

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Centre Number

Candidate Number

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Pearson Edexcel International GCSE (9–1)

Time 2 hours

Paper
reference

4CP0/01

Computer Science

PAPER 1: Principles of Computer Science

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.*

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.*
- You are not allowed to use a calculator.

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.
- Marks will not be awarded for using product or trade names in answers without giving further explanation.

Turn over ►

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Pseudocode command set

Questions in the written examination that involve code will use this pseudocode for clarity and consistency. However, students may answer questions using any valid method.

Data types

INTEGER

REAL

BOOLEAN

CHARACTER

Type coercion

Type coercion is automatic if indicated by context. For example $3 + 8.25 = 11.25$ (integer + real = real)

Mixed mode arithmetic is coerced like this:

	INTEGER	REAL
INTEGER	INTEGER	REAL
REAL	REAL	REAL

Coercion can be made explicit. For example, RECEIVE age FROM (INTEGER) KEYBOARD assumes that the input from the keyboard is interpreted as an INTEGER, not a STRING.

Constants

The value of constants can only ever be set once. They are identified by the keyword CONST. Two examples of using a constant are shown.

CONST REAL PI

SET PI TO 3.14159

SET circumference TO radius * PI * 2

Data structures

ARRAY

STRING

Indices start at zero (0) for all data structures.

All data structures have an append operator, indicated by &.

Using & with a STRING and a non-STRING will coerce to STRING. For example, SEND 'Fred' & age TO DISPLAY, will display a single STRING of 'Fred18'.

Identifiers

Identifiers are sequences of letters, digits and ‘_’, starting with a letter, for example: MyValue, myValue, My_Value, Counter2

Functions

LENGTH()

For data structures consisting of an array or string.

RANDOM(n)

This generates a random number from 0 to n.

Comments

Comments are indicated by the # symbol, followed by any text.

A comment can be on a line by itself or at the end of a line.

Devices

Use of KEYBOARD and DISPLAY are suitable for input and output.

Additional devices may be required, but their function will be obvious from the context. For example, CARD_READER and MOTOR are two such devices.

Notes

In the following pseudocode, the < > indicates where expressions or values need to be supplied. The < > symbols are not part of the pseudocode.

Variables and arrays

Syntax	Explanation of syntax	Example
SET Variable TO <value>	Assigns a value to a variable.	SET Counter TO 0 SET MyString TO 'Hello world'
SET Variable TO <expression>	Computes the value of an expression and assigns to a variable.	SET Sum TO Score + 10 SET Size to LENGTH(Word)
SET Array[index] TO <value>	Assigns a value to an element of a one-dimensional array.	SET ArrayClass[1] TO 'Ann' SET ArrayMarks[3] TO 56
SET Array TO [<value>, ...]	Initialises a one-dimensional array with a set of values.	SET ArrayValues TO [1, 2, 3, 4, 5]
SET Array [RowIndex, ColumnIndex] TO <value>	Assigns a value to an element of a two dimensional array.	SET ArrayClassMarks[2,4] TO 92

Selection

Syntax	Explanation of syntax	Example
IF <expression> THEN <command> END IF	If <expression> is true then command is executed.	IF Answer = 10 THEN SET Score TO Score + 1 END IF
IF <expression> THEN <command> ELSE <command> END IF	If <expression> is true then first <command> is executed, otherwise second <command> is executed.	IF Answer = 'correct' THEN SEND 'Well done' TO DISPLAY ELSE SEND 'Try again' TO DISPLAY END IF

Repetition		
Syntax	Explanation of syntax	Example
WHILE <condition> DO <command> END WHILE	Pre-conditioned loop. Executes <command> whilst <condition> is true.	WHILE Flag = 0 DO SEND 'All well' TO DISPLAY END WHILE
REPEAT <command> UNTIL <expression>	Post-conditioned loop. Executes <command> until <condition> is true. The loop must execute at least once.	REPEAT SET Go TO Go + 1 UNTIL Go = 10
REPEAT <expression> TIMES <command> END REPEAT	Count controlled loop. The number of times <command> is executed is determined by the expression.	REPEAT 100-Number TIMES SEND '*' TO DISPLAY END REPEAT
FOR <id> FROM <expression> TO <expression> DO <command> END FOR	Count controlled loop. Executes <command> a fixed number of times.	FOR Index FROM 1 TO 10 DO SEND ArrayNumbers[Index] TO DISPLAY END FOR
FOR <id> FROM <expression> TO <expression> STEP <expression> DO <command> END FOR	Count controlled loop using a step.	FOR Index FROM 1 TO 500 STEP 25 DO SEND Index TO DISPLAY END FOR
FOR EACH <id> FROM <expression> DO <command> END FOREACH	Count controlled loop. Executes for each element of an array.	SET WordsArray TO ['The', 'Sky', 'is', 'grey'] SET Sentence to "" FOR EACH Word FROM WordsUArray DO SET Sentence TO Sentence & Word & '' END FOREACH

