

- 8 A program is being developed to manage student book loans from a college library. Students may borrow up to five books at a time from the library.

The programmer has defined a record type to define each loan.

The record data items are:

Data item	Data type	Comment
StudentID	STRING	the unique ID of the student who has borrowed the book
BookID	STRING	the unique ID of the book being borrowed
OnLoan	BOOLEAN	TRUE if the book has not been returned

The programmer has defined a global array `Loan` to store 5000 loan records.

There are more elements in the array than books in the library. Unused elements have the `StudentID` set to an empty string. These may occur anywhere in the array.

The programmer has defined the first program module:

Module	Description
<code>OKToBorrow()</code>	- called with a parameter of type <code>STRING</code> representing a <code>StudentID</code> - search the array for loan records for the specified student - output a suitable message to say whether the student may, or may not, borrow another book

(a) Write efficient pseudocode for the module `OKToBorrow()`

[7]

(b) A second module is defined:

Module	Description
ReturnBook()	- called with two parameters of type <code>STRING</code> representing a <code>StudentID</code> and a <code>BookID</code> - searches the array for the relevant loan record - when found, sets <code>OnLoan</code> to <code>FALSE</code> and returns <code>TRUE</code> - if a loan record is not found, or the book has already been returned, then returns <code>FALSE</code>

Write efficient pseudocode for the module `ReturnBook()`

Assume that each student is only allowed to borrow each book only once. That means that there will be no more than **one** loan record for a given combination of student and book.

Handwriting practice sheet with 20 rows of dotted lines for tracing and writing.

[8]

- (c) It is decided to introduce a system of fines for books that have been borrowed for too long.
- Two new requirements are defined:
1.

Each loan has a maximum length, represented as a number of days.
2.

Each book in the library will be assigned one of three categories. Each category has a different maximum loan length.

Record structure and program design changes are needed to meet these two requirements.

Outline the changes that are necessary to meet the **two** requirements.

[2]

1 The composite data type, `Car`, is defined in pseudocode as:

```
TYPE Car
  DECLARE RegNumber : STRING
  DECLARE Make : STRING
  DECLARE Model : STRING
  DECLARE BodyStyle : STRING
  DECLARE Colour : STRING
  DECLARE IntoStock : DATE
  DECLARE Price : REAL
ENDTYPE
```

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

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..... [1]

(ii) Write the **pseudocode** statements to assign the following values to the variable set up in part (a)(i):

- "Blue" to `Colour`
- 21/10/2025 to `IntoStock`

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..... [2]

(b) The data type for `BodyStyle` is changed to an enumerated type, `Body`.

(i) Write the **pseudocode** statement for the type declaration of `Body` to hold the names of the available choices:

Convertible, Hatchback, Saloon, SUV

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..... [2]

(ii) Write the new **pseudocode** statement required to update the declaration of `BodyStyle` in the definition of `Car`.

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..... [1]

2 Numbers are stored in a computer system using binary 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 denary value of the given normalised binary floating-point number.
Show your working.

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

Working

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Denary value [3]

(b) Calculate the normalised binary floating-point representation of +26.6875 in this system.
Show your working.

Mantissa										Exponent					

Working

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[3]

2 Numbers are stored in a computer system using binary floating-point representation with:

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

(a) Outline the effect of changing the number of bits used to store the mantissa to 10 bits, in this system.

[3]

(b) Describe **one** example of a situation that could cause an overflow to occur and the consequences of such an overflow.

[3]

- 1 Numbers are stored in a computer using binary 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 binary floating-point representation of +201.125 in this system.
- Show your working.

Mantissa

Exponent

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Working

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[3]

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

Mantissa

Exponent

1	0	1	0	1	1	0	0	1	1
---	---	---	---	---	---	---	---	---	---

0	0	0	1	0	1
---	---	---	---	---	---

Working

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Answer

[3]