Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9–1)

Centre Number	Candidate Number

Thursday 14 May 2020

Afternoon (Time: 2 hours)

Paper Reference **1CP1/02**

Computer Science

Paper 2: Application of Computational Thinking

You must have:
Pseudocode command set (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Use of a calculator is **prohibited**.

Information

- The total mark for this paper is 80.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

Pearson

Answer ALL questions. Write your answers in the spaces provided.

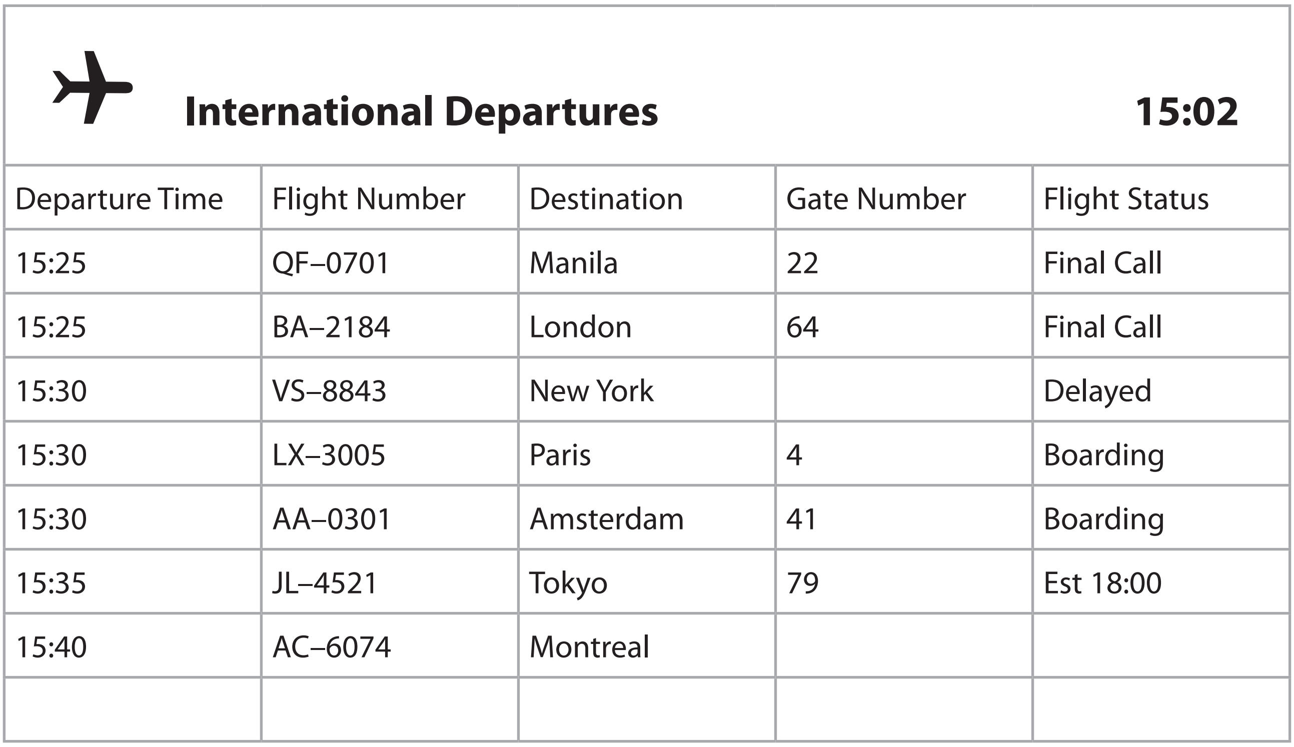
Questions in this paper are based on a scenario.

The Airport

An international airport uses a variety of computer systems to deal with passengers, flights and employees.

1 Arrivals and departures are controlled by computer programs.

(a) Here is an example of a departure screen.



