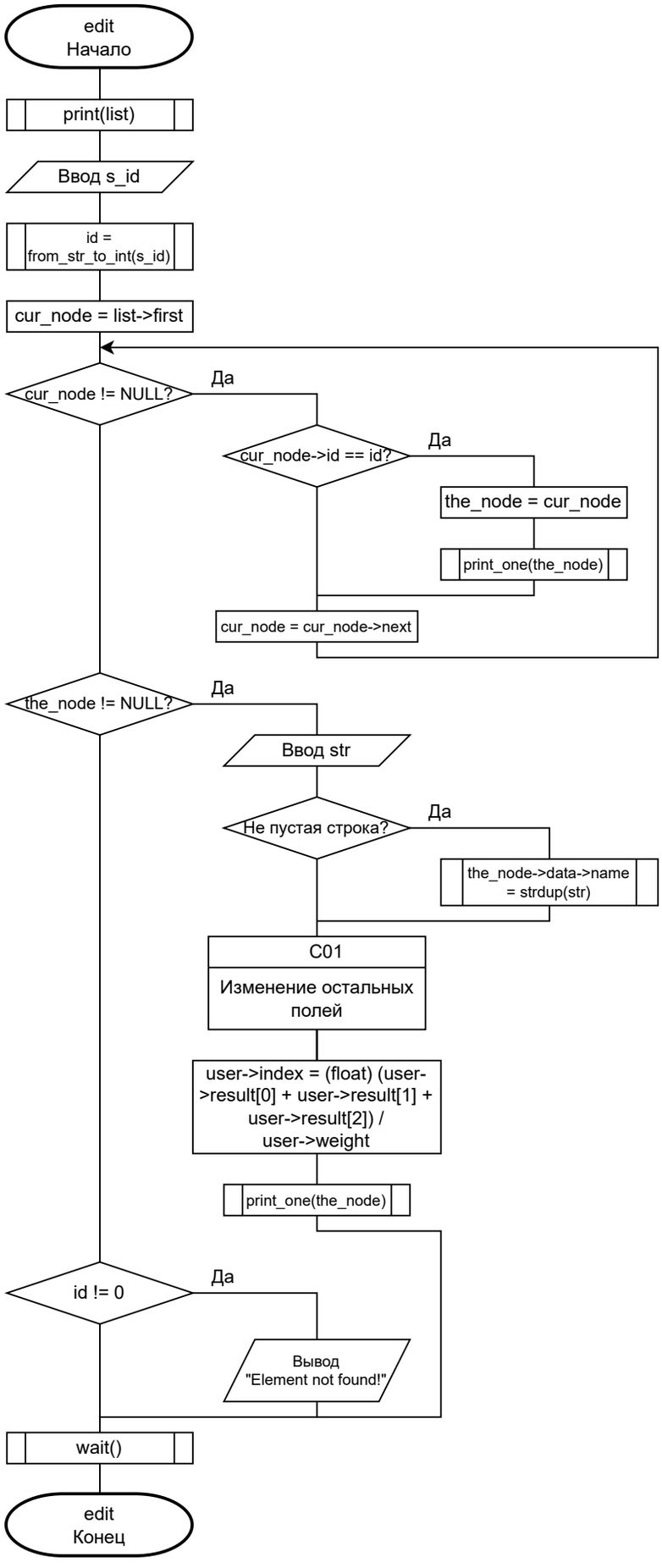

B02
Начало
print_line()
Ввод str
param =
from_str_to_int(str)
param < 0 || 10 <
param?
Да
Вывод
"Invalid command!"
param != 0?
Да
print_line()
print_head()
print_line()
sorted(mas, list,
param)
print_line()
B02
Конец

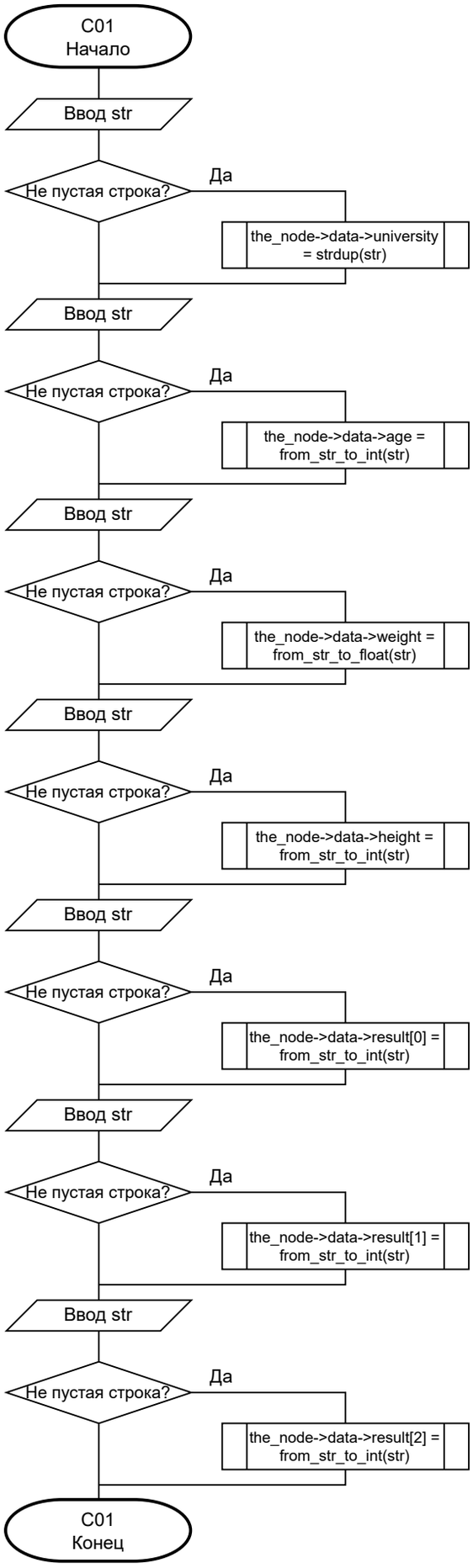

B01
Начало
cur_node != NULL &&
i < list->length?
Да
cur_node удовлетворяет
параметрам?
Да
fl == 0?
Да
print_line()
print_head()
print_line()
mas[i] = 0
print_node(cur_node)
fl = 1
mas[i] = 1
++i
cur_node = cur_node->next
B01
Конец

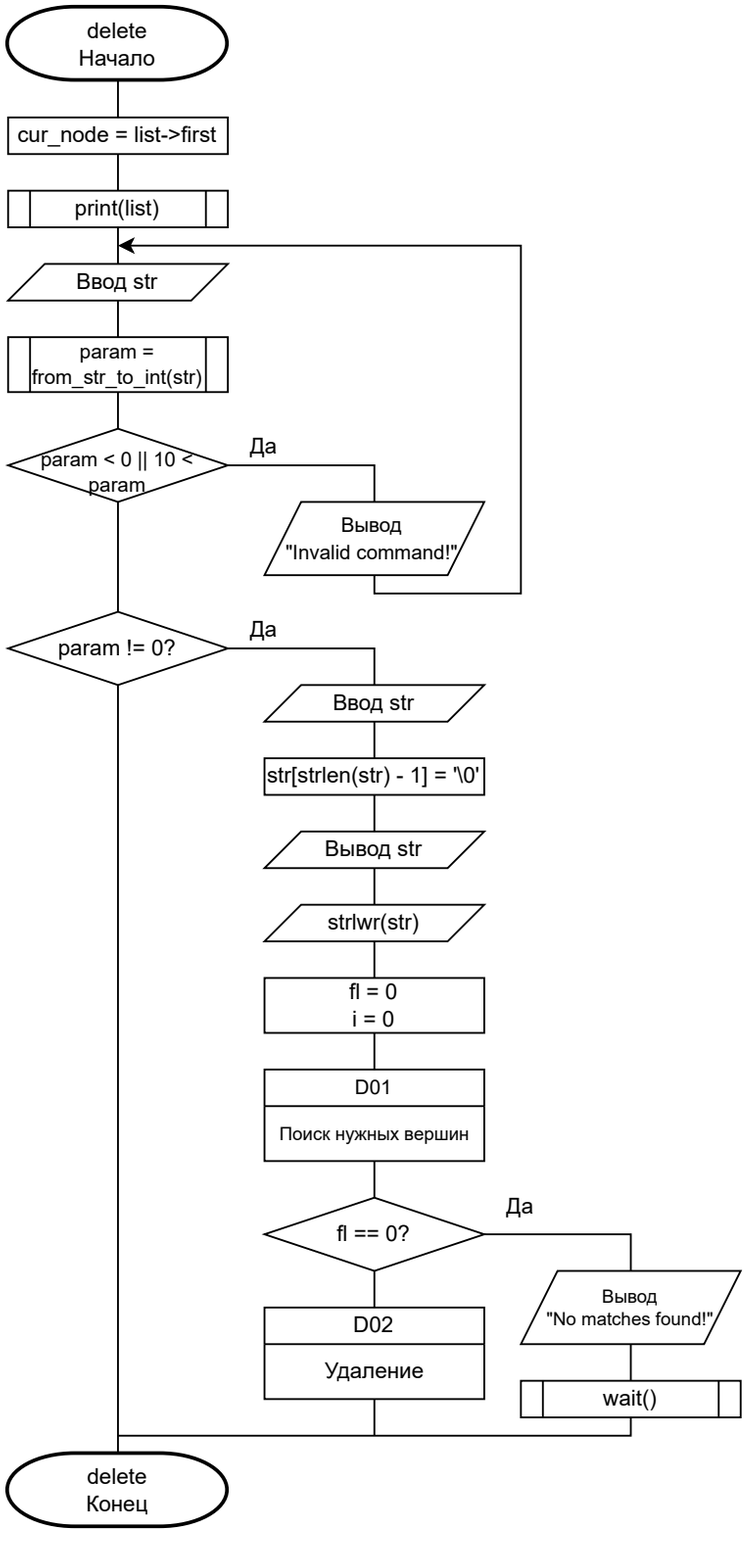

my_swap
Начало
mas[i] == list->first?
Да
mas[i - 1]->next = mas[j]
mas[j]->prev = mas[i - 1]
list->first = mas[j]
mas[j]->prev = NULL
mas[j] == list->last?
Да
mas[j + 1]->prev = mas[i]
mas[i]->next = mas[j + 1]
list->last = mas[i]
mas[i]->next = NULL
j - i == 1?
Да
mas[j - 1]->next = mas[i]
mas[i]->prev = mas[j - 1]
mas[i + 1]->prev = mas[j]
mas[j]->next = mas[i + 1]
mas[i]->prev = mas[j]
mas[j]->next = mas[i]
q = mas[i]
mas[i] = mas[j]
mas[j] = q
my_swap
Конец

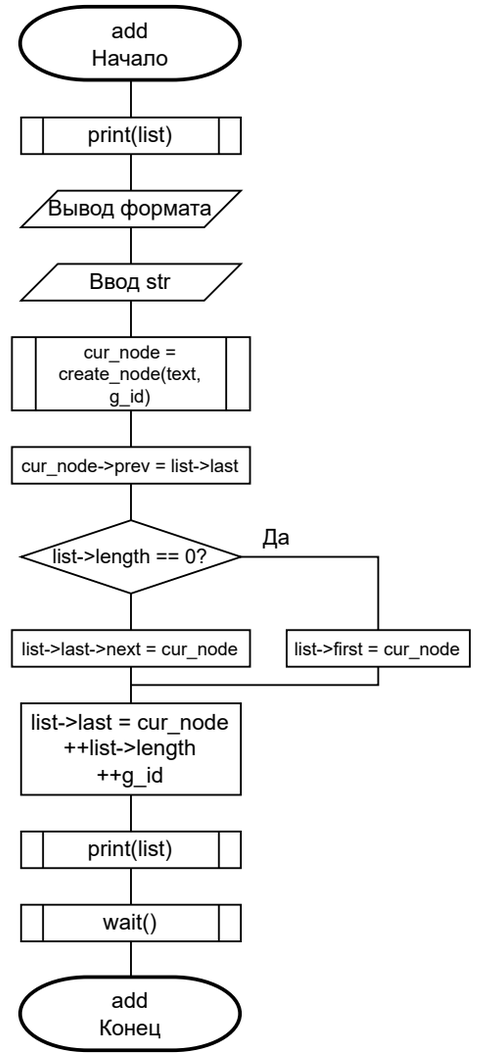

get_mas
Начало
cur_node = list->first
i = 0
cur_node != NULL?
Да
mas[i] = cur_node
cur_node = cur_node->next
++i
Вернуть mas
get_mas
Конец

