

13.2 File Organisation and Access

May/June 2015.P31/P32

- 3 (ii) The programmer decides to store all the data in a file. Initially, data from 27 locations will be stored. More rainfall locations will be added over time and will never exceed 100.

The programmer has to choose between two types of file organisation. The two types are serial and sequential.

Give **two** reasons for choosing serial file organisation.

[2]

May/June 2015.P33

- 4 (b) Temperature data from a number of weather stations are to be processed by a program.

The following data are to be stored:

- weather station ID (a unique four-letter code)
- latitude (to 2 decimal places)
- average temperature (to the nearest whole number) for each year from 2001 to 2015 inclusive

A programmer designs a composite data type `WeatherStation`. A variable of this type can be used to store all the data for one particular station.

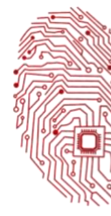
- (ii) The programmer decides to store all the data in a file. The number of weather stations could grow to reach 20000, but not all stations will be present at first.

The programmer decides on random organisation for the file.

Describe **three** steps which show how a new weather station record is added to the file.

[3]





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May/June 2016.P31/P32/P33

- 4 (a) Three file organisation methods and two file access methods are shown below.

Draw lines to link each file organisation method to its appropriate file access method or methods.

File organisation method

serial

sequential

random

File access method

direct

sequential



[4]

- (b) A bank has a very large number of customers. The bank stores data for each customer. This includes:

- unique customer number
- personal data (name, address, telephone number)
- transactions

The bank computer system makes use of three files:

- A – a file that stores customer personal data. This file is used at the end of each month for the production of the monthly statement.
- B – a file that stores encrypted personal identification numbers (PINs) for customer bank cards. This file is accessed when the customer attempts to withdraw cash at a cash machine (ATM).



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- C – a file that stores all customer transaction records for the current month. Every time the customer makes a transaction, a new record is created.

For each of the files A, B and C, state an appropriate method of organisation. Justify your choice.

- (i) File A organisation + Justification [3]
- (ii) File B organisation + Justification [3]
- (iii) File C organisation + Justification [3]

May/June 2017.P31/P33

- 4 A bank has 95000 customers. Each customer has a unique ID.

When a customer uses an Automated Teller Machine (ATM) to obtain cash, their current balance is checked. The balance is stored in a file which has the following fields:

- the customer ID (6-digit number in the range 100000 to 999999)
 - an encrypted PIN
 - the current balance
- The file can store a maximum of 100000 records.

- (a) Give a reason why a random organisation would be appropriate for this file. [1]

- (b) An algorithm for inserting a new record in this file uses the following hash function:

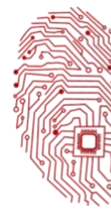
$$\text{RecordKey} = \text{CustomerID} \text{ MOD } 100000$$

where RecordKey is the record position in the file.

- (i) Complete the table to show the values generated by the hash function for the given customer IDs.

| CustomerID | RecordKey |
|------------|-----------|
| 802139 | 2139 |
| 700004 | |
| 689998 | |
| 102139 | |





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[1]

(ii) State the range of possible values for RecordKey.

Minimum value of RecordKey:

Maximum value of RecordKey:

[2]

(iii) A procedure is written to insert a new record into the file.

Complete the algorithm for this procedure.

```
PROCEDURE InsertRecord(CustomerID : INTEGER)
    RecordKey ← CustomerID MOD 100000
    Success ← FALSE
    // Find position for new record and insert it
    REPEAT
        IF record at position RecordKey is .....
            THEN
                Insert new record at position RecordKey
                Success ← TRUE
            ELSE
                IF RecordKey = .....
                    THEN
                        RecordKey ← .....
                    ELSE
                        RecordKey ← ..... + 1
                    ENDIF
                ENDIF
            UNTIL Success = TRUE
    ENDPROCEDURE
```



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[4]

(c)(i) Explain why an encrypted version of the PIN is stored in the file.

[2]

(ii) A customer attempts to withdraw cash from an ATM. An algorithm is used to check if the customer has entered the correct PIN.

Complete the algorithm.

1. Customer ID is read from card.
2. Customer enters PIN.
3. Customer PIN is
- 4.
5. Customer record is located in file.
- 6.
7. If match then transaction can proceed.

[3]

May/June 2017.P32

4 (a) Three file organisation methods and two file access methods are shown below.

Draw lines to link each file organisation method to its appropriate file access method(s).

File organisation method

random

serial

sequential

File access method

sequential

direct

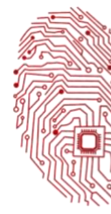


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[4]

(b) An energy company supplies electricity to a large number of customers. Each customer has a meter that records the amount of electricity used. Customers submit meter readings using their online account.

The company's computer system stores data about its customers.

This data includes:

- account number
- personal data (name, address, telephone number)
- meter readings
- username and encrypted password.

The computer system uses three files:

| File | Content | Use |
|------|--|---|
| A | Account number and meter readings for the current month. | Each time a customer submits their reading, a new record is added to the file. |
| B | Customer's personal data. | At the end of the month to create a statement that shows the electricity supplied and the total cost. |
| C | Username and encrypted passwords. | When customers log in to their accounts to submit meter readings. |





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For each of the files A, B and C, state an appropriate file organisation method for the use given in the table.

All three file organisation methods must be different.

Justify your choice.

(i) File A organization: [3]

(ii) File B organization: [3]

(iii) File C organization: [3]

May/June 2018.P32

- 1 (c)(ii) Data about all students and their assessments are stored in a file that uses random organisation. The StudentID is used as the key field.

The program allows a user to enter data for a new student.

Explain how the program adds the new data to the file.

[3]



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13.2 File Organisation and Access

Oct/Nov 2019.P32

5 A weather station uses monitoring and control systems.

(b)(i) The weather station records how the outside temperature changes over a period of time. The system will read the temperature once every hour, over a period of 100 days.

The temperature readings are automatically stored in a file. No other data are stored.

Explain why the weather station has decided to use serial organisation for the file. [2]

(ii) Serial files can be accessed using sequential access.

Explain how sequential access could be used for the temperature readings file. [2]

(iii) Name and describe a method of file organisation other than serial or sequential. [4]



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May/June 2020.P31/P32/P33

2 The diagram shows four files and three methods of file organisation.

Draw **one** line to match each file with its most appropriate method of file organisation.

File

Text file

File for recording the temperature every hour

Master file for paying each employee every month

Customer user name and password file

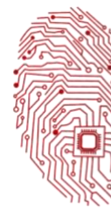
File organisation

Sequential

Random

Serial





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[4]

Oct/Nov 2021.P31/P33

- 1 (c) Data about all the computers are stored in a file that uses random file organisation.

ComputerID is used as the key field.

Explain how a program could search for a record stored in this file.

[3]

Oct/Nov 2021.P32

- 1 (c) Data about all the bicycles are stored in a file that uses random file organisation.

BicycleID is used as the key field.

Explain how a program could add an extra record to this file.

[3]

Oct/Nov 2021.P31/P32/P33 (9618)

- 5 (a) Compare sequential and serial methods of file organisation.

[4]

(b) State the most suitable method of file access when a record is referenced by a unique address on a disk-type storage medium.

[1]

(c) State the most suitable method of file access when a bank stores its data records in ascending order of account number.

[1]