International Departures **15:02**

Departure Time	Flight Number	Destination	Gate Number	Flight Status
15:25	QF–0701	Manila	22	Final Call
15:25	BA–2184	London	64	Final Call
15:30	VS–8843	New York		Delayed
15:30	LX–3005	Paris	4	Boarding
15:30	AA–0301	Amsterdam	41	Boarding
15:35	JL–4521	Tokyo	79	Est 18:00
15:40	AC–6074	Montreal		

Figure 1

(i) Identify **two** variables that are required to store the data about departures.

(2)

1 ....

....

2 ....

....

(ii) Explain why it is important to use descriptive names in program code.

(2)

....

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....

....

(iii) A programmer could use several built-in functions from a programming language library to implement the departure screen.

State **one** built-in library function that could be used.

(1)

....

....

(b) The safe interval between landings is based on the plane type and weather conditions.

The safe interval is at least 30 seconds. This is adjusted by a multiplier based on the plane type and then by adding a constant based on weather conditions.

Construct a general expression to calculate the safe interval between plane landings.

(2)

....

....

....

....

(Total for Question 1 = 7 marks)

Turn over ▶

2 The long-stay parking at the airport uses a variable rate charging system.

Here is the pseudocode for this algorithm.

```
10  SEND "Welcome to airport parking" TO DISPLAY
11  SEND "How long are you staying?" TO DISPLAY
12  RECEIVE days FROM (INTEGER) KEYBOARD
13  SEND "Cost based on " & days & " days" TO DISPLAY
14
15  IF (days > 8) THEN
16      SET cost TO 55 + (10 * (days - 8))
17  ELSE
18      IF (days > 6) THEN
19          SET cost TO 55
20      ELSE
21          IF (days > 3) THEN
22              SET cost TO 45
23          ELSE
24              SET cost TO 25
25          END IF
26      END IF
27  END IF
28
29  SEND "Cost: " & cost TO DISPLAY
```

(a) State the programming construct demonstrated by lines 10 to 13 of the algorithm.

(1)

....

....

(b) Complete the table to show the output of the algorithm for the given inputs.

(3)

Input	**Output**
10	
1	
7	

(c) The algorithm needs to be tested more thoroughly.

Complete the table to give suitable input test data to meet the requirements.

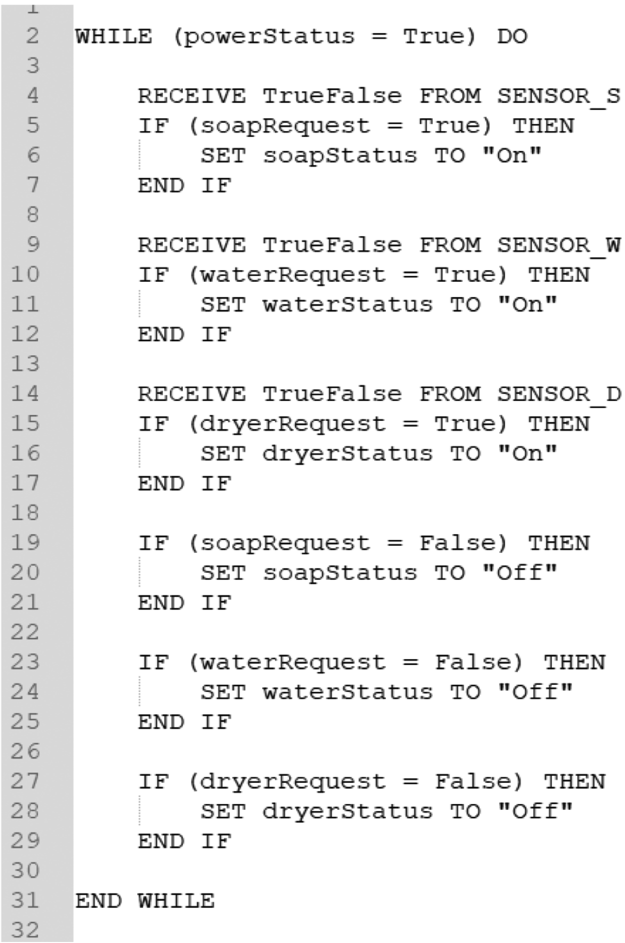
(2)

Requirement	**Input Test Data**
Output cost = 45	
An output that is not correct	

(Total for Question 2 = 6 marks)

3 The airport has touchless handwashing stations. The stations automatically dispense soap, water and warm air for drying. To conserve water, the stations must ensure that only one operation is carried out at a time.