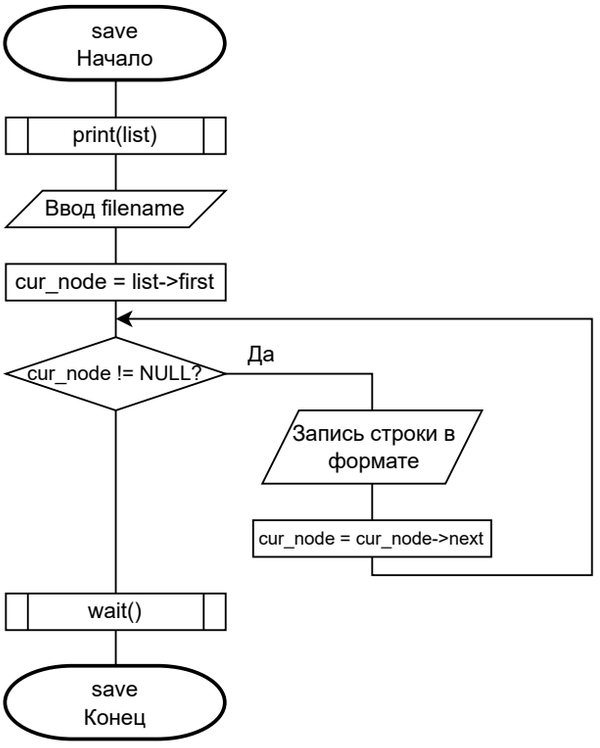

sort
Начало
n = list->length
mas = get_mas(list)
print(list)
Ввод str
param =
from_str_to_int(str)
param < 0 || 10 <
param?
Да
Вывод
"Invalid command!"
param != 0?
Да
i = 0
i < n?
Да
j = i + 1
j < n?
Да
Значение mas[i] больше,
чем у mas[j]?
Да
my_swap(mas,
list, i, j)
++j
++i
print(list)
sort
Конец

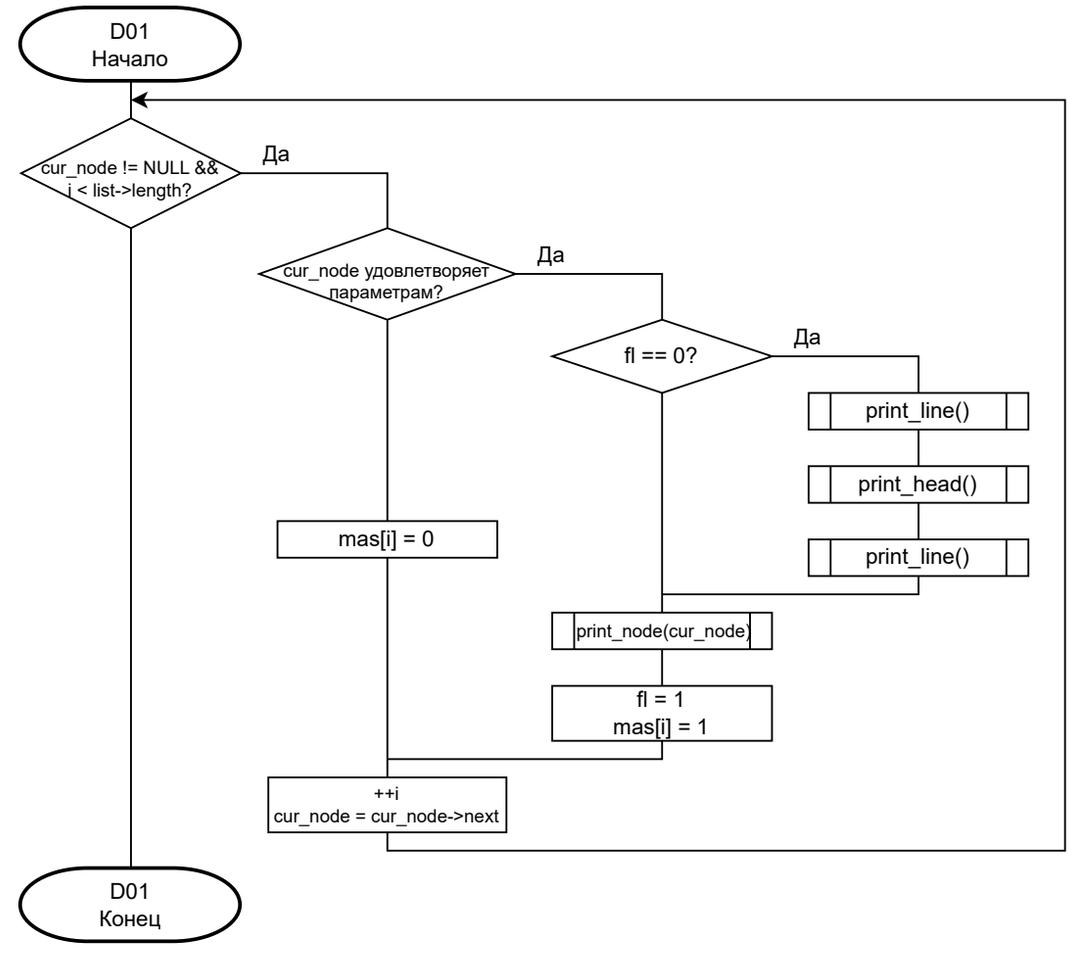

edit
Начало
print(list)
Ввод s_id
id =
from_str_to_int(s_id)
cur_node = list->first
cur_node != NULL?
Да
cur_node->id == id?
Да
the_node = cur_node
print_one(the_node)
cur_node = cur_node->next
the_node != NULL?
Да
Ввод str
Не пустая строка?
Да
the_node->data->name
= strdup(str)
C01
Изменение остальных
полей
user->index = (float) (user-
>result[0] + user->result[1] +
user->result[2]) /
user->weight
print_one(the_node)
id != 0
Да
Вывод
"Element not found!"
wait()
edit
Конец

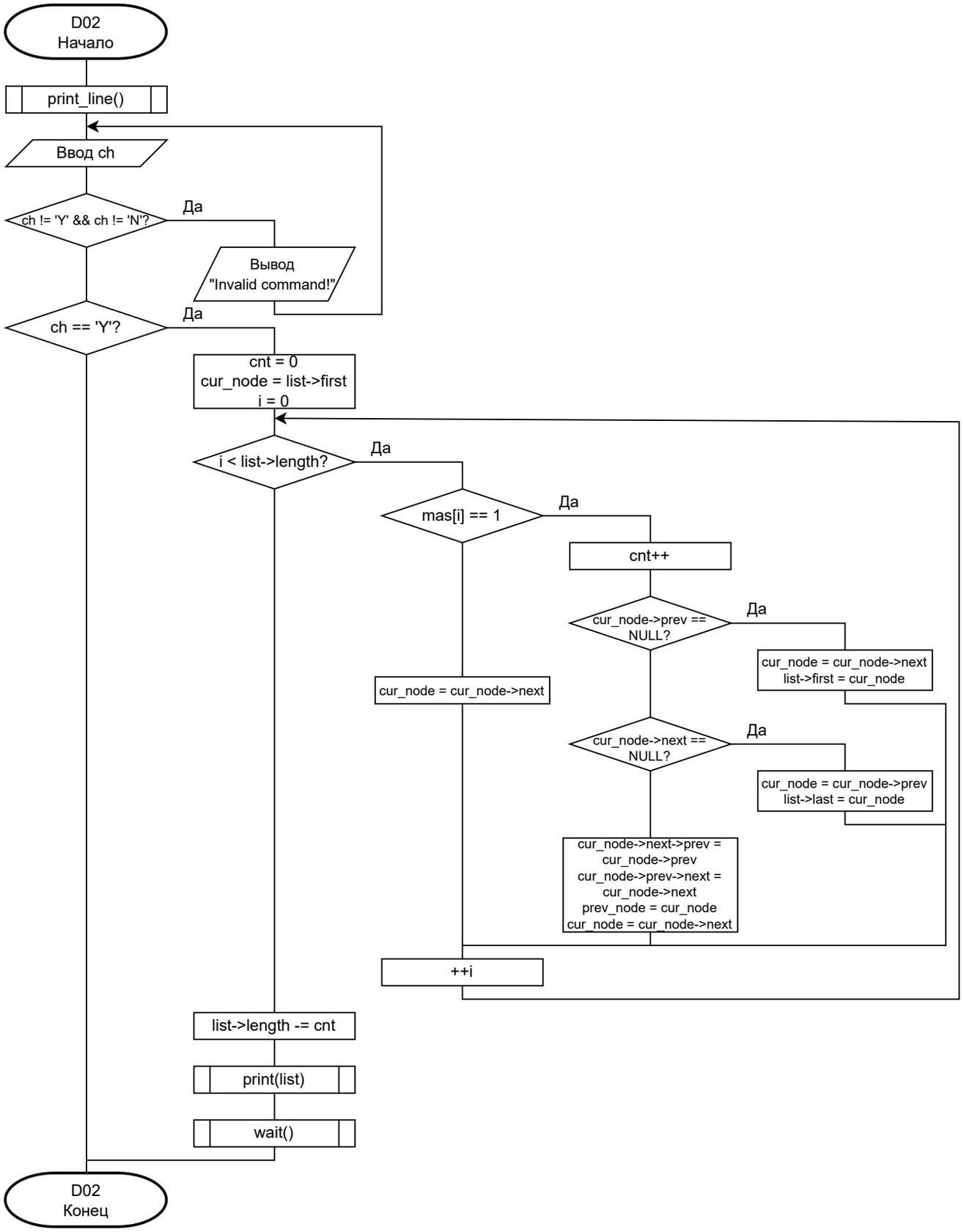

C01
Начало
Ввод str
Не пустая строка?
Да
the_node->data->university
= strdup(str)
Ввод str
Не пустая строка?
Да
the_node->data->age =
from_str_to_int(str)
Ввод str
Не пустая строка?
Да
the_node->data->weight =
from_str_to_float(str)
Ввод str
Не пустая строка?
Да
the_node->data->height =
from_str_to_int(str)
Ввод str
Не пустая строка?
Да
the_node->data->result[0] =
from_str_to_int(str)
Ввод str
Не пустая строка?
Да
the_node->data->result[1] =
from_str_to_int(str)
Ввод str
Не пустая строка?
Да
the_node->data->result[2] =
from_str_to_int(str)
C01
Конец


delete
Начало
cur_node = list->first
print(list)
Ввод str
param =
from_str_to_int(str)
param < 0 || 10 <
param
Да
Вывод
"Invalid command!"
param != 0?
Да
Ввод str
str[strlen(str) - 1] = '\0'
Вывод str
strlwr(str)
fl = 0
i = 0
D01
Поиск нужных вершин
fl == 0?
Да
Вывод
"No matches found!"
D02
Удаление
wait()
delete
Конец


add
Начало
print(list)
Вывод формата
Ввод str
cur_node = create_node(text, g_id)
cur_node->prev = list->last
list->length == 0?
Да
list->last->next = cur_node
list->first = cur_node
list->last = cur_node
++list->length
++g_id
print(list)
wait()
add
Конец


save
Начало
print(list)
Ввод filename
cur_node = list->first
cur_node != NULL?
Да
Запись строки в формате
cur_node = cur_node->next
wait()
save
Конец


