Universidade da Madeira

Scale with Macros calculator

Assessment Component P2 (20%) of Computer Architectures
School year: 2020/2021
Delivery date and discussion: 19-05-2021

1. Description of the work

1.1. General overview

In this evaluation work, the students should develop the program that controls the "Scale with Macros calculator". Assume you have a kitchen scale, with precision of 1 g and maximum weight capacity of 2500 g. The main function is allowing the selection of the food to be weighed, and the registration in a diary of the food macronutrients available in it. The scale should have an interface that allows the visualization of the macronutrients, as well as the kilocalories (kcal) that have been registered throughout its usage, as well as the remaining macronutrients in order to achieve a certain goal of the day. Henceforward, "weight" will be used for the sake of simplicity, although mass is what it is actually measured by the scale. The processor to be used is PEPE, as shown in the schematic of Annex I.

1.2. Requirements

In order to simulate the food database contained within the scale, students should place in memory the information presented in Annex II. The table has the quantities of each macronutrient (Protein – P, Carbohydrates – C, and Fats – F) per 100 g for all the foods.

The user interface will be made through a display (output peripheral), with dimensions of 7x16 (7 lines, each containing 16 characters - bytes). Initially, the scale should be turned off, which means the display should be fulfilled with the ASCII character 20H (space). After being turned on, it should be presented in the display the main menu. This menu contains the three system modes that can be selected by the user: scale with food (macronutrients) storage, visualization of the total macronutrients and kcal registered up to the moment, and reset of the accumulated total. The detailed description of each mode will be done ahead, since before that it is useful to know which input peripherals exist in order to interact with the system.

Input peripherals

- Switch ON/OFF;
- Input SEL_NR_MENU;
- Switch OK;
- Switch CHANGE;
- WEIGHT.

The switch ON/OFF is used to turn on the scale (when it is switched off), and to switch off (when it is on). When switching off, the display should become completely clear (character 20H). When switched on again, the system should present the main menu.

The input SEL_NR_MENU is used to choose the number from the listed options in the menus that allow the choice of several options (e.g., in the main menu, or in a menu that allows choice of the foods from the several contained within the database). In this sense, some menus should indicate a numerical option for each of the possible choices.

The switch OK is used to validate the number chosen by the user (using the peripheral SEL_NR_MENU) within the menus that allow several choices. Thus, in each menu with several choices, the validation of the choice is done by the user using this switch.

The switch CHANGE allows, when the system is in the scale mode (described in detail below), to show the menus that contain the list of the foods present within the database. Each time this switch is pressed, a new list of foods should be shown, so that the user can choose a different food.

The weight of a food is provided as input to the system by the user through the WEIGHT peripheral, in hexadecimal. Whenever the user changes the value in WEIGHT (e.g., 00FFH = 255), the display should be updated with the corresponding ASCII information of the decimal digits (e.g., 255). Take into account that the ASCII character "0" has the value 30H = 48.

System Modes

In the scale mode, it should be shown to the user the current food chosen, as well as its weight. Whenever the weight changes, the display should be updated. In the case of exceeding the maximum value of 2500 g, it should be shown the value 0 again. If the user wants to change the food, he should use the switch CHANGE so that the system shows the new menu containing the foods within the database. The foods should be listed numerically so that the user can select and validate his choice (using the inputs SEL_NR_MENU and OK respectively). If the user tries to register a food with a given weight that leads to one of the macronutrients or kcals exceeding the range of values that can be represented (*overflow*), the system should display a warning to the user, and the registry of the food should not be done. In case it is possible to register all the food macronutrients and kcals for a given weight, the rounding should be done to the unity of gram (e.g., if you have 7,24 g you should register 7 g, and if you have 7,52 g you should register 8 g).

In mode of visualization of the totals registered, in addition to the total of each of the three macronutrients, the system should also show the total kcals. Each gram of P or C has 4 kcal, and each gram of F has 9 kcal.

In the mode of *resetting* the totals, the system should display to the user the information that it will reset the totals registered up to the moment, and ask for confirmation by the user in order to do the reset. Thus, this menu should include the option of cancelling, e.g., using the switch OK.

Finally, in the daily goal mode, the user should be able to set a daily goal for the kcal (or for each of the three macronutrients individually), and it must be possible for the user to view the remaining macronutrients and kcal in order to reach the specified daily goal.

In this evaluation work, it is expected that the student is capable of designing a personalized solution within the scope of the presented theme.

2. Work Plan

The following items will be taken into account in this evaluation work:
- Specification and design of the dataflow diagrams;
- Programming in *assembly* language and implementation;
- Implementation of extra/additional functions;
- Elaboration of the report.