Here is the algorithm for controlling the handwashing stations.



```
WHILE (powerStatus = True) DO

    RECEIVE TrueFalse FROM SENSOR_S
    IF (soapRequest = True) THEN
        SET soapStatus TO "On"
    END IF

    RECEIVE TrueFalse FROM SENSOR_W
    IF (waterRequest = True) THEN
        SET waterStatus TO "On"
    END IF

    RECEIVE TrueFalse FROM SENSOR_D
    IF (dryerRequest = True) THEN
        SET dryerStatus TO "On"
    END IF

    IF (soapRequest = False) THEN
        SET soapStatus TO "Off"
    END IF

    IF (waterRequest = False) THEN
        SET waterStatus TO "Off"
    END IF

    IF (dryerRequest = False) THEN
        SET dryerStatus TO "Off"
    END IF

END WHILE
```

(a) State the name of the input device in the algorithm used to control the water dispenser.

(1)

(b) State **one** condition allowed by the algorithm that does **not** meet the requirements for the hand washing stations.

(1)

(c) The algorithm does not make efficient use of the selection programming construct.

Write replacement code to control the soap dispenser that would improve the efficiency of the algorithm.

(2)

....

....

....

....

(d) When a handwashing station is not in use, the variables soapStatus (S), waterStatus (W) and dryerStatus (D) are all set to false and a message 'Everything is off' is displayed.

Construct a Boolean logic statement using S, W and D to represent the conditions necessary for the system to display 'Everything is off'.

(2)

....

....

....

....

(Total for Question 3 = 6 marks)

Turn over ▶

4 The airport stores information about its employees.

Here is an example of a data structure that holds an employee's information, including employee number, last name, first name, phone number and monthly salary.

38475	Charters	Rebecca	01234567890	1525.00

(a) (i) State the name of this type of data structure.

(1)

....

....

(ii) State the reason why an array is **not** suitable for storing this information.

(1)

....

....

(b) Name **two** file handling operations that are used to save data to a file.

(2)

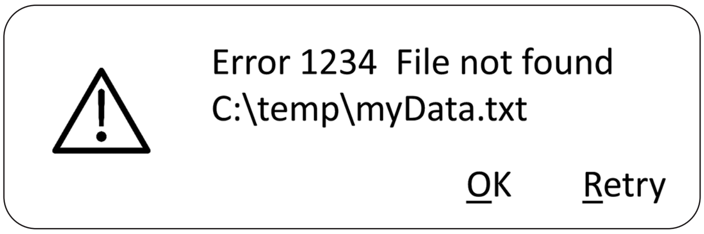
1 ....

....

2 ....

....

(c) Accessing files may cause errors. Here is an example of an error message.



Error 1234 File not found
C:\temp\myData.txt

(i) Name this type of error.

(1)

(ii) Give **two** reasons why the error in the example might occur.

(2)

1

2

(d) A program is used to process employees' monthly salaries.