D01
Начало
cur_node != NULL && i < list->length?
Да
cur_node удовлетворяет параметрам?
Да
fl == 0?
Да
print_line()
print_head()
print_line()
mas[i] = 0
print_node(cur_node)
fl = 1
mas[i] = 1
++i
cur_node = cur_node->next
D01
Конец


D02
Начало
print_line()
Ввод ch
ch != 'Y' && ch != 'N'?
Да
Вывод
"Invalid command!"
ch == 'Y'?
Да
cnt = 0
cur_node = list->first
i = 0
i < list->length?
Да
mas[i] == 1
Да
cnt++
cur_node->prev ==
NULL?
Да
cur_node = cur_node->next
list->first = cur_node
cur_node = cur_node->next
cur_node->next ==
NULL?
Да
cur_node = cur_node->prev
list->last = cur_node
cur_node->next->prev =
cur_node->prev
cur_node->prev->next =
cur_node->next
prev_node = cur_node
cur_node = cur_node->next
++i
list->length -= cnt
print(list)
wait()
D02
Конец

Текст программы

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <math.h>

#ifdef WIN32
#define CLS system("cls")
#else
#define CLS system("clear")
#endif


typedef struct Athlete {
    char *name; /* Pointer to the athlete's name */
    char *university; /* Pointer to the athlete's university name */
    int age; /* Athlete's age */
    float weight; /* Athlete's weight in kilograms */
    int height; /* Athlete's height in centimeters */
    int result[3]; /* Array to store results of the athlete's performance */
    float index; /* Index value calculated based on the athlete's performance */
} Athlete;

typedef struct NodeOfList {
    int id; /* Unique ID for the node */
    Athlete *data; /* Pointer to the data (athlete information) stored in the node */
    struct NodeOfList *next; /* Pointer to the next node in the list */
    struct NodeOfList *prev; /* Pointer to the previous node in the list */
} NodeOfList;

typedef struct ListOfAthlete {
    int length; /* Number of nodes (athletes) in the list */
    NodeOfList *first; /* Pointer to the first node in the list */
    NodeOfList *last; /* Pointer to the last node in the list */
} ListOfAthlete;


/* Convert a string to an integer */
int from_str_to_int(char *str);

/* Convert a string to a floating-point number */
float from_str_to_float(char *str);

/* Convert a string containing delimited integers to an integer array */
void from_str_to_int_mas(char *str, int *mas);

/* Fill an Athlete structure with data from a string */
Athlete *fill_struct(char *str);

/* Create an empty list of athletes */
ListOfAthlete *make_list();

/* Create a new node for the list */
NodeOfList *create_node(char *str, int g_id);

/* Display the list of available commands */
void help();

/* Wait for user input to continue */
void wait();

/* Print a line separator */
void print_line();

/* Print the header with column names */
void print_head();

/* Print data of a single node */
void print_node(NodeOfList *node);

/* Print data of a single node with header and footer */
void print_one(NodeOfList *node);

/* Print data of all nodes in the list */
void print(ListOfAthlete *list);

/* Sort and print nodes based on a specified parameter */
void sorted(int *mas, ListOfAthlete *list, int param);
```

```c
/* Find and print nodes based on user input */
void find(ListOfAthlete *list);

/* Creates an array of pointers to NodeOfList structures based on the given list */
NodeOfList **get_mas(ListOfAthlete *list);

/* Swaps two nodes in the list and updates their positions */
void my_swap(NodeOfList **mas, ListOfAthlete *list, int i, int j);

/* Sorts the list of athletes based on a selected parameter */
void sort(ListOfAthlete *list);

/* Adds a new athlete to the list */
void add(ListOfAthlete *list, int g_id);

/* Allows editing the details of an athlete in the list based on the provided ID */
void edit(ListOfAthlete *list);

/* Deleting athletes from the list based on the specified parameter */
void delete(ListOfAthlete *list);

/* Save the data of athletes stored in a linked list to a file specified by the user */
void save(ListOfAthlete *list);

int main() {
    ListOfAthlete *list; /* Pointer to the list of athletes */
    int g_id, cl; /* Variables for athlete ID and command line flag */
    char filename[128], str[128], text[1024]; /* Buffers for filename, user input, and file content */
    NodeOfList *cur_node = NULL; /* Pointer to the current node in the list */
    FILE *f; /* File pointer */

    g_id = 1; /* Initialize athlete ID */
    cl = 1; /* Initialize command line input flag */
    list = make_list(); /* Create an empty list of athletes */
    printf("Please enter the file name:\n");
    fgets(filename, sizeof(filename), stdin); /* Read the filename from the user */
    filename[strcspn(filename, "\n")] = '\0'; /* Remove the newline character from the input */
    f = fopen(filename, "r"); /* Open the file for reading */
    while (f == NULL) { /* Loop until a valid file is opened */
        printf("Something went wrong!\n"
               "Perhaps such a file does not exist.\n"
               "Please enter the file name again:\n");
        fgets(filename, sizeof(filename), stdin); /* Read the filename again if opening fails */
        filename[strcspn(filename, "\n")] = '\0'; /* Remove the newline character from the input */
        f = fopen(filename, "r"); /* Attempt to open the file again */
    }

    while (fgets(text, sizeof(text), f)) { /* Read each line from the file */
        cur_node = create_node(text, g_id); /* Create a new node with the text and assign a unique ID */
        if (cur_node != NULL) {
            cur_node->prev = list->last; /* Set the previous node pointer */
            if (list->length == 0) {
                list->first = cur_node; /* Set the first node if the list is empty */
            } else {
                list->last->next = cur_node; /* Link the new node to the end of the list */
            }
            list->last = cur_node; /* Update the last node pointer */
            ++list->length; /* Increment the list length */
            ++g_id;
        }
    }

    CLS; /* Clear the screen */
    printf("The file has been successfully processed!\n");
    fclose(f); /* Close the file */

    do {
        if (cl) help(); /* Display help information if the flag is set */
        cl = 1; /* Reset the flag */
        fgets(str, sizeof(str), stdin); /* Read a command from the user */
        str[strcspn(str, "\n")] = '\0'; /* Remove the newline character from the input */
        if (!strcmp(str, "!print")) { /* Compare the command with "!print" */
            CLS;
            print(list); /* Print the list of athletes */
            wait();
            CLS;
        } else if (!strcmp(str, "!find")) { /* Compare the command with "!find" */
            find(list); /* Find an athlete in the list */
        } else if (!strcmp(str, "!sort")) { /* Compare the command with "!sort" */
```

```
            sort(list); /* Sort the list of athletes */
        } else if (!strcmp(str, "!add")) { /* Compare the command with "!add" */
            add(list, g_id++); /* Add a new athlete to the list */
        } else if (!strcmp(str, "!edit")) { /* Compare the command with "!edit" */
            edit(list); /* Edit an existing athlete in the list */
        } else if (!strcmp(str, "!delete")) { /* Compare the command with "!delete" */
            delete(list); /* Delete an athlete from the list */
        } else if (!strcmp(str, "!save")) { /* Compare the command with "!save" */
            save(list); /* Save the list to a file */
        } else if (!strcmp(str, "!end")) { /* Compare the command with "!end" */
            printf("Goodbye!\n"); /* Print goodbye message */
        } else {
            printf("Unknown command!\n"); /* Handle unknown commands */
            cl = 0; /* Reset the flag to not display help next time */
        }
    } while (strcmp(str, "!end") != 0); /* Continue until the user enters "!end" */

    /* Free the allocated memory */
    for (cur_node = list->first; cur_node != NULL; cur_node = cur_node->next) {
        free(cur_node->data);
        free(cur_node);
    }
    free(list);
    return 0;
}

/* Convert a string to an integer */
int from_str_to_int(char *str) {
    int ans, x; /* Variable to store the resulting integer */

    ans = 0; /* Initialize the answer to 0 */
    while (*str != '\0' && *str != '\n') { /* Loop until the end of the string */
        x = *str - '0';
        if (0 > x || x > 9) {
            ans = 0;
            *str = '\0';
        } else {
            ans = ans * 10 + x; /* Convert character to integer and add to the result */
            ++str; /* Move to the next character in the string */
        }
    }
    return ans;
}

/* Convert a string to a floating-point number */
float from_str_to_float(char *str) {
    float ans, a, b, x; /* Variables to store the resulting float and decimal places */

    ans = 0; /* Initialize the answer to 0 */
    a = 10; /* Initialize the factor for integer part */
    b = 1; /* Initialize the factor for decimal part */
    while (*str != '\0' && *str != '\n') { /* Loop until the end of the string */
        if (*str == '.' || *str == ',') { /* Check for decimal separator */
            a = 1; /* Reset the factor for integer part */
            b = 10; /* Set the factor for decimal part */
            ++str; /* Move to the next character in the string */
        } else {
            x = (float) (*str - '0');
            if (0 > x || x > 9) {
                ans = 0;
                *str = '\0';
            } else {
                ans = ans * a + x / b; /* Convert character to float and add to the result */
                if (b > 1) b *= 10; /* Update the decimal factor */
                ++str; /* Move to the next character in the string */
            }
        }
    }
    return ans;
}

/* Convert a string containing delimited integers to an integer array */
void from_str_to_int_mas(char *str, int *mas) {
    int ind, j; /* Index variables */

    ind = 0; /* Initialize the index for the array */
    j = 0; /* Initialize the index for the string */
    while (str[j] != '\0' && ind < 3) { /* Loop until the end of the string or the maximum array size */
        if (str[j] == ';') { /* Check for delimiter */
            str[j] = '\0'; /* Replace delimiter with null terminator */
```

```
            mas[ind++] = from_str_to_int(str); /* Convert substring to integer and store in the array */
            str += j + 1; /* Move to the next substring */
            j = -1; /* Reset the index for the substring */
        }
        ++j; /* Move to the next character in the string */
    }
    if (ind < 3) mas[ind] = from_str_to_int(str); /* Convert the remaining substring to integer */
}

/* Fill an Athlete structure with data from a string */
Athlete *fill_struct(char *str) {
    Athlete *user = NULL; /* Pointer to the Athlete structure */
    char *word, *pole[5]; /* Pointers to substrings and an array to store substrings */
    int ind, tt; /* Index variables */

    word = str; /* Initialize the word pointer to the beginning of the string */
    ind = 0; /* Initialize the index for the substring array */
    user = (Athlete *) malloc(sizeof(Athlete)); /* Allocate memory for the Athlete structure */
    if (user != NULL) { /* Check if memory allocation is successful */
        for (tt = 0; str[tt] != '\n' && str[tt] != '\0'; ++tt) { /* Loop until the end of the string */
            if (str[tt] == ';' && ind < 5) { /* Check for delimiter and array bounds */
                str[tt] = '\0'; /* Replace delimiter with null terminator */
                pole[ind++] = word; /* Store the substring in the array */
                word = str + tt + 1; /* Move to the next substring */
            }
        }
        if (ind == 5) {
            str[tt] = '\0'; /* Replace the last delimiter with null terminator */
            user->name = pole[0]; /* Assign the name to the Athlete structure */
            user->university = pole[1]; /* Assign the university to the Athlete structure */
            user->age = from_str_to_int(pole[2]); /* Convert and assign the age to the Athlete structure
*/
            user->weight = from_str_to_float(pole[3]); /* Convert and assign the weight to the Athlete
structure */
            user->height = from_str_to_int(pole[4]); /* Convert and assign the height to the Athlete
structure */
            user->result[0] = 0;
            user->result[1] = 0;
            user->result[2] = 0;
            from_str_to_int_mas(word, user->result); /* Convert and assign the result to the Athlete
structure */
            user->index = (float) (user->result[0] + user->result[1] + user->result[2]) / user->weight;
/* Calculate and assign the index to the Athlete structure */
        } else {
            user = NULL;
        }
    }
    return user;
}

