GCSE
COMPUTER SCIENCE

Component 3 Programming project task

For candidates entering for the **June 2020** 8520 examination.

To be issued to candidates on 1 April 2019 or as soon as possible after that date.

Time allowed
- 20 hours

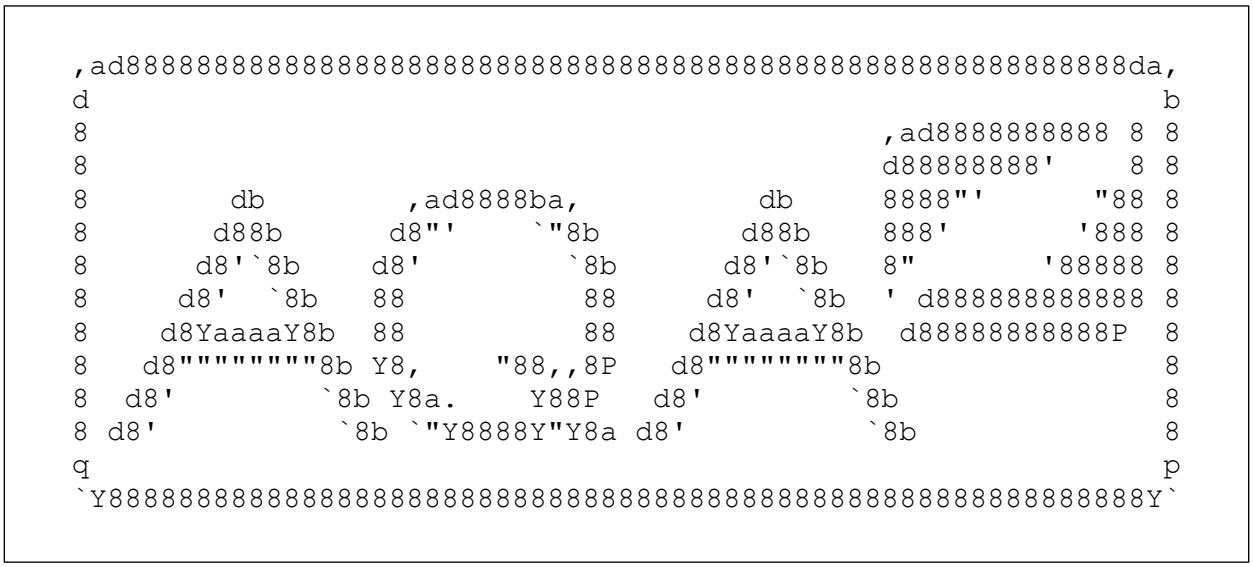
Instructions
- Evidence must include a complete listing of all program code together with a report. The report should describe the design of the solution, the testing and any potential enhancements and refinements to the solution.
- Students must use one of the following programming languages:
  - C#
  - Java
  - Pascal/Delphi
  - Python
  - VB.Net

Information
- The project is designed to be completed in 20 hours.
- The allocated time is not required to be continuous.
- There are restrictions on when and where students can work on this problem. Please see the Teachers' Notes which accompany this task for more information about these restrictions.
- Students may need to use the Internet to research certain parts of the problem. This must be within the 20 hours.
- Submission may be paper based or electronic using CD/DVD.
- Students will need to complete and sign a Candidate Record Form which declares that the work is their own. This must be countersigned by the teacher.
- Copyright permission is granted by AQA to use the copyright in the materials on the condition that such use is limited strictly to the personal use by each teacher and their students for the purpose of the preparation for and conduct of the programming project task only. The materials are not to be provided to anyone other than the teacher and the students undertaking the task. The teacher must collect this task back from the students at the end of each session. The use of the materials for the production and publication in any format of teaching materials or any other such material (other than for the teacher's personal use) is strictly forbidden.

AQA ASCII Art

ASCII art is a technique that uses multiple lines consisting of the 95 printable characters defined by the ASCII character set to create a graphical image. **Figure 1** shows an example of an ASCII art image.

Figure 1



The aim of compression is to reduce the number of bits needed to represent data. Reducing the number of bits used means that the data will take up less storage space and be quicker to transfer.

Run length encoding (RLE) is a simple method of compressing data that specifies the number of consecutive occurrences of a data item followed by the value of the data item.

Figure 2 shows an example of how a line from an ASCII art image can be compressed using RLE.

Figure 2

This is a line of uncompressed data:

```
aad888888           888888bbe
```

This represents the compressed data for the line above:

```
02a01d06810 06802b01e
```

Each set of three characters in the compressed data consists of a two-digit number representing the number of consecutive occurrences of a character in the ASCII art image followed by the character itself.

The line of uncompressed data in **Figure 2** is 28 characters in length, including the space characters, and the compressed data is 21 characters in length; this gives a saving of 7 characters.

Introduction to the programming project:

A program needs to be created that can compress ASCII art using RLE and decompress ASCII art that has been compressed using RLE.

Two text files have been provided that you may choose to use when testing your program:

- **LogoArt.txt** contains the ASCII art image shown in **Figure 1**
- **LogoRLE.txt** contains the compressed version of the ASCII art image shown in **Figure 1**.

When completing this programming project, you should always use two digits to represent the length of a run, even if the run could be represented using just one digit. You may assume that two digits will always be enough to represent the length of a run.

The program should work in the following way:

1 A menu is displayed allowing the user to select from the following options:

- Enter RLE
- Display ASCII art
- Convert to ASCII art
- Convert to RLE
- Quit.

2 If the user selects the 'Quit' option then a suitable message should be displayed and the program ends.

3 If the user selects the 'Enter RLE' option:
   a. the user is asked how many lines of RLE compressed data they want to enter
   b. the program should check that the number entered is greater than 2 and if it isn't display a suitable error message and get the user to keep re-entering the number until it is valid
   c. if the user entered a valid number, they then enter the compressed data one line at a time until they have entered the specified number of lines
   d. once all the compressed data has been entered, the program decompresses the data and displays the ASCII art image
   e. the user is returned to the main menu.

4 If the user selects the 'Display ASCII art' option:
   a. the user is asked to enter the name of the text file that contains the ASCII art
   b. the program reads the contents of the text file and displays the ASCII art image
   c. the user is returned to the main menu.

5 If the user selects the 'Convert to ASCII art' option:
   a. the user is asked to enter the name of the text file that contains the RLE compressed data
   b. the program reads the contents of the text file, decompresses the data and displays the ASCII art image
   c. the user is returned to the main menu.

6 If the user selects the 'Convert to RLE' option:
   a. the user is asked to enter the name of the text file that contains the ASCII art
   b. the program reads the contents of the text file, compresses each line and stores the compressed data in a new text file
   c. the program calculates the difference between the number of characters used in the compressed and uncompressed versions of the ASCII art and displays this value
   d. the user is returned to the main menu.

END OF PROGRAMMING PROJECT TASK