Input/output

Syntax	Explanation of syntax	Example
SEND <expression> TO DISPLAY	Sends output to the screen.	SEND 'Have a good day.' TO DISPLAY
RECEIVE <identifier> FROM (type) <device>	Reads input of specified type.	RECEIVE Name FROM (STRING) KEYBOARD RECEIVE LengthOfJourney FROM (INTEGER) CARD_READER RECEIVE YesNo FROM (CHARACTER) CARD_READER

File handling

Syntax	Explanation of syntax	Example
READ <File> <record>	Reads in a record from a <file> and assigns to a <variable>. Each READ statement reads a record from the file.	READ MyFile.doc Record
WRITE <File> <record>	Writes a record to a file. Each WRITE statement writes a record to the file.	WRITE MyFile.doc Answer1, Answer2, 'xyz 01'

Subprograms

Syntax	Explanation of syntax	Example
PROCEDURE <id> (<parameter>, ...) BEGIN PROCEDURE <command> END PROCEDURE	Defines a procedure.	PROCEDURE CalculateAverage (Mark1, Mark2, Mark3) BEGIN PROCEDURE SET Avg to (Mark1 + Mark2 + Mark3)/3 END PROCEDURE
FUNCTION <id> (<parameter>, ...) BEGIN FUNCTION <command> RETURN <expression> END FUNCTION	Defines a function.	FUNCTION AddMarks (Mark1, Mark2, Mark3) BEGIN FUNCTION SET Total to (Mark1 + Mark2 + Mark3)/3 RETURN Total END FUNCTION
<id> (<parameter>, ...)	Calls a procedure or a function.	Add (FirstMark, SecondMark)

Arithmetic operators	
Symbol	Description
+	Add
-	Subtract
/	Divide
*	Multiply
^	Exponent
MOD	Modulo
DIV	Integer division

Relational operators	
Symbol	Description
=	equal to
<>	not equal to
>	greater than
>=	greater than or equal to
<	less than
<=	less than or equal to

Logical operators	
Symbol	Description
AND	Returns true if both conditions are true.
OR	Returns true if any of the conditions are true.
NOT	Reverses the outcome of the expression; true becomes false, false becomes true.

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

Some questions must be answered with a cross . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

- 1 Computer systems have both hardware and software components.
- (a) The central processing unit (CPU) uses the fetch-decode-execute cycle.
- (i) State what is meant by the term **program instruction**. (1)
- (ii) State what is meant by the term **memory address**. (1)
- (b) Identify the component of the CPU that provides temporary data storage. (1)
- A** Address bus
- B** Data bus
- C** Control unit
- D** Register
- (c) The performance of the CPU is affected by the clock speed.
- (i) Give **one** benefit of having a higher clock speed. (1)
- (ii) Give **one** drawback of having a higher clock speed. (1)

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(d) Identify which **one** of these describes a sequential computational model.

(1)

- A** Program instructions are read one after another from external storage
- B** Program instructions are executed by multiple agents working together
- C** Program instructions are executed in parallel by different cores
- D** Program instructions are executed one after another

(e) A program can be written in a high-level or a low-level language.

(i) Give **one** reason for writing a program in a low-level language.

(1)

(ii) State the purpose of an assembler.

(1)

(iii) Complete the table by adding **one** tick (✓) in **each** row to match the description.

(3)

Description	Compiler	Interpreter
Translates the program each time it is executed		
Produces permanent object code		
Translates line by line		
Translates the whole program before it is run		
Generates a list of errors once the complete program has been translated		

(Total for Question 1 = 11 marks)



2 Computers use binary to represent and store data.

(a) The denary number 78 is the ASCII code for the character **N**.

(i) Convert the denary number 78 to 8-bit binary.

(2)

(ii) Identify the number of characters that can be represented using standard ASCII.