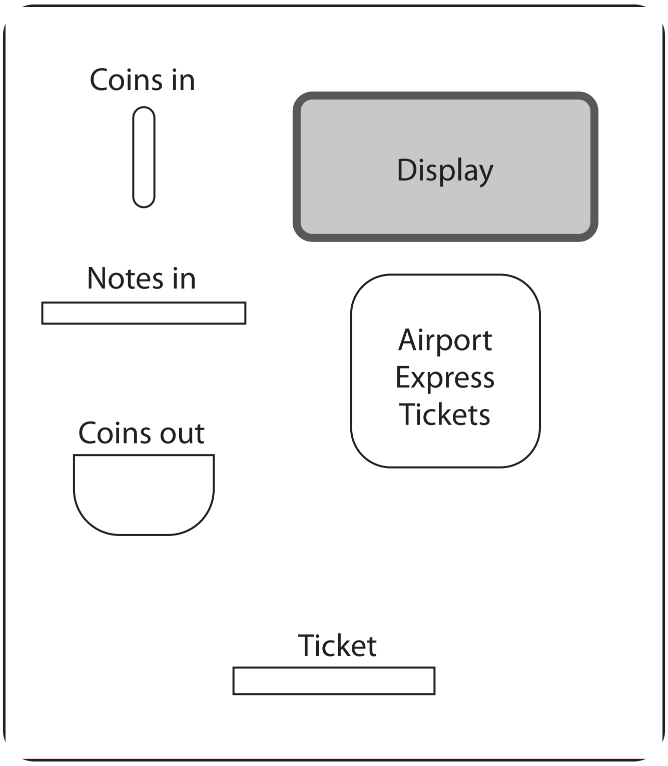
Explain why an iterative construct is used as part of this process.

(2)

(Total for Question 4 = 9 marks)

5 A train runs from the airport to the city centre. Passengers purchase tickets from a ticket machine at the station. Journeys must start within two hours of purchasing a ticket.

(a) Here is a diagram of a ticket machine.



Complete the table to give an input, a process and an output.

(3)

Input	**Process**	**Output**
	Calculate change	Change
Current time		Expiry time
Expiry time	Print	

(b) Here is a ticket for the airport train.

Ticket number: 4938

Expiry: 03–08–2020 13:20

Amount paid: 22.45

The ticket number is incremented by 1 each time a ticket is printed.

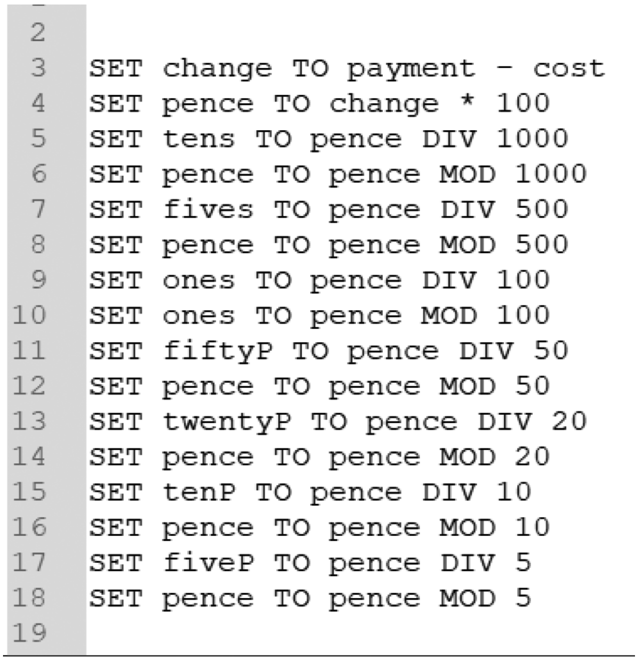
Complete the table to give the appropriate data type for each item.

(3)

Item	Data type
Ticket number	
Expiry	
Amount paid	

(c) The ticket machine executes a program to determine the amount and type of change returned when a passenger purchases a ticket.

Here is the code that determines the amount and type of change.



```

SET change TO payment - cost
SET pence TO change * 100
SET tens TO pence DIV 1000
SET pence TO pence MOD 1000
SET fives TO pence DIV 500
SET pence TO pence MOD 500
SET ones TO pence DIV 100
SET ones TO pence MOD 100
SET fiftyP TO pence DIV 50
SET pence TO pence MOD 50
SET twentyP TO pence DIV 20
SET pence TO pence MOD 20
SET tenP TO pence DIV 10
SET pence TO pence MOD 10
SET fiveP TO pence DIV 5
SET pence TO pence MOD 5

```

(i) Explain why integer division (DIV) and modulus (MOD) rather than division (/) are used in this algorithm.

