PROBLEM: BILLIONAIRES (contributed by F. R. Salvador)

Every year www.forbes.com publishes a list of the world's billionaires (richest people). You'll find the latest list of billionaires in Forbes Billionaires 2023: The Richest People In The World.

The accompanying text file **INPUT.TXT** (obtained from Forbes website) contains data for the top **20** billionaires in 2023. The list of billionaires are encoded in descending order of net worth based on the year 2023.

There are 8 columns of data as described below:

1st column : First name
2nd column : Last name
3rd column : Net worth in 2023 (in billion US Dollars)
4th column : Net worth in 2022 (to be used in determining if the billionaire lost or gained fortune in 2023 compared to 2022)
5th column : Age
6th column : Country (for determining nationality)
7th column : Source (company)
8th column : Segment of Industry

For example, the first row contains the data for the world's richest person:

BERNARD AURNAULT 211 158 74 FRANCE LVMH FASHION-RETAIL

This row is interpreted as follows: the billionaire's name is BERNARD AURNAULT. His net worth in 2023 is 211 billion US Dollars and in 2022 it was 158 billion US Dollars. He is a citizen of France, and his source of fortune is LVMH[1] which operates in the Fashion-Retail Industry.

Refer to the accompanying **`LASTNAME-BILLIONAIRES.c`**, **`main.c`** and **`billionaires.h`** source files as you read the contents of this document from hereon.

Your task is to write a function definition that will answer each of the following questions Q1 to Q5.

Q1: ***What is the combined net worth of the top <param_number> billionaires?***

Example: What is the combined net worth of the top 5 billionaires?
Answer: 718.00 BILLION US DOLLARS

Implement the function

```
double Q1_SumNetWorth(int param_number, BType BILLIONAIRE[], int n)
```

Q2: ***Who are the youngest and oldest billionaires?***

Answer: YOUNGEST: MARK ZUCKERBERG AGE 38
OLDEST: WARREN BUFFET AGE 92

Implement the function

```
void Q2_YoungestOldest(BType *ptrYoungest, BType *ptrOldest, BType BILLIONAIRE[], int n)
```

[1] LVMH is known as Moët Hennessy Louis Vuitton.

Q3: ***Who are the billionaires from <param_country>?***

Example: Who are the billionaires from FRANCE?

Answer: BERNARD AURNAULT
FRANCOIS MEYERS

Implement the function

```
int Q3_BillionairesByCountry(BType TEMPLIST[], char *param_country, BType BILLIONAIRE[], int n)
```

Q4: ***By how much and by how many percent did the billionaires' net worth change in 2023 compared to 2022?***

Answer:

BERNARD AURNAULT 53.00 33.54
ELON MUSK -39.00 -17.81
JEFF BEZOS -57.00 -33.33
LARRY ELLISON 1.00 0.94
WARREN BUFFET -12.00 -10.17
BILL GATES -25.00 -19.38
MICHAEL BLOOMBERG 12.50 15.24
CARLOS SLIM 11.80 14.53
MUKESH AMBANI -7.30 -8.05
STEVE BALLMER -10.70 -11.71
FRANCOIS MEYERS 5.70 7.62
LARRY PAGE -31.80 -28.65
AMANCIO ORTEGA 17.70 29.70
SERGEY BRIN -31.00 -28.97
ZHONG SHANSHAN 2.30 3.50
MARK ZUCKERBERG -2.90 -4.31
CHARLES KOCH -1.00 -1.67
JULIA KOCH -1.00 -1.67
JIM WALTON -7.40 -11.18
ROB WALTON -7.40 -11.38

Some explanation are provided below for you to understand the meaning of the numbers in the Answer:

- For the first line BERNARD AURNAULT 53.00 33.54:
  The first value was computed as difference = net worth in 2023 - net worth in 2022
  = 211 - 158
  = 53

  The second value was computed as percentage = difference/net worth in 2022 * 100
  = 53/158 * 100
  = 33.54%

  This means that Bernard Aurnault's fortune increased in 2023 by 53 billion US Dollars corresponding to a 33.54% change compared to his 2022 net worth. ***Note: a positive value means that this billionaire became richer!***

- For the second line ELON MUSK -39.00 -17.81:
  The first value was computed as difference = net worth in 2023 - net worth in 2022
  = 180 - 219
  = -39 *// note: negative value*

The second value was computed as percentage = difference/net worth in 2022 * 100
=-39/219 * 100
= -17.81% *// note: negative value*

This means that ELON MUSK's fortune decreased in 2023 by 39 billion US Dollars corresponding to a -17.81% change compared to his 2022 net worth. ***Note: a negative value means that this billionaire became less rich!***
… but not poor ;-)

Implement the function

```
void Q4_ChangeInNetWorth(CType CHANGE[], BType BILLIONAIRE[], int n)
```

Q5: ***How do you copy the value of a source structure variable to a destination structure variable with the following restrictions?***

a. Copying must be done ONE MEMBER at a time (i.e., dest = source is NOT allowed).

b. The structure members must be accessed indirectly via a structure pointer variable using the following operators

- ***** *(dereference or indirection operation)*
- **.** *(structure member access operator)*
- **->** *(structure pointer member access operator)*

Implement the function

```
void Q5_StructCopy(BType *ptrDest, BType *ptrSource)
```

You are given the following files for this problem:

- **`LASTNAME-BILLIONAIRES.c`** -- skeleton file which contains some initial code that you'll need to complete
- **`main.c`** -- contains other functions and the **`main()`** function for testing purposes; make sure to read this file
- **`billionaires.h`** -- header file containing macro definitions, typedef and function prototypes; make sure to read this file
- **`INPUT.TXT`** -- contains example input data; test your solution exhaustively by creating a text file with your own data
- **`EXPECTED.TXT`** -- this contains the expected results when **`a.exe`** is executed using data stored in **`INPUT.txt`** file

DELIVERABLES: Submit/upload two files before the Canvas submission deadline

1. **`LASTNAME-BILLIONAIRES.c`** -- this file contains your solution (i.e., C source code)
2. **`LASTNAME-ACTUAL.txt`** -- this is the actual output redirected text file produced by your own exe file. You can produce this file by running your a.exe file with input/output redirection in the command line as follows:

prompt> **`a < INPUT.TXT > LASTNAME-ACTUAL.txt`** **(Press Enter)**

Make sure to rename these files using your own last name. For example, if your last name is SANTOS, you must upload your files as SANTOS-BILLIONAIRES.c and SANTOS-ACTUAL.txt.

TESTING & SCORING:

- Your program will be tested using a different input text file, and a different main() function.
- Each correct function definition will be given **10 points** each. Thus, the maximum total score will be 50/50.
- **A function that has a syntax/compilation error will result in a score of 0.**
- **A function that does not produce any of the required output (for example, due to runtime error) will result in a score of 0.**

--- THE END ---