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**Кафедра Вычислительной техники**

**Курсовая работа**

**по дисциплине «Программирование»**

**Тема: Разработка электронной картотеки**

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# Цель работы

Введение: цель + краткая формулировка задачи (с учетом предметной области). Пример краткой формулировки: «Создание электронной картотеки суперкаров».

# Задание

Задание (общая формулировка) с конкретизацией пунктов меню, без раздела "Дополнительно".

# Постановка задачи и описание решения

Ну, аббас просил ещё в разделе «Постановка задачи и описание решения» сразу прописывать свою предметную область.

# 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 |

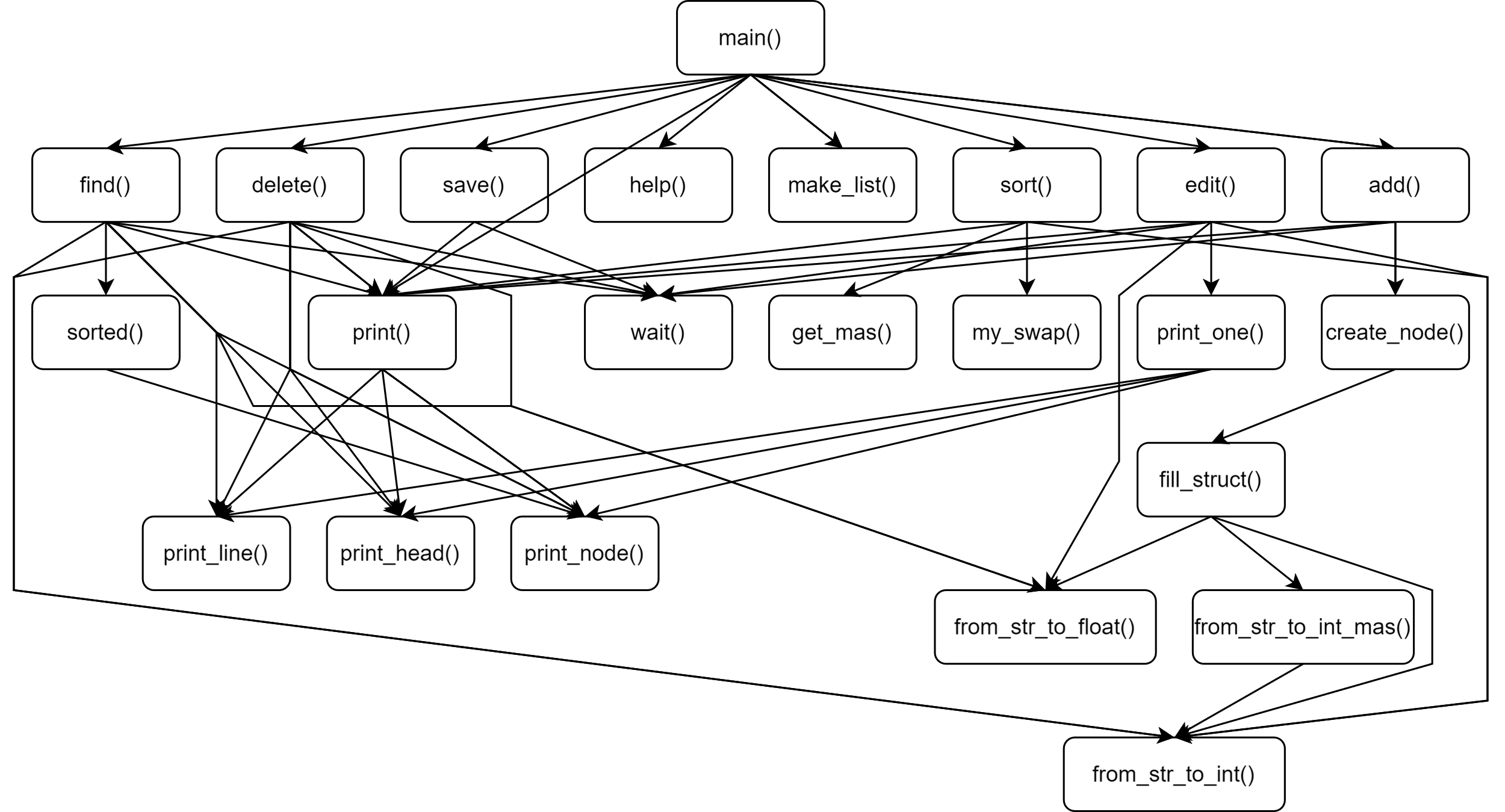
3. Структура ListOfAthlete

|  |  |  |  |
| --- | --- | --- | --- |
| **№** | **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. |
| 3 | from\_str\_to\_float | Конвертирует строку в число с плавающей точкой. |
| 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 |
| 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 |
| 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 спортменов |
| 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**

# 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);  */\* 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 \*/* }  }   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; */\* 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 \*/* ans = ans \* 10 + (\*str - '0'); */\* 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; */\* 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 \*/* } else {  ans = ans \* a + (float) (\*str - '0') / 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 \*/* }  }  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 \*/* 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 \*/* }  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 \*/* }  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(" ");  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) ||  (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) { */\* 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 \*/* }  cur\_node = cur\_node->next; */\* Move to the next node \*/* }  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 (i == 0) {  list->first = mas[j]; */\* Set the first node to the new first node \*/* } else {  mas[i - 1]->next = mas[j]; */\* Update the next pointer of the previous node \*/* }  mas[j - 1]->next = mas[i]; */\* Link the swapped node to the next node \*/* q = mas[j]->next; */\* Swap the next pointers of the nodes \*/* mas[j]->next = mas[i]->next;  mas[i]->next = q;  q = mas[i]; */\* Swap the pointers in the array \*/* 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; 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 \*/* 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 \*/* wait();  } 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 |  |  |
| 2 |  |  |
| 3 |  |  |

# Содержимое файлов

# Примеры выполнения программы

# Выводы

В «Заключении» указывается, какие заголовочные файлы стандартной библиотеки использованы и для чего (какие функции из этих заголовочных файлов использованы), делаются выводы о достижении цели работы.