(2)

....

....

....

....

(ii) Complete the trace table showing the execution of the code when change = 17.55

You may not need to fill in all the rows in the table.

(5)

pence	tens	fives	ones	fiftyP	twentyP	tenP	fiveP
1755							

(Total for Question 5 = 13 marks)

6 The airport uses a computer-controlled system to process luggage.

(a) The programmers who designed the luggage system use a variety of methods to describe their algorithms.

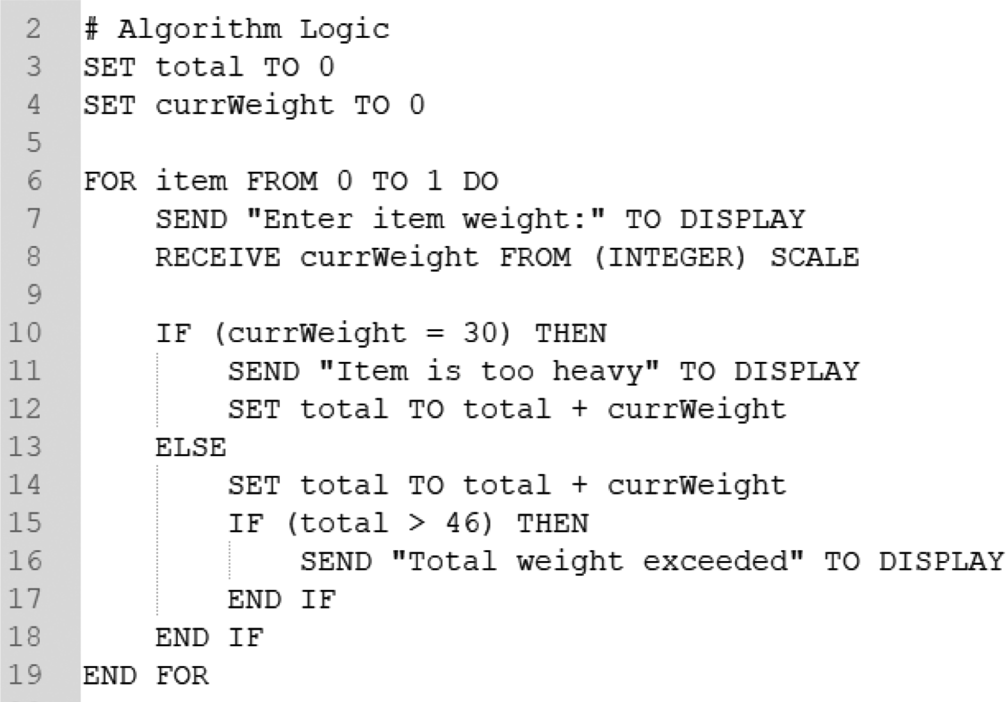
Explain why programmers use both flowcharts and pseudocode to represent the logic of their algorithms.

(4)

(b) Each passenger is allowed two items of luggage weighing no more than 46kg in total.

Each item of luggage must weigh less than 30kg.

Here is an algorithm to determine if the luggage weight allowance has been exceeded.



```
 2  # Algorithm Logic
 3  SET total TO 0
 4  SET currWeight TO 0
 5
 6  FOR item FROM 0 TO 1 DO
 7      SEND "Enter item weight:" TO DISPLAY
 8      RECEIVE currWeight FROM (INTEGER) SCALE
 9
10      IF (currWeight = 30) THEN
11          SEND "Item is too heavy" TO DISPLAY
12          SET total TO total + currWeight
13      ELSE
14          SET total TO total + currWeight
15          IF (total > 46) THEN
16              SEND "Total weight exceeded" TO DISPLAY
17          END IF
18      END IF
19  END FOR
```

Line 10 and line 12 cause logic errors.

Identify the error in each line and give a correction for the errors.