(1)

- A** 64
- B** 128
- C** 256
- D** 512

(iii) Explain **one** reason for using Unicode rather than ASCII to encode languages other than English.

(2)

(b) Convert the denary number -43 to 8-bit binary using sign and magnitude representation.

(2)

(c) Complete the table by adding these two 8-bit binary integers.

(2)

0	0	1	1	0	1	0	0
0	0	0	1	0	1	1	0

(d) A bitmap image is made up of pixels.

(i) An image has five colours.

Complete the table by adding a unique binary pattern for each colour.

Each pattern must use the **same minimum colour depth**.

(2)

Colour	Binary pattern
Green	
Black	
White	
Red	
Blue	

(ii) Another image is 3579 pixels high and 6128 pixels wide.

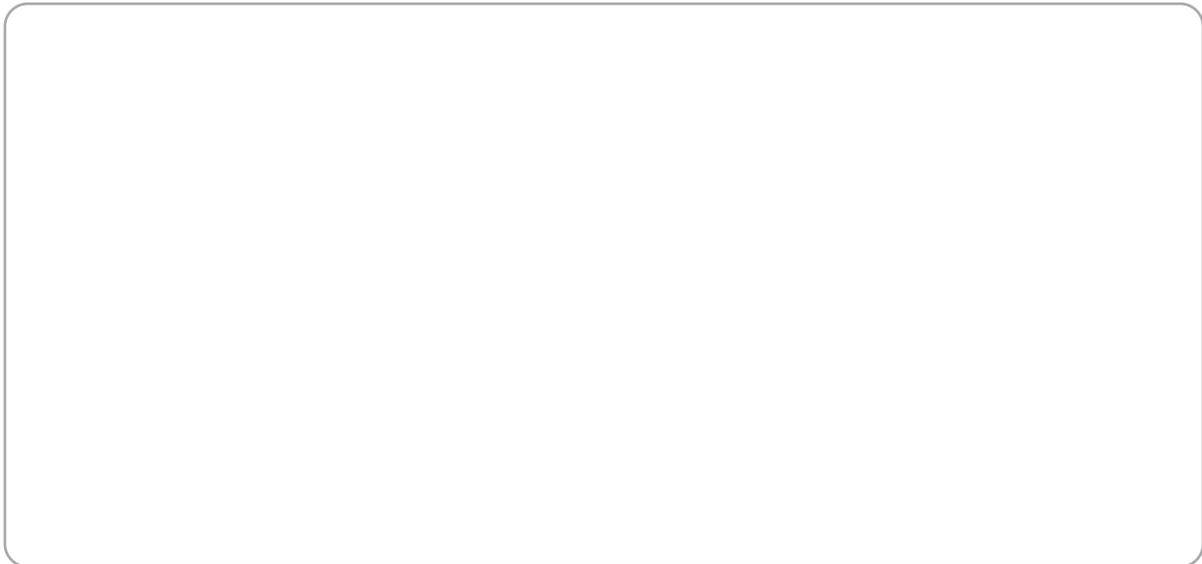
The image is stored with a 32-bit colour depth.

The metadata for the image is 732 bytes.

Construct an expression to show how the file size, in **megabytes**, is calculated.

You do **not** need to do the calculation.

(4)



(Total for Question 2 = 15 marks)

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QUESTION 3 BEGINS ON THE NEXT PAGE.

