AQA

GCSE
COMPUTER SCIENCE
Component 3 Programming Project Task

For candidates entering for the **June 2021** 8520 examination.

To be issued to candidates on 1 April 2020 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.

8520/CA/CB/CC/CD/CE

Flight Planning

A new airline wants to start running commercial passenger flights. In order to assess the feasibility of proposed flights they want a program that can help them calculate the likely profitability of running a flight between a UK airport and an overseas airport. The UK airport will be either Liverpool John Lennon or Bournemouth International.

A comma separated (csv) file called **Airports.txt** has been provided that contains the name and code for each overseas airport, the distance from Liverpool John Lennon airport and the distance from Bournemouth International airport. The contents of this comma separated file are shown in **Figure 1**.

Figure 1

Overseas airport code	Overseas airport name	Distance from Liverpool John Lennon (km)	Distance from Bournemouth International (km)
JFK	John F Kennedy International	5326	5486
ORY	Paris-Orly	629	379
MAD	Adolfo Suarez Madrid-Barajas	1428	1151
AMS	Amsterdam Schiphol	526	489
CAI	Cairo International	3779	3584

When the program is used, the following details will need to be entered:

- UK airport
- overseas airport
- type of aircraft
- number of first-class seats
- price of a first-class seat
- price of a standard-class seat.

The airline owns three types of aircraft. **Figure 2** shows the characteristics of each type of aircraft.

Figure 2

Type	Running cost per seat per 100 km	Maximum flight range (km)	Capacity if all seats are standard-class	Minimum number of first-class seats (if there are any)
Medium narrow body	£8	2650	180	8
Large narrow body	£7	5600	220	10
Medium wide body	£5	4050	406	14

From the details provided by the user, the program will calculate the potential profit or loss of running the proposed flight assuming it is at maximum capacity. **Figure 3** shows how the profit or loss is calculated. Each first-class seat takes up space for two standard-class seats.

Figure 3

Number of standard-class seats	Capacity if all seats are standard-class – Number of first-class seats x 2
Flight cost per seat	running cost per seat per 100 km (for the selected type of aircraft) × distance between the UK airport and the overseas airport / 100
Flight cost	flight cost per seat × (number of first-class seats + number of standard-class seats)
Flight income	number of first-class seats × price of a first-class seat + number of standard-class seats × price of a standard-class seat
Flight profit	flight income - flight cost

Figure 4 shows an example.

Figure 4

UK airport	Liverpool John Lennon
Overseas airport	John F Kennedy International
Distance	5326 kilometres
Type of aircraft	Large narrow body
Maximum flight range	5600 kilometres
Running cost per seat per 100 kilometres	£7
Capacity if all seats are standard-class	220
Number of first-class seats	40
Number of standard-class seats: 220 - 40 × 2	140
Price of a standard-class seat	£400
Price of a first-class seat	£1200
Flight cost per seat: 7 × 5326/100	£372.82
Flight cost: 372.82 × (140 + 40)	£67 107.60
Flight income: 140 × 400 + 40 × 1200	£56 000 + £48 000 = £104 000
Flight profit: 104 000 - 67 107.6	£36 892.40

The user will also have the option to clear all the data they have entered and start again.

The program should work in the following way:

1. The program should read in the comma separated file **Airports.txt**

2. A menu should be displayed allowing the user to select from the following options:
   - Enter airport details
   - Enter flight details
   - Enter price plan and calculate profit
   - Clear data
   - Quit

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

4. If the user selects the 'Enter airport details' option:
   a. the user should be asked to enter the three-letter airport code for the UK airport
   b. if the code entered is not for Liverpool John Lennon (LPL) or Bournemouth International (BOH) then a suitable error message should be displayed and the user returned to the main menu
   c. the user should then be asked to enter the three-letter airport code for the overseas airport
   d. the program should check that the code for the overseas airport is valid based on the data read from the csv file
      - if the code for the overseas airport is valid then the full name of the overseas airport should be displayed
      - if the code for the overseas airport is not valid then a suitable error message should be displayed
   e. the user should be returned to the main menu.

5. If the user selects the 'Enter flight details' option:
   a. the user should be asked to enter the type of aircraft to be used. The allowed types are shown in **Figure 2**
   b. if the type of aircraft is not valid then a suitable error message should be displayed and the user returned to the main menu
   c. the data in **Figure 2** for that type of aircraft should then be displayed
   d. the user should then be asked to enter the number of first-class seats on the aircraft
   e. if the number of first-class seats entered is not 0 then:
      - if the number of first-class seats is less than the 'minimum number of first-class seats' then a suitable error message should be displayed and the user returned to the main menu
      - if the number of first-class seats is greater than half the 'capacity if all seats are standard-class' then a suitable error message should be displayed and the user returned to the main menu.
   f. the program should then calculate the number of standard-class seats on the aircraft using the formula:

      'Capacity if all seats are standard-class – Number of first-class seats x 2'

   g. the user should be returned to the main menu.

6. If the user selects the 'Enter price plan and calculate profit' option:
   a. the program should check that codes for the UK and overseas airports have been entered. If not then a suitable error message should be displayed and the user returned to the main menu
   b. the program should check if the type of aircraft has been entered. If not then a suitable error message should be displayed and the user returned to the main menu
   c. the program should check that the number of first-class seats has been entered. If not then a suitable error message should be displayed and the user returned to the main menu
   d. the program should check that the maximum flight range for the type of aircraft is greater than or equal to the distance between the airports. If not then a suitable error message should be displayed and the user returned to the main menu
   e. the user should be asked to enter the price of a standard-class seat and the price of a first-class seat
   f. the program should then calculate the flight cost per seat, flight cost, flight income and flight profit using the formulae shown in **Figure 3**
   g. the results of these calculations should be displayed and the user returned to the main menu.

7. If the user selects the 'Clear data' option:
   - the program should clear all data that has been entered by the user and then return the user to the main menu.

END OF PROGRAMMING PROJECT TASK