QUESTION 2: DELPHI – OBJECT-ORIENTED PROGRAMMING

The local municipality wants to make people more aware of how much water they are using on a daily basis. They want software for personal use by households to encourage them to use water sparingly.

A program, that has been partially developed, consists of an object class (unit), which describes the attributes and behaviours of a household regarding their water usage, and an application class (main unit). The program has to process data regarding the daily water consumption of the household over a period of one week and display information they can use to monitor their water usage.

Do the following:

- Rename the folder **Question2_Delphi** as **Question2_X** (where X must be replaced with your examination number).
- Open Delphi and then open the file **Question2_P.dpr** in the folder **Question2_X**.
- Go to 'File/Save As …' and save the main unit as **Question2_UXXXX** (where XXXX must be replaced with the last FOUR digits of your examination number).
- Open the unit **uHousehold.pas**.
- Go to 'File/Save As …' and save the unit as **uHouseholdXXXX.pas** (where XXXX must be replaced with the last FOUR digits of your examination number).
- Go to 'File/Save Project As …' and save the project as **Question2_PXXXX** (where XXXX must be replaced with the last FOUR digits of your examination number).

You are required to correct and complete the given program by doing the following:

2.1 The unit named **uHouseholdXXXX.pas** contains attributes and methods that describe the water usage of a single household. Modify code in the given methods and write some additional methods, as described below.

2.1.1 The constructor receives the following information of a household as parameters:

- An account number
- The number of members in the household
- An array containing seven integer values representing the daily water usage of the household, measured in litres, over a period of one week

Initialise the account number field, the number of members field and the array, using the parameters received by the constructor. (3)

2.1.2 Write a method called **calculateTotal** to calculate and return the total amount of water used by the household during one week. Use the values assigned to the array to calculate the total. (4)

2.1.3 Write a method called **calculateAve** to calculate and return the average water usage of the household per day. Use the method **calculateTotal** in the calculation. (2)

2.1.4 Write a method called **determineHighDay** that will calculate and return the day of the week when the most water was used by the household. The value to be returned must be a number. (4)

2.1.5 The method called **determineHighRisk** will return a Boolean value indicating whether the household is a high-risk household or not, in terms of their water usage. The method receives a parameter indicating the acceptable limit of water usage for a household per day.

A household is a high-risk household in terms of water usage, if:

- The average water usage of the household per day is more than the daily limit

OR

- More than two of the daily water-usage figures by the household in one week exceed the daily limit

Complete the method to return the correct Boolean value based on the criteria explained above. (9)

2.1.6 You have been provided with a method called **toString** that constructs and returns a string containing the account number and the number of members in the household.

Add code to the method so that the string will include headings, labels and the contents of the array in the following format:

Account number: xxxxx
Number of members: x
Daily water usage

Days:	1	2	3	etc.
Water used:	xxx	xxx	xxx	etc.

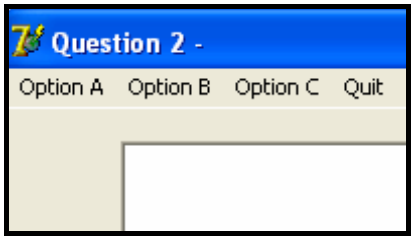
Example of the output when the string returned by the **toString** method is displayed:

Account number: AC-23245
Number of members: 4
Daily water usage

Days:	1	2	3	4	5	6	7
Water used:	481	438	454	353	421	396	432

(6)

2.2 In the **Question2_UXXXX.pas** file (the main unit) you have been provided with a menu component that will display the following options when you execute the program:



Do the following:

- Add your examination number to the right of 'Question 2 –' in the caption of the form.
- Write code in the given **Question2_UXXXX.pas** file (the main unit) to do the following:

2.2.1 Use the account number, the number of members in the household and the array containing the water-usage values of the household for seven days, as given in the program, to create a type **THousehold** object. (2)

2.2.2 **Menu Option A**

When the user selects this menu option, the program must invoke the relevant methods to display the account number, number of members in the household, the water usage for each of the seven days of the week, the total water usage and the average water usage per day as shown below.

Example of the output:

```
Account number: AC-23245
Number of members: 4
Daily water usage
Days:          1    2    3    4    5    6    7
Water used:    481  438  454  353  421  396  432

Total water usage: 2975 litres
Average water usage per day: 425.0 litres
```

(4)

2.2.3 **Menu Option B**

When the user selects this menu option, the program must display a heading and invoke the relevant methods to display the average water usage of the household per day. The program must then display subheadings and the days on which the water usage exceeded the average water usage per day, and by how many litres it was exceeded.

Example of the output (on the next page):

```
Days and amount of water exceeding the average
========================================
Average water usage per day: 425.0 litres
Days   Value exceeding average by (litres)
1          56.0
2          13.0
3          29.0
7          7.0
```

(6)

2.2.4 **Menu Option C**

When the user selects this menu option, the user will be asked to enter a value representing an acceptable limit of water usage for a household per day. The program must invoke the relevant methods to display the information, as shown in the sample output. Also display a suitable message indicating whether the household is a high-risk household or not.

Example of the output with an input value of 400:

```
Account number: AC-23245
Number of members: 4
Daily water usage
Days:          1     2     3     4     5     6     7
Water used:    481   438   454   353   421   396   432

The day on which the most water was used: 1

High-risk household
```

(5)

- Make sure your examination number is entered as a comment in the first line of the main unit **Question2_UXXXX.pas**, as well as the unit **uHouseholdXXXX.pas**.
- Save all the files (File/Save All).
- Printouts of the code for the main unit **Question2_UXXXX.pas** and the unit **uHouseholdXXXX.pas** will be required.

[45]