- Specification and dataflow diagrams
- Brief study of requirements for the *software* solution;
- Drawing of dataflow diagrams for the main control modes and secondary procedures.

- Programming in *assembly* and implementation
- Programming the algorithm in *assembly* language;
- Experimental verification of the program.

- Work report
- Maximum of 5 pages;
- Cover with course, teachers and students identification;
- Project description and analysis of results;
- Annex A with dataflow diagrams;
- Annex B with the code in *assembly* language, which should be organized and commented.

3. Important information

- The second evaluation work (report and oral) represents 20% of the final grade and has a minimum grade of 8/20;
- The work should be done individually or in groups of two elements;
- Code should have comments, otherwise penalties will be given;
- The report in PDF, the file with the *assembly* code (.asm) and the simulator used should be zipped in one file, and sent to the Student Support Office ("trabalhos@uma.pt") no later than 19-05-2021. In the email body that will be sent, you should state your name and student number, the course name, the work identification and the teachers' name.
- On the day of the discussion (19-05-2021), each student has to show the program working correctly, and thus it is asked that you bring your personal laptop with you.
- In the discussion evaluation it will be taken into account if any extra/additional function to those proposed in the work was implemented, with a value of 1 point out of 20.

Annex I - PEPE processor and connection to the data memory
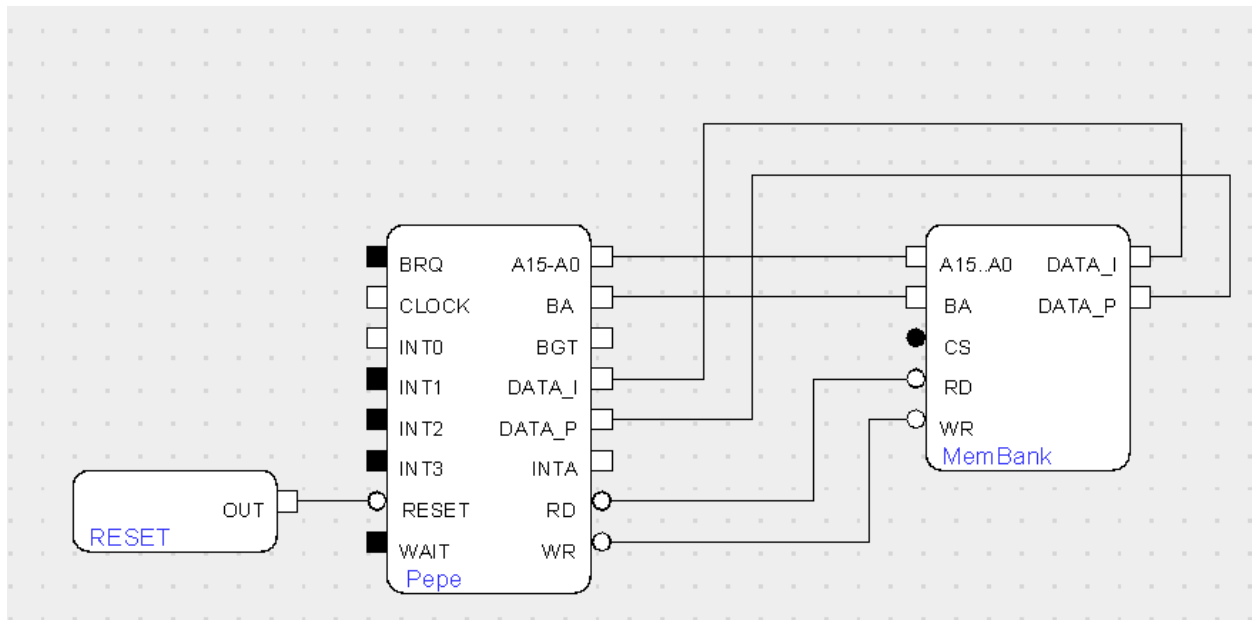
Annex II – Table with macronutrients for each 100g of a specific food

Food	Protein (P)	Carbohydrates (C)	Fats (F)
Oats	11	56	7
Sliced Bread	9	42	3
Potatoes	3	19	0
Rice	7	25	0
Beans	10	13	0
Legumes	3	7	0
Tomato	1	3	0
Banana	1	23	0
Orange	1	12	0
Apple	1	14	0
Kiwi	1	15	0
Choc. Cookie	9	59	22
Pizza C&H PD	13	25	9
Almonds	25	6	55
Linseed	18	34	36
Olive Oil	0	0	100
Skim Milk	3	4	0
Whey	80	8	4
Salmon	21	0	15
White Fish	20	0	1
Tuna	25	0	2
Pork	22	0	15
Chicken	25	0	4
Turkey	28	0	1
Egg	7	0	5
Cheese	28	0	13