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Test: OOP and ADT
Full Marks: 24
Time: 50 min
```

1. The vending machine is part of a program that is written using object-oriented programming(OOP). The vending machine makes use of two classes that are described in the following tables.

> All attributes are declared as private.

foodItem	
name : STRING	// the name of the item of food
code : STRING	// the code to be entered for that item to be // selected
cost : REAL	// the cost of the item
constructor(nameP, codeP, costP)	// creates an instance of foodItem // takes the name, code and cost as parameters
getCode()	// returns the code for the item
getCost()	// returns the cost of the item
getName()	// returns the name of the item

vendingMachine	
items : ARRAY[0:3] OF foodItem	// stores four items of type foodItem
moneyIn : REAL	// stores the total money inserted by the // user, initialised to 0 in the constructor

constructor(item1, item2,
item3, item4)
	// creates an instance of vendingMachine,
	// takes four objects of type foodItem as
	// parameters and stores them in array items

insertMoney()	// takes the value of the coin as a parameter // and adds it to moneyIn
checkValid ()	// takes a code as a parameter and checks it is // valid against the food item codes
getItemName()	// takes the array index as a parameter and // returns the name of the food items

(i) Write **program code** to declare the class vendingMachine. You are only required to write program code for attribute declarations and the constructor.[4]

If you are writing in Python, include attribute declarations using comments.

(ii) The method `checkValid()` takes the food item code as a parameter. It checks the code against each element in items and returns:

- `-1` if the code is not valid
- `-2` if the code is valid, but the `moneyIn` is less than the cost of the item
- the index of the item, if the code is valid and the `moneyIn` is greater than or equal to the cost of item.

Write program code for the method checkValid(). [5]

(iii) Four objects of type FoodItem are declared with the identifiers: chocolate, sweets, sandwich, apple. Write **program code** to declare an instance of vendingMachine with the identifier machineOne and the objects: chocolate, sweets, sandwich, apple. [2]

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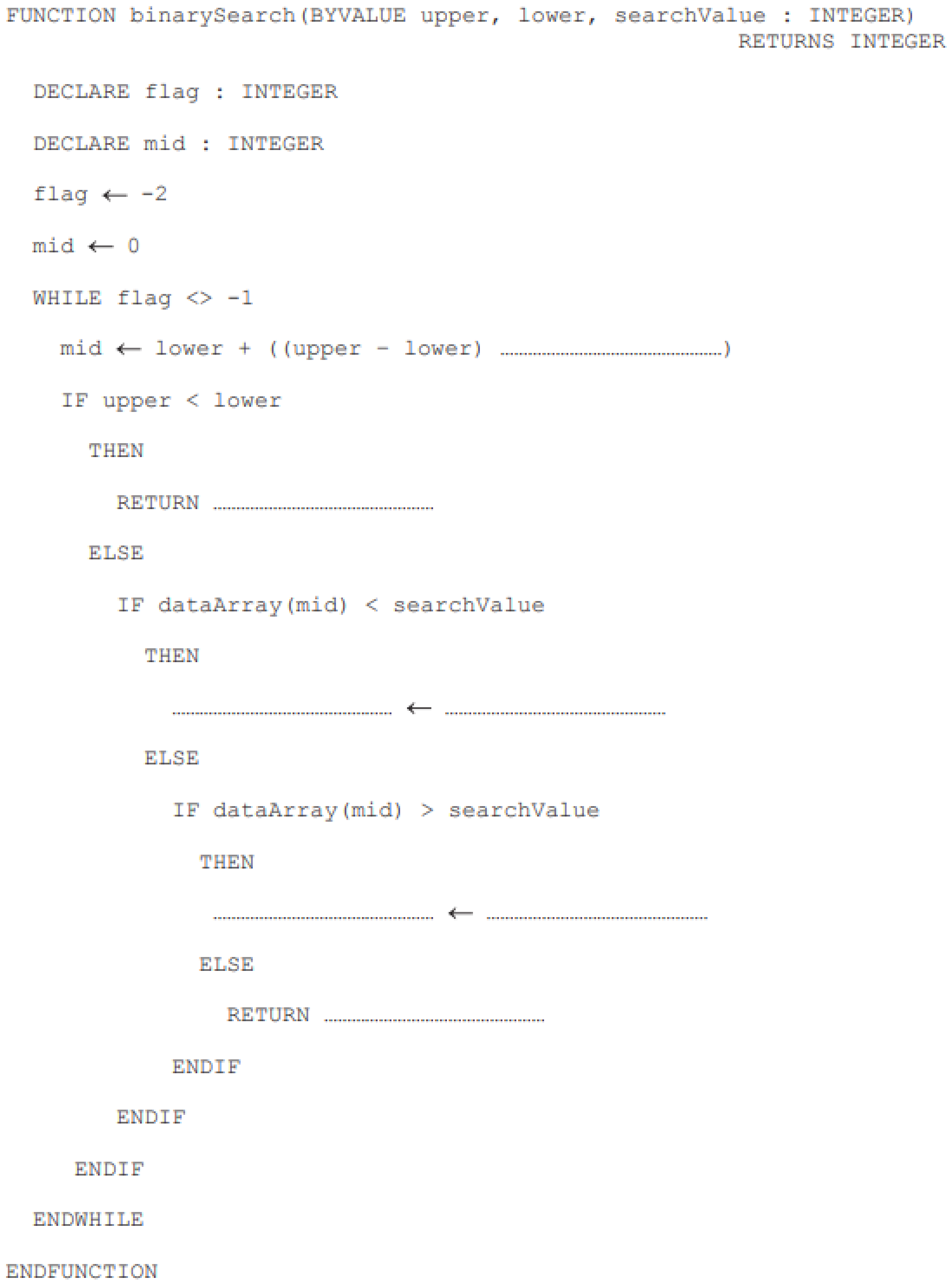
2. A binary search algorithm searches for data in sorted array.



```
FUNCTION binarySearch(BYVALUE upper, lower, searchValue : INTEGER)
                                                     RETURNS INTEGER
  DECLARE flag : INTEGER
  DECLARE mid : INTEGER
  flag ← -2
  mid ← 0
  WHILE flag <> -1
    mid ← lower + ((upper - lower) .................................)
    IF upper < lower
      THEN
        RETURN ................................
      ELSE
        IF dataArray(mid) < searchValue
          THEN
            ................................ ← ................................
          ELSE
            IF dataArray(mid) > searchValue
              THEN
                ................................ ← ................................
              ELSE
                RETURN ................................
            ENDIF
        ENDIF
    ENDIF
  ENDWHILE
ENDFUNCTION
```

(a) The pseudocode function binarySearch() performs a binary search to find a given value in the global array, dataArray. If the value is found, the function returns its index. If the value is not found, the function returns -1.

Write program for the function `binarySearch()` after completing the provided pseudocode. [6]

(b) Giles is writing a program using a stack.

The stack stores upto 1000 integers in the 1D array, `stackArray`.

(i) The procedure `setUpStack()` takes two parameters:

- the array, stackArray
- a pointer to the last element pushed onto the stack, `topOfStack`.

The procedure initializes all array elements to -1 and the pointer to -1.

Write **program code** for the procedure `setUpStack()`. [3]

(ii) The function `pop()` pops and returns the item from the top of the stack. If the stack is empty, it returns `-1`.

Write program for the function `pop()`. [4]
