1   Real numbers are stored in a computer system using floating-point representation with:

- 10 bits for the mantissa
- 6 bits for the exponent
- Two's complement form for both the mantissa and the exponent.

(a) Calculate the normalised floating-point representation of –7.25 in this system.
Show your working.

Mantissa

Exponent

Working ....

....

....

....

....

....

....

....

[3]

(b) Calculate the denary value of the given binary floating-point number.
Show your working.

Mantissa

1	0	1	1	0	0	0	1	1	1

Exponent

0	0	0	1	1	1

Working ....

....

....

....

....

Answer ....

[3]

(c) The given binary floating-point number is not normalised.

Normalise the floating-point number. Show your working.

Mantissa

0	0	0	0	0	0	0	1	1	1

Exponent

1	0	0	1	1	1

Mantissa

Exponent

Working ....

....

....

....

....

....

[3]

(d) The denary number 513 cannot be stored accurately as a normalised floating-point number in this computer system.

(i) Explain the reason for this.

....

....

....

....

....

.... [3]

(ii) Describe an alteration to the way floating-point numbers are stored to enable this number to be stored accurately using the same total number of bits.

....

....

....

.... [2]

2 (a) Describe the purpose of a user-defined data type.

....

....

....

....

.... [2]

(b) Define, using pseudocode, the following enumerated data types:

(i) `SchoolDay` to hold data about the days students are usually in school.

....

.... [1]

(ii) `WeekEnd` to hold data about the days that are not school days.

....

.... [1]

(c) Define, using pseudocode, the composite data type `ClubMeet`. This will hold data about club members that includes:

- first name and last name
- the two days they attend:
  - one on a school day
  - one not on a school day.

Use the enumerated types you created in **part (b)**.

....

....

....

....

....

....

....

.... [4]

1 (a) Numbers are stored in a computer using floating-point representation with:

- 12 bits for the mantissa
- 4 bits for the exponent
- two's complement form for both the mantissa and exponent.

(i) Write the normalised floating-point representation of the following unsigned binary number using this system.

1011100.011001

Working ....

....

....

....

....

Mantissa	**Exponent**
0 1 0 1 1 1 0 0 0 1 1 0	0 1 1 1

[2]

(ii) State the consequence of storing the binary number in **part (a)(i)** as a floating-point number in this system. Justify your answer.

Consequence ....

....

Justification ....

....

....

[2]

(b) Explain the reason why binary numbers are stored in normalised form.

....

....

....

....

....

....

.... [3]

3 Enumerated and pointer are two non-composite data types.

(a) Write **pseudocode** to create an enumerated type called `Parts` to include these parts sold in a computer shop:

`Monitor, CPU, SSD, HDD, LaserPrinter, Keyboard, Mouse`

....

....

.... [2]

(b) Write **pseudocode** to create a pointer type called `SelectParts` that will reference the memory location in which the current part name is stored.

....

....

.... [2]

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]

1 Data types can be defined using pseudocode.

The data type, `LibraryRecord`, is defined in pseudocode as:

```
TYPE LibraryRecord
    DECLARE Title : STRING
    DECLARE Fiction : BOOLEAN
    DECLARE Author : STRING
    DECLARE NumberOfCopies : INTEGER
ENDTYPE
```

A variable, `LibraryBook`, is declared in pseudocode as:

```
DECLARE LibraryBook : LibraryRecord
```

(a) Write **pseudocode** statements to assign:

- `A Level Computer Science` to `Title` of `LibraryBook`
- `FALSE` to `Fiction` of `LibraryBook`.

....

....

....

.... [2]

(b) The type definition for `LibraryRecord` is changed.

(i) The value for `NumberOfCopies` must be between `1` and `10` inclusive.

Write the updated line of **pseudocode** from the type definition of `LibraryRecord` to implement the change.

....

.... [1]

(ii) Every copy of every book is now uniquely identified by an accession number, `AccessionNumber`, as it is added to the library. Each library record will include one or more accession numbers. Each accession number is an integer.

Write the extra line of **pseudocode** needed in the type definition of `LibraryRecord`.

....

....

....

.... [2]

(c) A record is a user-defined composite data type.

Explain what is meant by a **user-defined composite data type**.
Include an example of **another** user-defined composite data type in your answer.

....

....

....

....

....

....

[3]

1   Real numbers are stored in a computer system using floating-point representation with:

- 8 bits for the mantissa
- 8 bits for the exponent
- two's complement form for both mantissa and exponent.

(a) Write the normalised floating-point representation of +202 in this system.
Show your working.

Mantissa   **Exponent**

| | | | | | | | | | | | | | | | | |

Working ....

....

....

....

....

....

[3]

(b) Write the normalised floating-point representation of −202 in this system.
Show your working.

Mantissa   **Exponent**

| | | | | | | | | | | | | | | | | |

Working ....

....

....

....

....

....

[3]

(c) A binary number is stored in the computer system.

Mantissa

0	0	0	1	1	1	1	0

Exponent

0	0	0	1	1	0	0	0

(i) State why the number is **not** normalised.

....

.... [1]

(ii) Write the normalised floating-point representation of the number.

Mantissa

Exponent

[2]

3 (a) State what is meant by the term **enumerated data type**.

....

.... [1]

(b) State what is meant by the term **pointer data type**.

....

.... [1]

(c) The months of the year are: January, February, March, April, May, June, July, August, September, October, November and December.

Write the **pseudocode** statement to define the data type `Quarter1`, to hold the names of the first three months of a year.

....

....

....

.... [2]

(d) The composite data type `Pet` is used to store data about the various pets of a group of students. It uses these fields:

Field name	Data type
PetName	String
AnimalType	String
PetAge	Integer
PetGender	Char
OwnerName	String

(i) Write the **pseudocode** statement to set up a variable for one record of the composite data type `Pet`.

....

.... [1]

(ii) Write **pseudocode** to store the details of the following pet, in the variable you set up in **part (d)(i)**.

PetName	AnimalType	PetAge	PetGender	OwnerName
Tibbles	Cat	8	M	Jasmine Smith

....

....

....

....

....

.... [3]