/* Create an empty list of athletes */
ListOfAthlete *make_list() {
    ListOfAthlete *ph = NULL; /* Pointer to the list */

    ph = (ListOfAthlete *) malloc(sizeof(ListOfAthlete)); /* Allocate memory for the list */
    if (ph != NULL) { /* Check if memory allocation is successful */
        ph->length = 0; /* Initialize the length of the list to 0 */
        ph->first = NULL; /* Initialize the pointer to the first node to NULL */
        ph->last = NULL; /* Initialize the pointer to the last node to NULL */
    }
    return ph;
}

/* Create a new node for the list */
NodeOfList *create_node(char *str, int g_id) {
    NodeOfList *new_node = NULL; /* Pointer to the new node */

    new_node = (NodeOfList *) malloc(sizeof(NodeOfList)); /* Allocate memory for the new node */
    if (new_node != NULL) { /* Check if memory allocation is successful */
        new_node->data = fill_struct(strdup(str)); /* Fill the node with data from the string */
        new_node->next = NULL; /* Initialize the pointer to the next node to NULL */
        new_node->prev = NULL; /* Initialize the pointer to the previous node to NULL */
        new_node->id = g_id; /* Assign the unique identifier to the node */
    }
    if (new_node->data == NULL) {
        free(new_node);
        new_node = NULL;
    }
    return new_node;
}
```

```
/* Display the list of available commands */
void help() {
    printf("Enter the command:\n"
           "\"!print\" = to display the data\n"
           "\"!find\" = to find elements of the data\n"
           "\"!sort\" = to sort the data\n"
           "\"!add\" = to add new data\n"
           "\"!edit\" = to edit the data\n"
           "\"!delete\" = to remove elements of the data\n"
           "\"!save\" = to save the data\n"
           "\"!end\" = to end the program\n");
}

/* Wait for user input to continue */
void wait() {
    printf("\nTo continue press \"Enter\"...");
    getchar();
}

/* Print a line separator */
void print_line() {
    printf("+----+----------------------+------------+-----+--------+--------+------+------+------+------
-+\n");
}

/* Print the header with column names */
void print_head() {
    printf("| ID | %-20s | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |\n", "Name");
}

/* Print data of a single node */
void print_node(NodeOfList *node) {
    printf("| %-2i | %-20s | %-10s | %-3i | %0.1f  ", node->id, node->data->name, node->data->university,
node->data->age, node->data->weight);
    if (node->data->weight < 100) printf(" ");
    if (node->data->weight < 10) printf(" ");
    printf("| %-6i | %-4i | %-4i | %-4i | %0.3f |\n", node->data->height, node->data->result[0], node-
>data->result[1], node->data->result[2], node->data->index);
}

/* Print data of a single node with header and footer */
void print_one(NodeOfList *node) {
    print_line(); /* Print line separator */
    print_head(); /* Print header with column names */
    print_line(); /* Print line separator */
    print_node(node); /* Print data of the node */
    print_line(); /* Print line separator */
}

/* Print data of all nodes in the list */
void print(ListOfAthlete *list) {
    print_line(); /* Print line separator */
    print_head(); /* Print header with column names */
    print_line(); /* Print line separator */
    for (NodeOfList *cur_node = list->first; cur_node != NULL; cur_node = cur_node->next) {
        print_node(cur_node); /* Print data of each node */
    }
    print_line(); /* Print line separator */
}

/* Sort and print nodes based on a specified parameter */
void sorted(int *mas, ListOfAthlete *list, int param) {
    NodeOfList *cur_node, *min_node; /* Pointers to nodes */
    int ind; /* Index variable */

    for (int j = 0; j < list->length; ++j) { /* Iterate through the list */
        cur_node = list->first; /* Initialize current node */
        min_node = NULL; /* Initialize node with minimum value */
        for (int i = 0; cur_node != NULL && i < list->length; ++i, cur_node = cur_node->next) { /*
Iterate through the list */
            if (mas[i] == 1) { /* Check if the node is not yet sorted */
                if ((min_node == NULL) ||
                    ((param == 1 && min_node->id > cur_node->id) || /* Check for match based on parameter
*/
                     (param == 2 && strcasecmp(min_node->data->name, cur_node->data->name) > 0) ||
                     (param == 3 && strcasecmp(min_node->data->university, cur_node->data->university) >
0) ||
                     (param == 4 && min_node->data->age > cur_node->data->age) ||
                     (param == 5 && min_node->data->weight > cur_node->data->weight) ||
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                    (param == 6 && min_node->data->height > cur_node->data->height) ||
                    (param == 7 && min_node->data->result[0] > cur_node->data->result[0]) ||
                    (param == 8 && min_node->data->result[1] > cur_node->data->result[1]) ||
                    (param == 9 && min_node->data->result[2] > cur_node->data->result[2]) ||
                    (param == 10 && min_node->data->index > cur_node->data->index))) {
                    min_node = cur_node; /* Update node with minimum value */
                    ind = i; /* Update index of the minimum value */
                }
            }
        }
        if (min_node != NULL) { /* Check if a minimum value node is found */
            mas[ind] = 2; /* Mark the node as sorted */
            print_node(min_node); /* Print the sorted node */
        }
    }
    for (int j = 0; j < list->length; ++j) { /* Iterate through the list */
        if (mas[j] == 2) mas[j] = 1; /* Reset sorted nodes */
    }
}

/* Find and print nodes based on user input */
void find(ListOfAthlete *list) {
    NodeOfList *cur_node; /* Pointer to the current node */
    char str[128]; /* Buffer for user input */
    int mas[list->length], fl, param; /* Array to track sorted nodes, flag, and parameter */

    CLS; /* Clear the screen */
    cur_node = list->first; /* Initialize current node */
    print(list); /* Print the list */
    do {
        printf("Select a field to find by:\n"
               "1 = id\n"
               "2 = name\n"
               "3 = university\n"
               "4 = age\n"
               "5 = weight\n"
               "6 = height\n"
               "7 = result 1\n"
               "8 = result 2\n"
               "9 = result 3\n"
               "10 = index\n"
               "0 = exit\n"
               "Enter only one number!\n");
        fgets(str, sizeof(str), stdin); /* Read user input */
        param = from_str_to_int(str); /* Convert user input to integer */
        if (param < 0 || 10 < param) { /* Validate user input */
            printf("Invalid command!\n");
        }
    } while (param < 0 || 10 < param); /* Continue until a valid parameter is selected */
    if (param != 0) { /* Check if user wants to exit */
        printf("Enter the search string:\n"); /* Prompt for search string */
        fgets(str, sizeof(str), stdin); /* Read search string */
        str[strlen(str) - 1] = '\0'; /* Remove newline character */
        CLS; /* Clear the screen */
        printf("%s\n", str); /* Print the search string */
        strlwr(str); /* Convert search string to lowercase */
        fl = 0; /* Initialize flag */
        for (int i = 0; cur_node != NULL && i < list->length; ++i, cur_node = cur_node->next) { /*
Iterate through the list */
            if ((param == 1 && from_str_to_int(str) == cur_node->id) || /* Check for match based on
parameter */
                (param == 2 && strstr(strlwr(strdup(cur_node->data->name)), str) != NULL) ||
                (param == 3 && strstr(strlwr(strdup(cur_node->data->university)), str) != NULL) ||
                (param == 4 && from_str_to_int(str) == cur_node->data->age) ||
                (param == 5 && from_str_to_float(str) == cur_node->data->weight) ||
                (param == 6 && from_str_to_int(str) == cur_node->data->height) ||
                (param == 7 && from_str_to_int(str) == cur_node->data->result[0]) ||
                (param == 8 && from_str_to_int(str) == cur_node->data->result[1]) ||
                (param == 9 && from_str_to_int(str) == cur_node->data->result[2]) ||
                (param == 10 && fabsf(from_str_to_float(str) - cur_node->data->index) < 0.001)) {
                if (fl == 0) { /* Check if matches are found */
                    print_line(); /* Print line separator */
                    print_head(); /* Print header */
                    print_line(); /* Print line separator */
                }
                print_node(cur_node); /* Print the matching node */
                fl = 1; /* Set flag to indicate matches found */
                mas[i] = 1; /* Mark node as found */
            } else {
                mas[i] = 0; /* Mark node as not found */
```

```
            }
        }
        if (fl == 0) { /* If no matches are found */
            printf("No matches found!\n"); /* Print message */
            wait();
        } else {
            print_line(); /* Print line separator */
            do {
                printf("Select a field to sort by or exit:\n"
                       "1 = id\n"
                       "2 = name\n"
                       "3 = university\n"
                       "4 = age\n"
                       "5 = weight\n"
                       "6 = height\n"
                       "7 = result 1\n"
                       "8 = result 2\n"
                       "9 = result 3\n"
                       "10 = index\n"
                       "0 = exit\n"
                       "Enter only one number!\n");
                fgets(str, sizeof(str), stdin); /* Read user input */
                param = from_str_to_int(str); /* Convert input to integer */
                if (param < 0 || 10 < param) { /* Validate input */
                    printf("Invalid command!\n");
                } else if (param != 0) { /* If valid sort parameter */
                    print_line(); /* Print line separator */
                    print_head(); /* Print header */
                    print_line(); /* Print line separator */
                    sorted(mas, list, param); /* Sort and print nodes */
                    print_line(); /* Print line separator */
                }
            } while (param != 0); /* Continue until user exits */
        }
    }
    CLS; /* Clear the screen */
}

/*Creates an array of pointers to NodeOfList structures based on the given list*/
NodeOfList **get_mas(ListOfAthlete *list) {
    NodeOfList *cur_node; /* Pointer to traverse the list */
    NodeOfList **mas = NULL; /* Array to hold pointers to list nodes */

    cur_node = list->first; /* Start from the first node of the list */
    mas = (NodeOfList **) malloc(list->length * sizeof(NodeOfList *)); /* Allocate memory for the array
of NodeOfList pointers */

    if (mas != NULL) {
        for (int i = 0; cur_node != NULL; ++i) { /* Iterate through the list and fill the array with
pointers to the nodes */
            mas[i] = cur_node; /* Assign the current node to the array */
            cur_node = cur_node->next; /* Move to the next node in the list */
        }
    }
    return mas;
}

/* Swaps two nodes in the list and updates their positions */
void my_swap(NodeOfList **mas, ListOfAthlete *list, int i, int j) {
    NodeOfList *q;

    if (mas[i] == list->first) { /* Update the list's first pointer and set the previous pointer of
mas[j] to NULL */
        list->first = mas[j];
        mas[j]->prev = NULL;
    } else { /* Update the next pointer of the previous node and set the previous pointer of mas[j] */
        mas[i - 1]->next = mas[j];
        mas[j]->prev = mas[i - 1];
    }
    if (mas[j] == list->last) { /* Update the list's last pointer and set the next pointer of mas[i] to
NULL */
        list->last = mas[i];
        mas[i]->next = NULL;
    } else { /* Update the previous pointer of the next node and set the next pointer of mas[i] */
        mas[j + 1]->prev = mas[i];
        mas[i]->next = mas[j + 1];
    }
    if (j - i == 1) { /* If j and i are adjacent, swap their next and previous pointers */
        mas[i]->prev = mas[j];
        mas[j]->next = mas[i];
```