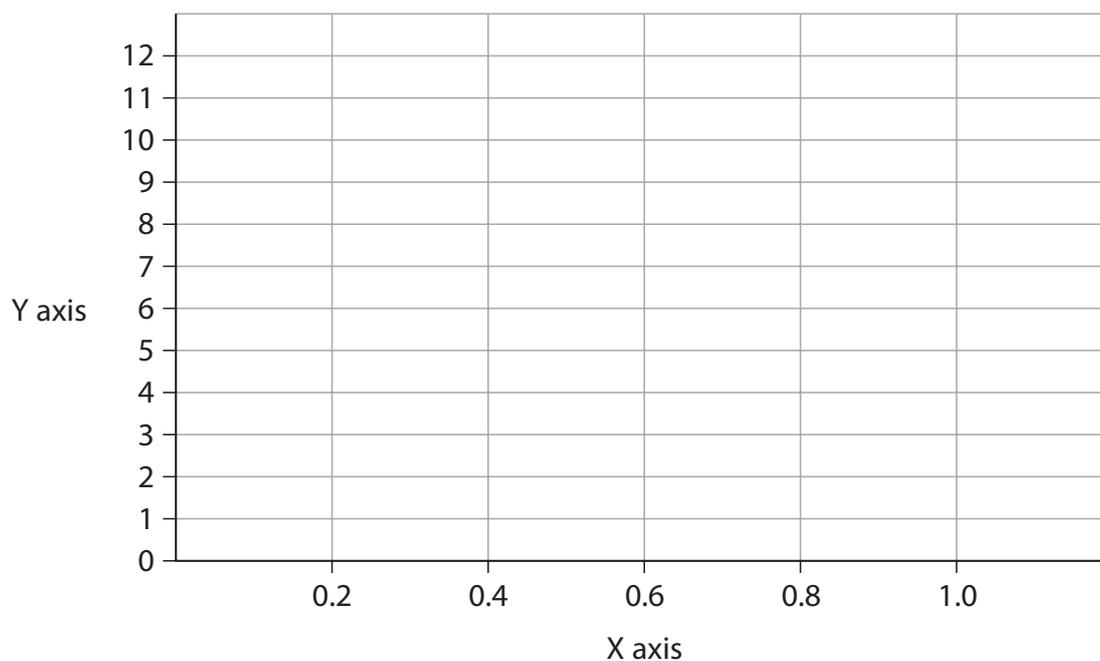


3 Alyssa is a music producer.

- (a) **Figure 1** shows the denary values of five samples of an analogue sound using a sample interval of 0.2 seconds.

Sample number	Denary value
1	1
2	10
3	12
4	5
5	3

Figure 1



- (i) Complete this graph using the sample information from **Figure 1** to show the digital sound wave.

(3)

- (ii) Give a suitable label for the X axis.

(1)

- (iii) Give a suitable label for the Y axis.

(1)

(b) Alyssa uploads music files to her cloud storage.

- (i) She compresses the files before she uploads them using a lossless algorithm.

Give **one** disadvantage of using a lossless rather than a lossy algorithm for this purpose.

(1)

- (ii) Explain **one** benefit to Alyssa of storing her music files in the cloud.

(2)

- (iii) Give **one** possible security issue associated with storing music files in the cloud.

(1)

- (iv) One of Alyssa's music files is stored at <https://www.cloudisfab.com/re12/ru2.mp3>

Complete the table by adding a description of each URL component.

(4)

URL component	Description
https	
www.cloudisfab.com	
re12	
ru2.mp3	

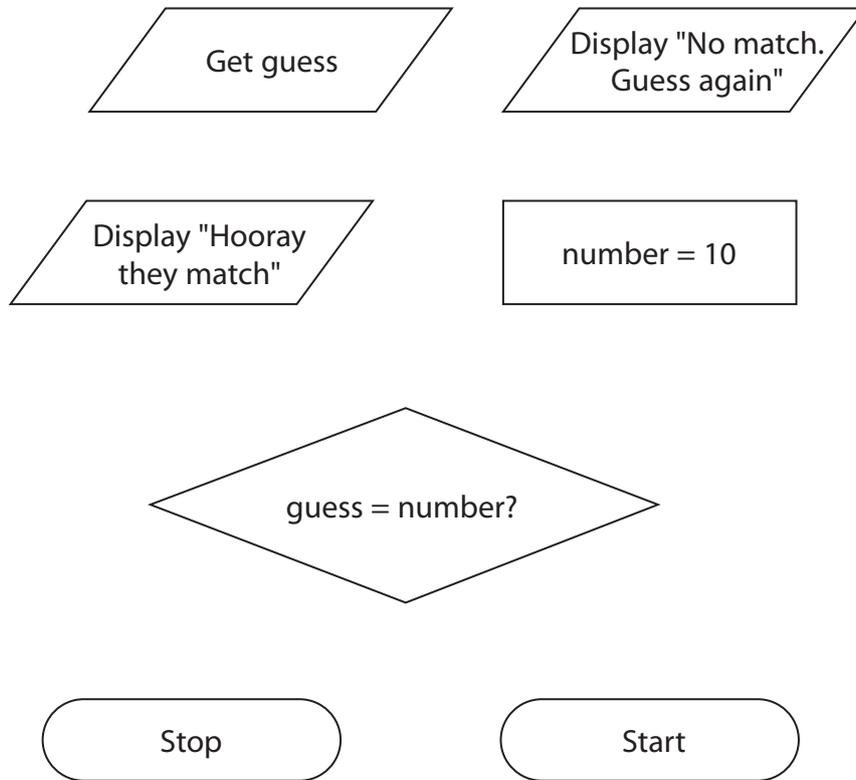
(Total for Question 3 = 13 marks)

4 Reba likes writing programs.

(a) She is writing a guessing game.