(4)

	Error	**Correction**
Line 10		
Line 12		

(Total for Question 6 = 8 marks)

7 When the item of luggage leaves the check-in area, it is sorted and delivered to the aircraft.

(a) A printed label is attached to each item. Each label is made up of fields separated by hyphens.

The label begins with the letters 'D' or 'I'. The next field is the destination airport. The next field is the airline code, followed by the flight number. The last field is a four digit item number.

Valid labels are shown.

- D-LHR-BA-2181-0012
- I-AMS-AA-0302-0125
- I-HND-JL-4522-0317

(i) The labels are validated using standard length, type and presence checks.

Give **one other** validation test that could be used to check the airline code in the label.

(1)

....

....

(ii) Construct an expression, using indexing, to locate the destination airport code in a label.

(3)

....

....

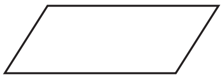
....

....

(b) Luggage is sent to either the international or the domestic sorting hub.

If the label begins with ‘I’, the item is sent to the international hub. If the label begins with ‘D’, the item is sent to the domestic hub.

If the label is damaged and not readable, the item is sent for manual inspection.



This shape represents input or output.

Draw a flowchart to represent this process for a **single** item of luggage.

Answer space is provided on pages 18 and 19. You may not need to use all of the answer space. Put a line through any work you do not want to be marked.

(6)

