A-LEVEL COMPUTER SCIENCE • EXERCISE SHEET

10.3 Files

Name: _____ Class: _____ Date: _____ **Total: 31 marks**

KEY WORDS file 文件 • text file 文本文件 • end of file 文件结束 • record 记录

Objective

Build the skills to answer exam questions on **text files** 文本文件 — why files are needed, and reading and writing them in pseudocode.

You must be able to:

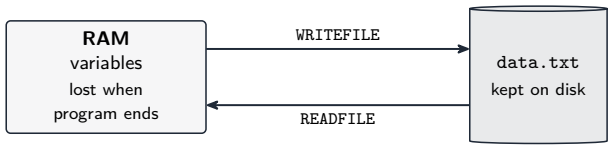
- explain **why** a program uses files
- write pseudocode to **read** a text file line by line using `EOF`
- write pseudocode to **write** or **append** lines to a text file

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Why files

Variables live in **RAM** and are lost when the program ends. A **file** on disk is **kept** between runs — so it stores data permanently (high scores, records) and lets programs share data.



■ Reading a text file

Open it, read each line until **end of file**, then **close** it:

```
OPENFILE "data.txt" FOR READ
WHILE NOT EOF("data.txt") DO
    READFILE "data.txt", LineString
    OUTPUT LineString
ENDWHILE
CLOSEFILE "data.txt"
```

`EOF` returns `TRUE` when there is nothing left to read — test it **before** each `READFILE`.

■ Writing and appending

`FOR WRITE` creates a new file (or **overwrites** an old one); `FOR APPEND` keeps the existing lines and adds after them:

```
OPENFILE "log.txt" FOR WRITE
FOR i ← 1 TO 100
    WRITEFILE "log.txt", "Event " & i
NEXT i
CLOSEFILE "log.txt"
```

Always **close** a file — otherwise buffered writes can be lost and the file may stay locked.

2 Practice

Now apply the methods above.

2.1 State **one** reason a program needs to use a file rather than only variables. [1]

2.2 State when the function `EOF` returns `TRUE`. [1]

2.3 Write pseudocode to **open** `"scores.txt"` for reading and then **close** it. [2]

2.4 State **one** reason you must always **close** a file. [1]

3 Exam-style questions

3.1 Write pseudocode to read **every line** of `"names.txt"` and output each line. [4]

3.2 Write pseudocode to write the numbers **1 to 50**, one per line, to a new file `"nums.txt"`. [3]

3.3 A file `"members.txt"` holds one name per line. Write pseudocode to **count** how many names are in the file and output the total. [4]

3.4 A sports club stores one line per member in a text file `members.txt`. Each line holds the membership number, the surname and the class of membership, separated by the character `|`.

```
40118|Chen|Full
40119|Osei|Junior
```

(a) **Explain** why a **separator** character is needed, and **state** one property the chosen character must have. [3]

(b) **Write** pseudocode for a procedure `CountClass(Wanted)` that reads the whole file and outputs how many members are in the class given by `Wanted`. [6]

(c) The club adds two new items for each member: a phone number and an emergency contact, **both encrypted**. **Explain** one problem this could cause for the file format, and **describe** how you would solve it. [3]

(d) **Compare** storing this data in a **serial** file with storing it in a **sequential** file ordered by membership number, for the task of finding one member. [3]

Solutions

Each answer shows the steps, then the **result**.

2.1

- any one: data is **kept** after the program ends; it stores large amounts permanently; it lets programs share data / restart from a saved state

2.2

- when the **end of the file** has been reached — there is nothing left to read

2.3

- open for read, then close

```
OPENFILE "scores.txt" FOR READ
CLOSEFILE "scores.txt"
```

2.4

- any one: so **buffered writes are saved**; so the file is not left **locked** for other programs

3.1

- open, loop until EOF, read and output, then close

```
OPENFILE "names.txt" FOR READ
WHILE NOT EOF("names.txt") DO
    READFILE "names.txt", Line
    OUTPUT Line
ENDWHILE
CLOSEFILE "names.txt"
```

3.2

- open for write, loop 1 to 50, then close

```
OPENFILE "nums.txt" FOR WRITE
FOR i ← 1 TO 50
    WRITEFILE "nums.txt", i
NEXT i
CLOSEFILE "nums.txt"
```

3.3

- start `Count` at 0, then read every record

```
Count ← 0
OPENFILE "members.txt" FOR READ
WHILE NOT EOF("members.txt") DO
    READFILE "members.txt", Name
    Count ← Count + 1
ENDWHILE
CLOSEFILE "members.txt"
OUTPUT Count
```

- increment inside the loop; close and output

3.4

(a) the three items are of different lengths, so without a marker the program cannot tell where one field ends and the next begins

- the separator must be a character that can **never appear inside the data itself** — a surname could contain a space or a hyphen, so `|` is safer than either

(b)

```
PROCEDURE CountClass(Wanted : STRING)
    DECLARE Line, ThisClass : STRING
    DECLARE Count : INTEGER
    Count ← 0
    OPENFILE "members.txt" FOR READ
    WHILE NOT EOF("members.txt")
        READFILE "members.txt", Line
        ThisClass ← the text after the second "|" in Line
        IF ThisClass = Wanted THEN Count ← Count + 1 ENDIF
    ENDWHILE
    CLOSEFILE "members.txt"
    OUTPUT Count
ENDPROCEDURE
```

- header with parameter; counter initialised; `OPENFILE … FOR READ`; `WHILE NOT EOF` with `READFILE`; the field extracted and compared; `CLOSEFILE` and output

(c) encrypted data is arbitrary bytes, so it may **contain the separator character itself**, which would split one field into two and corrupt every field after it on that line

- encode the encrypted values in a form that cannot contain `|` (hex or Base64), or use fixed-length fields instead of a separator

(d) in a **serial** file the records are in the order they were added, so a search must read from the start until it finds the member: on average half the file

- a **sequential** file is ordered by membership number, so the search can stop as soon as it passes the wanted key, and the file can be searched far faster
- the cost is that inserting a new member into a sequential file means rewriting the file to keep the order, whereas a serial file just appends