```
    } else { /* Update the next and previous pointers of the nodes surrounding mas[i] and mas[j] */
        mas[j - 1]->next = mas[i];
        mas[i]->prev = mas[j - 1];
        mas[i + 1]->prev = mas[j];
        mas[j]->next = mas[i + 1];
    }
    /* Swap the positions of mas[i] and mas[j] in the array */
    q = mas[i];
    mas[i] = mas[j];
    mas[j] = q;
}

/* Sorts the list of athletes based on a selected parameter */
void sort(ListOfAthlete *list) {
    NodeOfList **mas; /* Array to hold pointers to the list nodes */
    char str[128]; /* Buffer to read user input */
    int n, param; /* n: number of nodes, param: sorting parameter */

    CLS; /* Clear the screen */
    n = list->length; /* Get the length of the list */
    mas = get_mas(list); /* Create an array of nodes */
    print(list); /* Print the list */
    do { /* Loop to get the sorting parameter from the user */
        printf("Select a field to sort by or exit:\n"
               "1 = id\n"
               "2 = name\n"
               "3 = university\n"
               "4 = age\n"
               "5 = weight\n"
               "6 = height\n"
               "7 = result 1\n"
               "8 = result 2\n"
               "9 = result 3\n"
               "10 = index\n"
               "0 = exit\n"
               "Enter only one number!\n");
        fgets(str, sizeof(str), stdin); /* Read the sorting parameter */
        param = from_str_to_int(str); /* Convert the input to an integer */
        if (param < 0 || param > 10) { /* Check for valid input */
            printf("Invalid command!\n");
        } else if (param != 0) {
            for (int i = 0; i < n; ++i) {
                for (int j = i + 1; j < n; ++j) {
                    if ((param == 1 && mas[i]->id > mas[j]->id) || /* Check if nodes should be swapped
based on the selected parameter */
                        (param == 2 && strcasecmp(mas[i]->data->name, mas[j]->data->name) > 0) ||
                        (param == 3 && strcasecmp(mas[i]->data->university, mas[j]->data->university) >
0) ||
                        (param == 4 && mas[i]->data->age > mas[j]->data->age) ||
                        (param == 5 && mas[i]->data->weight > mas[j]->data->weight) ||
                        (param == 6 && mas[i]->data->height > mas[j]->data->height) ||
                        (param == 7 && mas[i]->data->result[0] > mas[j]->data->result[0]) ||
                        (param == 8 && mas[i]->data->result[1] > mas[j]->data->result[1]) ||
                        (param == 9 && mas[i]->data->result[2] > mas[j]->data->result[2]) ||
                        (param == 10 && mas[i]->data->index > mas[j]->data->index)) {
                        my_swap(mas, list, i, j); /* Swap the nodes */
                    }
                }
            }
            print(list); /* Print the sorted list */
        }
    } while (param != 0); /* Continue until the user exits */

    free(mas); /* Free the allocated memory */
    CLS; /* Clear the screen */
}

/* Adds a new athlete to the list */
void add(ListOfAthlete *list, int g_id) {
    char str[1024]; /* Buffer to store user input */
    NodeOfList *cur_node; /* Pointer to the newly created node */

    CLS; /* Clear the screen */
    print(list); /* Print the current list of athletes */
    printf("Enter data of the athlete in the format:\n"
           "name;university;age;weight;height;result1;result2;result3\n");
    fgets(str, sizeof(str), stdin); /* Read user input */
    cur_node = create_node(str, g_id); /* Create a new node with the given data */
    if (cur_node != NULL) { /* If the new node is created successfully */
        cur_node->prev = list->last; /* Link the previous node to the new node */
```

```
        if (list->length == 0) {
            list->first = cur_node; /* If the list is empty, set the new node as the first node */
        } else {
            list->last->next = cur_node; /* Otherwise, link the last node to the new node */
        }
        list->last = cur_node; /* Update the last pointer to the new node */
        ++list->length; /* Increment the length of the list */
        ++g_id;
        printf("The item has been successfully inserted!\n"); /* Inform the user about the successful
insertion */
    }
    print(list); /* Print the updated list */
    wait();
    CLS; /* Clear the screen */
}

/* Allows editing the details of an athlete in the list based on the provided ID */
void edit(ListOfAthlete *list) {
    NodeOfList *the_node = NULL; /* Pointer to the node to be edited */
    int id; /* ID of the athlete to be edited */
    char str[128], s_id[128]; /* Buffers for user input */

    CLS; /* Clear the screen */
    print(list); /* Print the current list of athletes */
    printf("Enter the ID of the Athlete you want to edit or 0 to exit:\n");
    fgets(s_id, sizeof(s_id), stdin); /* Read the ID input from the user */
    id = from_str_to_int(s_id); /* Convert the input to an integer */
    for (NodeOfList *cur_node = list->first; cur_node != NULL; cur_node = cur_node->next) { /* Find the
node with the specified ID */
        if (cur_node->id == id) {
            the_node = cur_node;
            print_one(the_node); /* Print the details of the selected athlete */
        }
    }
    if (the_node != NULL) { /* If the node with the specified ID is found */
        /* Prompt the user to edit each attribute and update if necessary */
        printf("\nCurrent name: %s\n"
               "Write new name or skip (press \"Enter\"):\n", the_node->data->name);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            str[strcspn(str, "\n")] = '\0';
            the_node->data->name = strdup(str);
        }

        printf("\nCurrent university: %s\n"
               "Write new university or skip (press \"Enter\"):\n", the_node->data->university);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            str[strcspn(str, "\n")] = '\0';
            the_node->data->university = strdup(str);
        }

        printf("\nCurrent age: %i\n"
               "Write new age or skip (press \"Enter\"):\n", the_node->data->age);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            the_node->data->age = from_str_to_int(str);
        }

        printf("\nCurrent weight: %0.1f\n"
               "Write new weight or skip (press \"Enter\"):\n", the_node->data->weight);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            the_node->data->weight = from_str_to_float(str);
        }

        printf("\nCurrent height: %i\n"
               "Write new height or skip (press \"Enter\"):\n", the_node->data->height);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            the_node->data->height = from_str_to_int(str);
        }

        printf("\nCurrent Res1: %i\n"
               "Write new Res1 or skip (press \"Enter\"):\n", the_node->data->result[0]);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            the_node->data->result[0] = from_str_to_int(str);
        }
```

```
        printf("\nCurrent Res2: %i\n"
               "Write new Res2 or skip (press \"Enter\"):\n", the_node->data->result[1]);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            the_node->data->result[1] = from_str_to_int(str);
        }

        printf("\nCurrent Res3: %i\n"
               "Write new Res3 or skip (press \"Enter\"):\n", the_node->data->result[2]);
        fgets(str, sizeof(str), stdin);
        if (strcmp(str, "\n") != 0) {
            the_node->data->result[2] = from_str_to_int(str);
        }

        the_node->data->index = (float) (the_node->data->result[0] + the_node->data->result[1] +
the_node->data->result[2]) / the_node->data->weight;
        print_one(the_node); /* Print the updated details of the athlete */
    } else if (id != 0) {
        printf("Element not found!\n"); /* Notify the user if the ID is not found */
    }
    wait();
    CLS; /* Clear the screen */
}

/* Deleting athletes from the list based on the specified parameter */
void delete(ListOfAthlete *list) {
    NodeOfList *cur_node, *prev_node; /* Pointers to current and previous nodes */
    char str[128], ch; /* Buffers for user input */
    int mas[list->length], fl, param, cnt; /* Array to mark matched athletes, flag, parameter, count */

    CLS; /* Clear the screen */
    cur_node = list->first; /* Start from the first node */
    print(list); /* Print the current list of athletes */
    do { /* Prompt the user to select a field to delete by */
        printf("Select a field to delete by:\n"
               "1 = id\n"
               "2 = name\n"
               "3 = university\n"
               "4 = age\n"
               "5 = weight\n"
               "6 = height\n"
               "7 = result 1\n"
               "8 = result 2\n"
               "9 = result 3\n"
               "10 = index\n"
               "0 = exit\n"
               "Enter only one number!\n");
        fgets(str, sizeof(str), stdin);
        param = from_str_to_int(str); /* Convert user input to an integer */
        if (param < 0 || 10 < param) {
            printf("Invalid command!\n");
        }
    } while (param < 0 || 10 < param);
    if (param != 0) { /* If the user chooses to delete */
        printf("Enter the delete string:\n");
        fgets(str, sizeof(str), stdin); /* Read the delete string from the user */
        CLS; /* Clear the screen */
        printf("%s", str); /* Print the delete string */
        str[strcspn(str, "\n")] = '\0'; /* Remove the newline character */
        strlwr(str); /* Convert the delete string to lowercase */
        fl = 0; /* Reset the flag */
        for (int i = 0; cur_node != NULL && i < list->length; ++i) {
            if ((param == 1 && from_str_to_int(str) == cur_node->id) || /* Check for match based on
parameter */
                (param == 2 && strstr(strlwr(strdup(cur_node->data->name)), str) != NULL) ||
                (param == 3 && strstr(strlwr(strdup(cur_node->data->university)), str) != NULL) ||
                (param == 4 && from_str_to_int(str) == cur_node->data->age) ||
                (param == 5 && from_str_to_float(str) == cur_node->data->weight) ||
                (param == 6 && from_str_to_int(str) == cur_node->data->height) ||
                (param == 7 && from_str_to_int(str) == cur_node->data->result[0]) ||
                (param == 8 && from_str_to_int(str) == cur_node->data->result[1]) ||
                (param == 9 && from_str_to_int(str) == cur_node->data->result[2]) ||
                (param == 10 && fabsf(from_str_to_float(str) - cur_node->data->index) < 0.001)) {
                if (fl == 0) { /* Check if matches are found */
                    print_line(); /* Print line separator */
                    print_head(); /* Print header */
                    print_line(); /* Print line separator */
                }
                print_node(cur_node); /* Print the details of the matched athlete */
                fl = 1; /* Set the flag */
```

```
                mas[i] = 1; /* Mark the matched athlete */
            } else {
                mas[i] = 0; /* Mark as unmatched */
            }
            cur_node = cur_node->next; /* Move to the next node */
        }
        if (fl == 0) { /* If matches are found */
            printf("No matches found!\n");
            wait();
        } else {
            print_line();
            printf("Are you sure want to delete these athletes? (Y/N)\n");
            do { /* Prompt for confirmation */
                ch = (char) getchar();
                getchar();
                if (ch != 'Y' && ch != 'N') printf("Invalid command!\n");
            } while (ch != 'Y' && ch != 'N');
            if (ch == 'Y') { /* If confirmed to delete */
                cnt = 0; /* Initialize counter */
                cur_node = list->first; /* Start from the first node */
                for (int i = 0; i < list->length; ++i) { /* Iterate through the list and delete the
matched athletes */
                    if (mas[i] == 1) {
                        cnt++; /* Increment counter */
                        /* Adjust pointers and free memory */
                        if (cur_node->prev == NULL) {  /* First node */
                            cur_node = cur_node->next;
                            list->first = cur_node;  /* Update the first node pointer */
                            free(cur_node->prev->data);  /* Free memory occupied by data of the deleted
node */
                            free(cur_node->prev);  /* Free memory occupied by the deleted node */
                            cur_node->prev = NULL;  /* Set the prev pointer of the new first node to NULL
*/
                        } else if (cur_node->next == NULL) { /* Last node */
                            cur_node = cur_node->prev;  /* Move to the previous node */
                            list->last = cur_node;  /* Update the last node pointer */
                            free(cur_node->next->data);  /* Free memory occupied by data of the deleted
node */
                            free(cur_node->next);  /* Free memory occupied by the deleted node */
                            cur_node->next = NULL;  /* Set the next pointer of the new last node to NULL
*/
                        } else { /* Another node */
                            cur_node->next->prev = cur_node->prev;  /* Update the prev pointer of the
next node */
                            cur_node->prev->next = cur_node->next;  /* Update the next pointer of the
previous node */
                            prev_node = cur_node;  /* Save a reference to the node to be deleted */
                            cur_node = cur_node->next;  /* Move to the next node */
                            free(prev_node->data);  /* Free memory occupied by data of the deleted node
*/
                            free(prev_node);  /* Free memory occupied by the deleted node */
                        }
                    } else {
                        cur_node = cur_node->next; /* Move to the next node in the list */
                    }
                }
                list->length -= cnt; /* Update the length of the list */
                print(list); /* Print the updated list */
                wait();
            }
        }
    }
    CLS; /* Clear the screen */
}