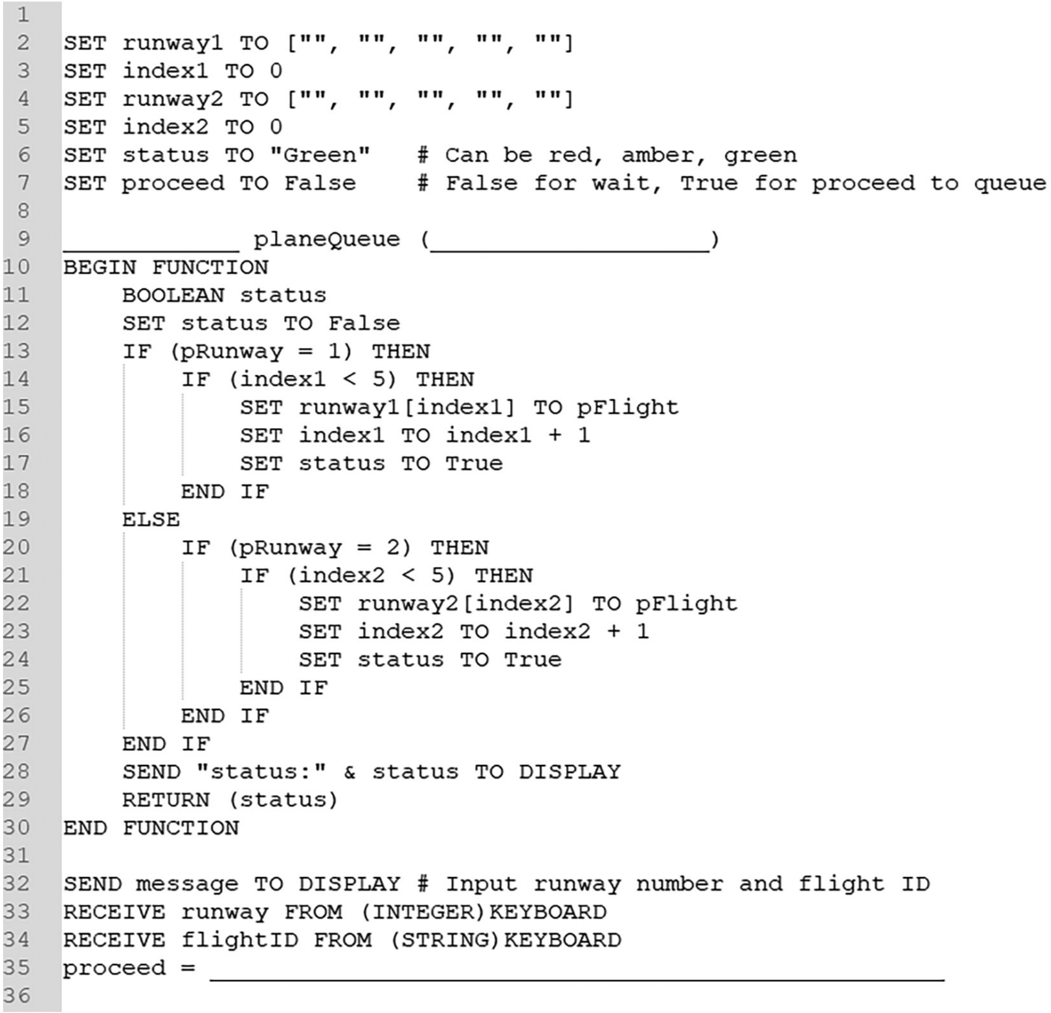
TURN OVER

(Total for Question 7 = 10 marks)

8 The airport has two runways. Each runway has a queue of planes waiting to take off. Only five planes can be queued for each runway. Other planes remain at the gate until a place is free. When a plane leaves the gate, its details are added to a runway queue.

This process is controlled by a computer program.

Here is an algorithm for the process of adding planes to the runway queues.



```

SET runway1 TO ["", "", "", "", ""]
SET index1 TO 0
SET runway2 TO ["", "", "", "", ""]
SET index2 TO 0
SET status TO "Green"   # Can be red, amber, green
SET proceed TO False    # False for wait, True for proceed to queue

____________ planeQueue (___________________)
BEGIN FUNCTION
    BOOLEAN status
    SET status TO False
    IF (pRunway = 1) THEN
        IF (index1 < 5) THEN
            SET runway1[index1] TO pFlight
            SET index1 TO index1 + 1
            SET status TO True
        END IF
    ELSE
        IF (pRunway = 2) THEN
            IF (index2 < 5) THEN
                SET runway2[index2] TO pFlight
                SET index2 TO index2 + 1
                SET status TO True
            END IF
        END IF
    END IF
    SEND "status:" & status TO DISPLAY
    RETURN (status)
END FUNCTION

SEND message TO DISPLAY # Input runway number and flight ID
RECEIVE runway FROM (INTEGER)KEYBOARD
RECEIVE flightID FROM (STRING)KEYBOARD
proceed = __________________________________________________

```

(a) Give a line number of an instruction in the algorithm that assigns a value to an element of an array.

(1)

....

....

(b) The algorithm is incomplete. Line 9 should hold the pseudocode for the function header. Line 35 should hold a call to the function.

Construct the code for line 9 and line 35.

(6)

Line 9 ....

....

Line 35 ....

....

(c) A subprogram can be either a function or a procedure.

State why planeQueue is a function.

(1)

....

....

Turn over ▶

(d) The scope of a variable can be either global or local.

Compare the **scope** and **memory** use of the variable 'status' referred to on line 6 of the algorithm, with the variable 'status' referred to on line 12.

(4)

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(Total for Question 8 = 12 marks)

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9 Passengers are counted as they go through the security barriers.

There are currently eight barriers operating. The number of barriers may change.

A barrier sends a signal to the main computer when a passenger goes through. Each time a signal is received, the main computer increments the count for that barrier. The program on the main computer stores the barrier counts in a two-dimensional array.

Write an algorithm to increment the count for each barrier in the two-dimensional array.

- Use pseudocode or a programming language with which you are familiar.
- Assume inBarrier holds the number of the barrier that has sent a signal.

You may not need to use all of the answer space. Put a line through any work you do not want to be marked.

(9)

```
ARRAY counts

SET counts TO [[2, 0], [8, 0], [5, 0], [4, 0], [1, 0], [3, 0], [6, 0], [7, 0]]

INTEGER inBarrier
```

(Total for Question 9 = 9 marks)

TOTAL FOR PAPER = 80 MARKS

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