/* Save the data of athletes stored in a linked list to a file specified by the user */
void save(ListOfAthlete *list) {
    FILE *f;  /* File pointer for saving data */
    char filename[128];  /* Array to store the filename entered by the user */

    CLS;  /* Clear the screen */
    print(list);  /* Print the list of athletes */
    printf("Please enter the name of the file to save the data to:\n");  /* Prompt the user to enter the
filename */
    fgets(filename, sizeof(filename), stdin);  /* Read the filename from the user */
    filename[strcspn(filename, "\n")] = '\0';  /* Remove the newline character from the filename */
    f = fopen(filename, "w");  /* Open the file for writing */
    for (NodeOfList *cur_node = list->first; cur_node != NULL; cur_node = cur_node->next) {
        /* Write the data of each athlete to the file in the specified format */
        fprintf(f, "%s;%s;%i;%0.1f;%i;%i;%i;%i\n", cur_node->data->name, cur_node->data->university,
```

```
cur_node->data->age, cur_node->data->weight, cur_node->data->height, cur_node->data->result[0], cur_node-
>data->result[1], cur_node->data->result[2]);
    }
    fclose(f);  /* Close the file */
    printf("The file has been successfully written!\n");  /* Inform the user that the file has been
written successfully */
    wait();
    CLS;  /* Clear the screen */
}
```

Контрольные примеры

№	Исходные данные	Результаты
1	input1.txt !print !find 3 m 4 0 !add Novikov N.N.;ITMO;26;80.6;195;210;240;25 0 !end	+----+----------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------+----------+-----+--------+--------+------+------+------+-------+ | 1 | Ivanov I.I. | MSU | 25 | 70.5 | 175 | 120 | 200 | 230 | 7.801 | | 2 | Petrov P.P. | SPbSU | 22 | 65.2 | 180 | 140 | 180 | 210 | 8.129 | | 3 | Sidorov S.S. | MIPT | 18 | 55.8 | 165 | 90 | 150 | 180 | 7.527 | | 4 | Kuznetsov K.K. | HSE | 20 | 75.1 | 185 | 200 | 220 | 240 | 8.788 | | 5 | Smirnov A.A. | MGU | 27 | 90.3 | 190 | 180 | 220 | 250 | 7.198 | | 6 | Fedorov F.F. | NRU HSE | 19 | 68.7 | 170 | 110 | 170 | 200 | 6.987 | | 7 | Volkov V.V. | BSU | 21 | 60.0 | 160 | 80 | 0 | 0 | 1.333 | | 8 | Mikhailov M.M. | ITMO | 24 | 72.4 | 178 | 160 | 190 | 220 | 7.873 | | 9 | Novikov N.N. | ITMO | 26 | 80.6 | 195 | 210 | 240 | 250 | 8.685 | | 10 | Morozov M.I. | RANEPA | 23 | 73.8 | 183 | 170 | 200 | 230 | 8.130 | | 11 | Kozlov K.V. | UralSU | 28 | 85.2 | 188 | 220 | 240 | 250 | 8.333 | | 12 | Orlov O.D. | MIIT | 17 | 57.5 | 163 | 100 | 160 | 0 | 4.522 | | 13 | Nikitin N.P. | SFU | 30 | 95.0 | 200 | 230 | 250 | 250 | 7.684 | | 14 | Kovalev K.N. | KPI | 16 | 50.6 | 155 | 70 | 120 | 150 | 6.719 | +----+----------+----------+-----+--------+--------+------+------+------+-------+ +----+----------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------+----------+-----+--------+--------+------+------+------+-------+ | 1 | Ivanov I.I. | MSU | 25 | 70.5 | 175 | 120 | 200 | 230 | 7.801 | | 3 | Sidorov S.S. | MIPT | 18 | 55.8 | 165 | 90 | 150 | 180 | 7.527 | | 5 | Smirnov A.A. | MGU | 27 | 90.3 | 190 | 180 | 220 | 250 | 7.198 | | 8 | Mikhailov M.M. | ITMO | 24 | 72.4 | 178 | 160 | 190 | 220 | 7.873 | | 9 | Novikov N.N. | ITMO | 26 | 80.6 | 195 | 210 | 240 | 250 | 8.685 | | 12 | Orlov O.D. | MIIT | 17 | 57.5 | 163 | 100 | 160 | 0 | 4.522 | +----+----------+----------+-----+--------+--------+------+------+------+-------+ +----+----------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------+----------+-----+--------+--------+------+------+------+-------+ | 12 | Orlov O.D. | MIIT | 17 | 57.5 | 163 | 100 | 160 | 0 | 4.522 | | 3 | Sidorov S.S. | MIPT | 18 | 55.8 | 165 | 90 | 150 | 180 | 7.527 | | 8 | Mikhailov M.M. | ITMO | 24 | 72.4 | 178 | 160 | 190 | 220 | 7.873 | | 1 | Ivanov I.I. | MSU | 25 | 70.5 | 175 | 120 | 200 | 230 | 7.801 | | 9 | Novikov N.N. | ITMO | 26 | 80.6 | 195 | 210 | 240 | 250 | 8.685 | | 5 | Smirnov A.A. | MGU | 27 | 90.3 | 190 | 180 | 220 | 250 | 7.198 | +----+----------+----------+-----+--------+--------+------+------+------+-------+ +----+----------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------+----------+-----+--------+--------+------+------+------+-------+ | 1 | Ivanov I.I. | MSU | 25 | 70.5 | 175 | 120 | 200 | 230 | 7.801 | | 2 | Petrov P.P. | SPbSU | 22 | 65.2 | 180 | 140 | 180 | 210 | 8.129 | | 3 | Sidorov S.S. | MIPT | 18 | 55.8 | 165 | 90 | 150 | 180 | 7.527 | | 4 | Kuznetsov K.K. | HSE | 20 | 75.1 | 185 | 200 | 220 | 240 | 8.788 | | 5 | Smirnov A.A. | MGU | 27 | 90.3 | 190 | 180 | 220 | 250 | 7.198 | | 6 | Fedorov F.F. | NRU HSE | 19 | 68.7 | 170 | 110 | 170 | 200 | 6.987 | | 7 | Volkov V.V. | BSU | 21 | 60.0 | 160 | 80 | 0 | 0 | 1.333 | | 8 | Mikhailov M.M. | ITMO | 24 | 72.4 | 178 | 160 | 190 | 220 | 7.873 | | 9 | Novikov N.N. | ITMO | 26 | 80.6 | 195 | 210 | 240 | 250 | 8.685 | | 10 | Morozov M.I. | RANEPA | 23 | 73.8 | 183 | 170 | 200 | 230 | 8.130 | | 11 | Kozlov K.V. | UralSU | 28 | 85.2 | 188 | 220 | 240 | 250 | 8.333 | | 12 | Orlov O.D. | MIIT | 17 | 57.5 | 163 | 100 | 160 | 0 | 4.522 | | 13 | Nikitin N.P. | SFU | 30 | 95.0 | 200 | 230 | 250 | 250 | 7.684 | | 14 | Kovalev K.N. | KPI | 16 | 50.6 | 155 | 70 | 120 | 150 | 6.719 | | 15 | Novikov N.N. | ITMO | 26 | 80.6 | 195 | 210 | 240 | 250 | 8.685 | +----+----------+----------+-----+--------+--------+------+------+------+-------+
2	input2.txt !sort 2 0 !delete 2 ov Y !end	+----+----------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------+----------+-----+--------+--------+------+------+------+-------+ | 6 | Bogdanov B.B. | MIPT | 18 | 55.5 | 162 | 90 | 150 | 180 | 7.568 | | 7 | Danilov D.D. | HSE | 22 | 75.3 | 183 | 200 | 220 | 240 | 8.765 | | 1 | Gusev G.A. | KAI | 26 | 76.8 | 182 | 200 | 220 | 240 | 8.594 | | 5 | Kiselev K.A. | SPbSU | 20 | 65.8 | 175 | 140 | 180 | 210 | 8.055 | | 8 | Nesterov N.N. | MGU | 27 | 90.8 | 188 | 180 | 220 | 250 | 7.159 | | 4 | Pavlov P.A. | MSU | 24 | 70.2 | 177 | 160 | 200 | 230 | 8.405 | | 2 | Popov P.V. | NSU | 25 | 71.7 | 176 | 180 | 210 | 230 | 8.647 | | 3 | Vasiliev V.S. | TSU | 19 | 66.0 | 170 | 110 | 160 | 190 | 6.970 | +----+----------+----------+-----+--------+--------+------+------+------+-------+ ov +----+----------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------+----------+-----+--------+--------+------+------+------+-------+ | 6 | Bogdanov B.B. | MIPT | 18 | 55.5 | 162 | 90 | 150 | 180 | 7.568 | | 7 | Danilov D.D. | HSE | 22 | 75.3 | 183 | 200 | 220 | 240 | 8.765 | | 8 | Nesterov N.N. | MGU | 27 | 90.8 | 188 | 180 | 220 | 250 | 7.159 | | 4 | Pavlov P.A. | MSU | 24 | 70.2 | 177 | 160 | 200 | 230 | 8.405 | | 2 | Popov P.V. | NSU | 25 | 71.7 | 176 | 180 | 210 | 230 | 8.647 | +----+----------+----------+-----+--------+--------+------+------+------+-------+ Are you sure want to delete these athletes? (Y/N) +----+----------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------+----------+-----+--------+--------+------+------+------+-------+ | 1 | Gusev G.A. | KAI | 26 | 76.8 | 182 | 200 | 220 | 240 | 8.594 | | 5 | Kiselev K.A. | SPbSU | 20 | 65.8 | 175 | 140 | 180 | 210 | 8.055 | | 3 | Vasiliev V.S. | TSU | 19 | 66.0 | 170 | 110 | 160 | 190 | 6.970 | +----+----------+----------+-----+--------+--------+------+------+------+-------+

3	input3.txt !edit 3 LETI 24 70.2 160 190 !save input.txt !exit	+----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | 1 | Egorov E.E. | KPI | 16 | 51.2 | 158 | 70 | 120 | 150 | 6.641 | | 2 | Klimov K.K. | SPbPU | 21 | 64.5 | 170 | 130 | 180 | 210 | 8.062 | | 3 | Dmitriev D.S. | TomSU | 23 | 67.8 | 172 | 150 | 190 | 220 | 8.260 | | 4 | Ivanov I.V. | BSTU | 19 | 59.4 | 168 | 120 | 170 | 200 | 8.249 | | 5 | Golubev G.S. | KAI | 25 | 77.6 | 180 | 200 | 220 | 240 | 8.505 | | 6 | Alexandrov A.A. | NSU | 24 | 72.3 | 175 | 180 | 210 | 230 | 8.575 | | 7 | Sokolov S.V. | TSU | 20 | 66.6 | 171 | 110 | 160 | 190 | 6.907 | | 8 | Vorobyov V.I. | MSU | 28 | 86.2 | 186 | 220 | 240 | 250 | 8.237 | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ Enter the ID of the Athlete you want to edit or 0 to exit: 3 +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | 3 | Dmitriev D.S. | TomSU | 23 | 67.8 | 172 | 150 | 190 | 220 | 8.260 | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | 3 | Dmitriev D.S. | LETI | 24 | 70.2 | 172 | 160 | 190 | 220 | 8.120 | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | ID | Name | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ | 1 | Egorov E.E. | KPI | 16 | 51.2 | 158 | 70 | 120 | 150 | 6.641 | | 2 | Klimov K.K. | SPbPU | 21 | 64.5 | 170 | 130 | 180 | 210 | 8.062 | | 3 | Dmitriev D.S. | LETI | 24 | 70.2 | 172 | 160 | 190 | 220 | 8.120 | | 4 | Ivanov I.V. | BSTU | 19 | 59.4 | 168 | 120 | 170 | 200 | 8.249 | | 5 | Golubev G.S. | KAI | 25 | 77.6 | 180 | 200 | 220 | 240 | 8.505 | | 6 | Alexandrov A.A. | NSU | 24 | 72.3 | 175 | 180 | 210 | 230 | 8.575 | | 7 | Sokolov S.V. | TSU | 20 | 66.6 | 171 | 110 | 160 | 190 | 6.907 | | 8 | Vorobyov V.I. | MSU | 28 | 86.2 | 186 | 220 | 240 | 250 | 8.237 | +----+----------------------+----------+-----+--------+--------+------+------+------+-------+ Please enter the name of the file to save the data to: input.txt The file has been successfully written!

Содержимое файлов

input1.txt

```
Ivanov I.I.;MSU;25;70.5;175;120;200;230
Petrov P.P.;SPbSU;22;65.2;180;140;180;210
Sidorov S.S.;MIPT;18;55.8;165;90;150;180
Kuznetsov K.K.;HSE;20;75.1;185;200;220;240
Smirnov A.A.;MGU;27;90.3;190;180;220;250
Fedorov F.F.;NRU HSE;19;68.7;170;110;170;200
Volkov V.V.;BSU;21;60.0;160;80;0;0
Mikhailov M.M.;ITMO;24;72.4;178;160;190;220
Novikov N.N.;ITMO;26;80.6;195;210;240;250
Morozov M.I.;RANEPA;23;73.8;183;170;200;230
Kozlov K.V.;UralSU;28;85.2;188;220;240;250
Orlov O.D.;MIIT;17;57.5;163;100;160;0
Nikitin N.P.;SFU;30;95.0;200;230;250;250
Kovalev K.N.;KPI;16;50.6;155;70;120;150
```

input2.txt

```
Gusev G.A.;KAI;26;76.8;182;200;220;240
Popov P.V.;NSU;25;71.7;176;180;210;230
Vasiliev V.S.;TSU;19;66.0;170;110;160;190
Pavlov P.A.;MSU;24;70.2;177;160;200;230
Kiselev K.A.;SPbSU;20;65.8;175;140;180;210
Bogdanov B.B.;MIPT;18;55.5;162;90;150;180
Danilov D.D.;HSE;22;75.3;183;200;220;240
Nesterov N.N.;MGU;27;90.8;188;180;220;250
```

input3.txt

```
Egorov E.E.;KPI;16;51.2;158;70;120;150
Klimov K.K.;SPbPU;21;64.5;170;130;180;210
Dmitriev D.S.;TomSU;23;67.8;172;150;190;220
Ivanov I.V.;BSTU;19;59.4;168;120;170;200
Golubev G.S.;KAI;25;77.6;180;200;220;240
Alexandrov A.A.;NSU;24;72.3;175;180;210;230
Sokolov S.V.;TSU;20;66.6;171;110;160;190
Vorobyov V.I.;MSU;28;86.2;186;220;240;250
```

input.txt

```
Egorov E.E.;KPI;16;51.2;158;70;120;150
Klimov K.K.;SPbPU;21;64.5;170;130;180;210
Dmitriev D.S.;LETI;24;70.2;172;160;190;220
Ivanov I.V.;BSTU;19;59.4;168;120;170;200
Golubev G.S.;KAI;25;77.6;180;200;220;240
Alexandrov A.A.;NSU;24;72.3;175;180;210;230
Sokolov S.V.;TSU;20;66.6;171;110;160;190
Vorobyov V.I.;MSU;28;86.2;186;220;240;250
```

Примеры выполнения программы

Пример 1:

```
Please enter the file name:
input1.txt
The file has been successfully processed!
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!print
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 1  | Ivanov I.I.          | MSU        | 25  | 70.5   | 175    | 120  | 200  | 230  | 7.801 |
| 2  | Petrov P.P.          | SPbSU      | 22  | 65.2   | 180    | 140  | 180  | 210  | 8.129 |
| 3  | Sidorov S.S.         | MIPT       | 18  | 55.8   | 165    | 90   | 150  | 180  | 7.527 |
| 4  | Kuznetsov K.K.       | HSE        | 20  | 75.1   | 185    | 200  | 220  | 240  | 8.788 |
| 5  | Smirnov A.A.         | MGU        | 27  | 90.3   | 190    | 180  | 220  | 250  | 7.198 |
| 6  | Fedorov F.F.         | NRU HSE    | 19  | 68.7   | 170    | 110  | 170  | 200  | 6.987 |
| 7  | Volkov V.V.          | BSU        | 21  | 60.0   | 160    | 80   | 0    | 0    | 1.333 |
| 8  | Mikhailov M.M.       | ITMO       | 24  | 72.4   | 178    | 160  | 190  | 220  | 7.873 |
| 9  | Novikov N.N.         | ITMO       | 26  | 80.6   | 195    | 210  | 240  | 250  | 8.685 |
| 10 | Morozov M.I.         | RANEPA     | 23  | 73.8   | 183    | 170  | 200  | 230  | 8.130 |
| 11 | Kozlov K.V.          | UralSU     | 28  | 85.2   | 188    | 220  | 240  | 250  | 8.333 |
| 12 | Orlov O.D.           | MIIT       | 17  | 57.5   | 163    | 100  | 160  | 0    | 4.522 |
| 13 | Nikitin N.P.         | SFU        | 30  | 95.0   | 200    | 230  | 250  | 250  | 7.684 |
| 14 | Kovalev K.N.         | KPI        | 16  | 50.6   | 155    | 70   | 120  | 150  | 6.719 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+

To continue press "Enter"...
```

```
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!find
```

ID	Name	University	Age	Weight	Height	Res1	Res2	Res3	Index
1	Ivanov I.I.	MSU	25	70.5	175	120	200	230	7.801
2	Petrov P.P.	SPbSU	22	65.2	180	140	180	210	8.129
3	Sidorov S.S.	MIPT	18	55.8	165	90	150	180	7.527
4	Kuznetsov K.K.	HSE	20	75.1	185	200	220	240	8.788
5	Smirnov A.A.	MGU	27	90.3	190	180	220	250	7.198
6	Fedorov F.F.	NRU HSE	19	68.7	170	110	170	200	6.987
7	Volkov V.V.	BSU	21	60.0	160	80	0	0	1.333
8	Mikhailov M.M.	ITMO	24	72.4	178	160	190	220	7.873
9	Novikov N.N.	ITMO	26	80.6	195	210	240	250	8.685
10	Morozov M.I.	RANEPA	23	73.8	183	170	200	230	8.130
11	Kozlov K.V.	UralSU	28	85.2	188	220	240	250	8.333
12	Orlov O.D.	MIIT	17	57.5	163	100	160	0	4.522
13	Nikitin N.P.	SFU	30	95.0	200	230	250	250	7.684
14	Kovalev K.N.	KPI	16	50.6	155	70	120	150	6.719

```
Select a field to find by:
1 = id
2 = name
3 = university
4 = age
5 = weight
6 = height
7 = result 1
8 = result 2
9 = result 3
10 = index
0 = exit
Enter only one number!
3
Enter the search string:
m
m
```

ID	Name	University	Age	Weight	Height	Res1	Res2	Res3	Index
1	Ivanov I.I.	MSU	25	70.5	175	120	200	230	7.801
3	Sidorov S.S.	MIPT	18	55.8	165	90	150	180	7.527
5	Smirnov A.A.	MGU	27	90.3	190	180	220	250	7.198
8	Mikhailov M.M.	ITMO	24	72.4	178	160	190	220	7.873
9	Novikov N.N.	ITMO	26	80.6	195	210	240	250	8.685
12	Orlov O.D.	MIIT	17	57.5	163	100	160	0	4.522

```
Select a field to sort by or exit:
1 = id
2 = name
3 = university
4 = age
5 = weight
6 = height
7 = result 1
8 = result 2
9 = result 3
10 = index
0 = exit
Enter only one number!
```

```
4
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 12 | Orlov O.D.           | MIIT       | 17  | 57.5   | 163    | 100  | 160  | 0    | 4.522 |
| 3  | Sidorov S.S.         | MIPT       | 18  | 55.8   | 165    | 90   | 150  | 180  | 7.527 |
| 8  | Mikhailov M.M.       | ITMO       | 24  | 72.4   | 178    | 160  | 190  | 220  | 7.873 |
| 1  | Ivanov I.I.          | MSU        | 25  | 70.5   | 175    | 120  | 200  | 230  | 7.801 |
| 9  | Novikov N.N.         | ITMO       | 26  | 80.6   | 195    | 210  | 240  | 250  | 8.685 |
| 5  | Smirnov A.A.         | MGU        | 27  | 90.3   | 190    | 180  | 220  | 250  | 7.198 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Select a field to sort by or exit:
1 = id
2 = name
3 = university
4 = age
5 = weight
6 = height
7 = result 1
8 = result 2
9 = result 3
10 = index
0 = exit
Enter only one number!
0
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!add
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 1  | Ivanov I.I.          | MSU        | 25  | 70.5   | 175    | 120  | 200  | 230  | 7.801 |
| 2  | Petrov P.P.          | SPbSU      | 22  | 65.2   | 180    | 140  | 180  | 210  | 8.129 |
| 3  | Sidorov S.S.         | MIPT       | 18  | 55.8   | 165    | 90   | 150  | 180  | 7.527 |
| 4  | Kuznetsov K.K.       | HSE        | 20  | 75.1   | 185    | 200  | 220  | 240  | 8.788 |
| 5  | Smirnov A.A.         | MGU        | 27  | 90.3   | 190    | 180  | 220  | 250  | 7.198 |
| 6  | Fedorov F.F.         | NRU HSE    | 19  | 68.7   | 170    | 110  | 170  | 200  | 6.987 |
| 7  | Volkov V.V.          | BSU        | 21  | 60.0   | 160    | 80   | 0    | 0    | 1.333 |
| 8  | Mikhailov M.M.       | ITMO       | 24  | 72.4   | 178    | 160  | 190  | 220  | 7.873 |
| 9  | Novikov N.N.         | ITMO       | 26  | 80.6   | 195    | 210  | 240  | 250  | 8.685 |
| 10 | Morozov M.I.         | RANEPA     | 23  | 73.8   | 183    | 170  | 200  | 230  | 8.130 |
| 11 | Kozlov K.V.          | UralSU     | 28  | 85.2   | 188    | 220  | 240  | 250  | 8.333 |
| 12 | Orlov O.D.           | MIIT       | 17  | 57.5   | 163    | 100  | 160  | 0    | 4.522 |
| 13 | Nikitin N.P.         | SFU        | 30  | 95.0   | 200    | 230  | 250  | 250  | 7.684 |
| 14 | Kovalev K.N.         | KPI        | 16  | 50.6   | 155    | 70   | 120  | 150  | 6.719 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Enter data of the athlete in the format:
name;university;age;weight;height;result1;result2;result3
```

```
Novikov N.N.;ITMO;26;80.6;195;210;240;250
The item has been successfully inserted!
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 1  | Ivanov I.I.          | MSU        | 25  | 70.5   | 175    | 120  | 200  | 230  | 7.801 |
| 2  | Petrov P.P.          | SPbSU      | 22  | 65.2   | 180    | 140  | 180  | 210  | 8.129 |
| 3  | Sidorov S.S.         | MIPT       | 18  | 55.8   | 165    | 90   | 150  | 180  | 7.527 |
| 4  | Kuznetsov K.K.       | HSE        | 20  | 75.1   | 185    | 200  | 220  | 240  | 8.788 |
| 5  | Smirnov A.A.         | MGU        | 27  | 90.3   | 190    | 180  | 220  | 250  | 7.198 |
| 6  | Fedorov F.F.         | NRU HSE    | 19  | 68.7   | 170    | 110  | 170  | 200  | 6.987 |
| 7  | Volkov V.V.          | BSU        | 21  | 60.0   | 160    | 80   | 0    | 0    | 1.333 |
| 8  | Mikhailov M.M.       | ITMO       | 24  | 72.4   | 178    | 160  | 190  | 220  | 7.873 |
| 9  | Novikov N.N.         | ITMO       | 26  | 80.6   | 195    | 210  | 240  | 250  | 8.685 |
| 10 | Morozov M.I.         | RANEPA     | 23  | 73.8   | 183    | 170  | 200  | 230  | 8.130 |
| 11 | Kozlov K.V.          | UralSU     | 28  | 85.2   | 188    | 220  | 240  | 250  | 8.333 |
| 12 | Orlov O.D.           | MIIT       | 17  | 57.5   | 163    | 100  | 160  | 0    | 4.522 |
| 13 | Nikitin N.P.         | SFU        | 30  | 95.0   | 200    | 230  | 250  | 250  | 7.684 |
| 14 | Kovalev K.N.         | KPI        | 16  | 50.6   | 155    | 70   | 120  | 150  | 6.719 |
| 15 | Novikov N.N.         | ITMO       | 26  | 80.6   | 195    | 210  | 240  | 250  | 8.685 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+

To continue press "Enter"...
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!end
Goodbye!
```

Пример 2:

```
Please enter the file name:
input2.txt
The file has been successfully processed!
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!sort
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 1  | Gusev G.A.           | KAI        | 26  | 76.8   | 182    | 200  | 220  | 240  | 8.594 |
| 2  | Popov P.V.           | NSU        | 25  | 71.7   | 176    | 180  | 210  | 230  | 8.647 |
| 3  | Vasiliev V.S.        | TSU        | 19  | 66.0   | 170    | 110  | 160  | 190  | 6.970 |
| 4  | Pavlov P.A.          | MSU        | 24  | 70.2   | 177    | 160  | 200  | 230  | 8.405 |
| 5  | Kiselev K.A.         | SPbSU      | 20  | 65.8   | 175    | 140  | 180  | 210  | 8.055 |
| 6  | Bogdanov B.B.        | MIPT       | 18  | 55.5   | 162    | 90   | 150  | 180  | 7.568 |
| 7  | Danilov D.D.         | HSE        | 22  | 75.3   | 183    | 200  | 220  | 240  | 8.765 |
| 8  | Nesterov N.N.        | MGU        | 27  | 90.8   | 188    | 180  | 220  | 250  | 7.159 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Select a field to sort by or exit:
1 = id
2 = name
3 = university
4 = age
5 = weight
6 = height
7 = result 1
8 = result 2
9 = result 3
10 = index
0 = exit
Enter only one number!
2
```

```
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 6  | Bogdanov B.B.        | MIPT       | 18  | 55.5   | 162    | 90   | 150  | 180  | 7.568 |
| 7  | Danilov D.D.         | HSE        | 22  | 75.3   | 183    | 200  | 220  | 240  | 8.765 |
| 1  | Gusev G.A.           | KAI        | 26  | 76.8   | 182    | 200  | 220  | 240  | 8.594 |
| 5  | Kiselev K.A.         | SPbSU      | 20  | 65.8   | 175    | 140  | 180  | 210  | 8.055 |
| 8  | Nesterov N.N.        | MGU        | 27  | 90.8   | 188    | 180  | 220  | 250  | 7.159 |
| 4  | Pavlov P.A.          | MSU        | 24  | 70.2   | 177    | 160  | 200  | 230  | 8.405 |
| 2  | Popov P.V.           | NSU        | 25  | 71.7   | 176    | 180  | 210  | 230  | 8.647 |
| 3  | Vasiliev V.S.        | TSU        | 19  | 66.0   | 170    | 110  | 160  | 190  | 6.970 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Select a field to sort by or exit:
1 = id
2 = name
3 = university
4 = age
5 = weight
6 = height
7 = result 1
8 = result 2
9 = result 3
10 = index
0 = exit
Enter only one number!
0
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!delete
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 6  | Bogdanov B.B.        | MIPT       | 18  | 55.5   | 162    | 90   | 150  | 180  | 7.568 |
| 7  | Danilov D.D.         | HSE        | 22  | 75.3   | 183    | 200  | 220  | 240  | 8.765 |
| 1  | Gusev G.A.           | KAI        | 26  | 76.8   | 182    | 200  | 220  | 240  | 8.594 |
| 5  | Kiselev K.A.         | SPbSU      | 20  | 65.8   | 175    | 140  | 180  | 210  | 8.055 |
| 8  | Nesterov N.N.        | MGU        | 27  | 90.8   | 188    | 180  | 220  | 250  | 7.159 |
| 4  | Pavlov P.A.          | MSU        | 24  | 70.2   | 177    | 160  | 200  | 230  | 8.405 |
| 2  | Popov P.V.           | NSU        | 25  | 71.7   | 176    | 180  | 210  | 230  | 8.647 |
| 3  | Vasiliev V.S.        | TSU        | 19  | 66.0   | 170    | 110  | 160  | 190  | 6.970 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Select a field to delete by:
1 = id
2 = name
3 = university
4 = age
5 = weight
6 = height
7 = result 1
8 = result 2
9 = result 3
10 = index
0 = exit
Enter only one number!
2
Enter the delete string:
ov
ov
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 6  | Bogdanov B.B.        | MIPT       | 18  | 55.5   | 162    | 90   | 150  | 180  | 7.568 |
| 7  | Danilov D.D.         | HSE        | 22  | 75.3   | 183    | 200  | 220  | 240  | 8.765 |
| 8  | Nesterov N.N.        | MGU        | 27  | 90.8   | 188    | 180  | 220  | 250  | 7.159 |
| 4  | Pavlov P.A.          | MSU        | 24  | 70.2   | 177    | 160  | 200  | 230  | 8.405 |
| 2  | Popov P.V.           | NSU        | 25  | 71.7   | 176    | 180  | 210  | 230  | 8.647 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Are you sure want to delete these athletes? (Y/N)
Y
```

```
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 1  | Gusev G.A.           | KAI        | 26  | 76.8   | 182    | 200  | 220  | 240  | 8.594 |
| 5  | Kiselev K.A.         | SPbSU      | 20  | 65.8   | 175    | 140  | 180  | 210  | 8.055 |
| 3  | Vasiliev V.S.        | TSU        | 19  | 66.0   | 170    | 110  | 160  | 190  | 6.970 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+

To continue press "Enter"...
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!end
Goodbye!
```

Пример 3:

```
Please enter the file name:
dsfd.wes
Something went wrong!
Perhaps such a file does not exist.
Please enter the file name again:
input3.txt
The file has been successfully processed!
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!edit
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 1  | Egorov E.E.          | KPI        | 16  | 51.2   | 158    | 70   | 120  | 150  | 6.641 |
| 2  | Klimov K.K.          | SPbPU      | 21  | 64.5   | 170    | 130  | 180  | 210  | 8.062 |
| 3  | Dmitriev D.S.        | TomSU      | 23  | 67.8   | 172    | 150  | 190  | 220  | 8.260 |
| 4  | Ivanov I.V.          | BSTU       | 19  | 59.4   | 168    | 120  | 170  | 200  | 8.249 |
| 5  | Golubev G.S.         | KAI        | 25  | 77.6   | 180    | 200  | 220  | 240  | 8.505 |
| 6  | Alexandrov A.A.      | NSU        | 24  | 72.3   | 175    | 180  | 210  | 230  | 8.575 |
| 7  | Sokolov S.V.         | TSU        | 20  | 66.6   | 171    | 110  | 160  | 190  | 6.907 |
| 8  | Vorobyov V.I.        | MSU        | 28  | 86.2   | 186    | 220  | 240  | 250  | 8.237 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Enter the ID of the Athlete you want to edit or 0 to exit:
3
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 3  | Dmitriev D.S.        | TomSU      | 23  | 67.8   | 172    | 150  | 190  | 220  | 8.260 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+

Current name: Dmitriev D.S.
Write new name or skip (press "Enter"):


Current university: TomSU
Write new university or skip (press "Enter"):
LETI

Current age: 23
Write new age or skip (press "Enter"):
24

Current weight: 67.8
Write new weight or skip (press "Enter"):
70.2
```

```
Current height: 172
Write new height or skip (press "Enter"):


Current Res1: 150
Write new Res1 or skip (press "Enter"):
160

Current Res2: 190
Write new Res2 or skip (press "Enter"):
190

Current Res3: 220
Write new Res3 or skip (press "Enter"):

+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 3  | Dmitriev D.S.        | LETI       | 24  | 70.2   | 172    | 160  | 190  | 220  | 8.120 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+

To continue press "Enter"...
```

```
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!save
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| ID | Name                 | University | Age | Weight | Height | Res1 | Res2 | Res3 | Index |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
| 1  | Egorov E.E.          | KPI        | 16  | 51.2   | 158    | 70   | 120  | 150  | 6.641 |
| 2  | Klimov K.K.          | SPbPU      | 21  | 64.5   | 170    | 130  | 180  | 210  | 8.062 |
| 3  | Dmitriev D.S.        | LETI       | 24  | 70.2   | 172    | 160  | 190  | 220  | 8.120 |
| 4  | Ivanov I.V.          | BSTU       | 19  | 59.4   | 168    | 120  | 170  | 200  | 8.249 |
| 5  | Golubev G.S.         | KAI        | 25  | 77.6   | 180    | 200  | 220  | 240  | 8.505 |
| 6  | Alexandrov A.A.      | NSU        | 24  | 72.3   | 175    | 180  | 210  | 230  | 8.575 |
| 7  | Sokolov S.V.         | TSU        | 20  | 66.6   | 171    | 110  | 160  | 190  | 6.907 |
| 8  | Vorobyov V.I.        | MSU        | 28  | 86.2   | 186    | 220  | 240  | 250  | 8.237 |
+----+----------------------+------------+-----+--------+--------+------+------+------+-------+
Please enter the name of the file to save the data to:
input.txt
The file has been successfully written!

To continue press "Enter"...
```

```
Enter the command:
"!print" = to display the data
"!find" = to find elements of the data
"!sort" = to sort the data
"!add" = to add new data
"!edit" = to edit the data
"!delete" = to remove elements of the data
"!save" = to save the data
"!end" = to end the program
!end
Goodbye!
```

Выводы

Создана электронная картотека и программа на языке Си, обеспечивающая взаимодействие с ней. Реализованы все указанные в задании функции. Создано понятное пользователю меню. Программа работоспособна и протестирована на Windows и Linux.

В работе использованы следующие заголовочные файлы стандартной библиотеки:

- <*stdio.h*> - используется для ввода и вывода из файла и консоли.
- <*stdlib.h*> - используется для выделения памяти для списка и динамических массивов.
- <*string.h*> - используется для обработки и преобразования строк.
- <*math.h*> - используется для поиска модуля числа.