She needs a flowchart to show the logic of the game.

(i) These are the components needed to draw the flowchart.



Draw the flowchart for the algorithm in the box on the next page.

Use each component once.

Do not add any additional components.

Use as many arrows and yes/no labels as you need.

(5)

Draw your flowchart here.

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(ii) Identify an alternative method for writing the algorithm.

(1)

- A** Simulation
- B** Cipher
- C** Program code
- D** Truth table

(b) Reba wants to develop a program that will convert a temperature in Fahrenheit to Celsius.

Here are four steps in the algorithm.

The steps are not in the correct order.

	Step
A	Change the temperature to Celsius
B	Get the temperature in Fahrenheit
C	Show the temperature in Celsius
D	Set the temperature to 0

(i) Give the letter of the step that initialises a variable.

(1)

(ii) Give the letter of the step that inputs a value.

(1)

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QUESTION 4 (c) BEGINS ON THE NEXT PAGE.



(c) **Figure 2** shows the pseudocode for an early version of an algorithm that Reba has written for another game.

The algorithm:

- asks the user to input a colour or input –1 to end the game
- awards 1 point for red
- awards 8 points for orange
- generates the score for the game
- displays the results of the game.

```
1 SET Colour TO ""
2 SET Score TO 0
3 SET RedPoints TO 0
4 SET OrangePoints TO 0
5 SET NumOranges TO 0
6
7 WHILE Colour <> "-1" DO
8     RECEIVE Colour FROM (STRING) KEYBOARD
9     IF Colour = "red" THEN
10        SET RedPoints TO RedPoints + 1
11    ELSE
12        IF Colour = "orange" THEN
13            SET OrangePoints TO OrangePoints + 8
14            SET NumOranges TO NumOranges + 1
15        END IF
16    END IF
17 END WHILE
18
19 SET Score TO RedPoints + OrangePoints
20
21 SEND ("Score: "& Score) TO DISPLAY
22 SEND ("Number of reds: "& RedPoints) TO DISPLAY
23 SEND ("Number of oranges: "& OrangePoints) TO DISPLAY
```

Figure 2

Reba inputs: red, orange, red, red, orange, -1

The outputs are not as she expects.

(i) Complete the trace table to show the outputs.

(4)

Colour	Score	RedPoints	OrangePoints	NumOranges	Outputs
	0	0	0	0	
red					
orange					
red					
red					
orange					
-1					

(ii) Give the line number of the pseudocode that contains the error.

(1)

(iii) Write a replacement line of pseudocode to correct the error.

(1)

(Total for Question 4 = 14 marks)

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5 Viza Health Centre is located in the North East of England.

- (a) The health centre uses artificial intelligence to provide a symptom-checking service for its patients.

Patients log on to the website and input their symptoms.

- (i) Describe how artificial intelligence could identify what is wrong with them. (2)

- (ii) Give **one** reason why a patient may not want to use this online service. (1)

- (b) The health centre has clinics in two buildings: Cleveland and Stockton.

The network server is in the Cleveland building.

- (i) Name the type of network used to access the server from within the Cleveland building. (1)

- (ii) Name the type of network used to access the server from the Stockton building. (1)

(c) The network is at risk of an eavesdropping attack.

Identify the description of eavesdropping.

(1)

- A** Tricking people into giving information by sending emails pretending to be from someone in authority
- B** Spying on someone using a computer
- C** Intercepting information as it is transmitted over a network
- D** Redirecting a user from a genuine website to a fake one

(d) Doctors use laptops when they visit patients in their homes.

(i) The laptops have solid state drives.

Explain **one** reason why a solid state drive is better than a magnetic hard drive for the laptops.

(2)

(ii) Describe how data is stored on a solid state drive.

(2)

(iii) The laptops have two types of memory.

Complete the table by adding **one** tick (✓) to match **each** description to the type of memory used.

(2)

Description	RAM	ROM
Stores the boot up sequence		
The contents are lost when the laptop is shut down		

(Total for Question 5 = 12 marks)

6 Santiago manages a computer network for a small business.

(a) Networks are based on a topology.

Figure 3 shows a network topology.

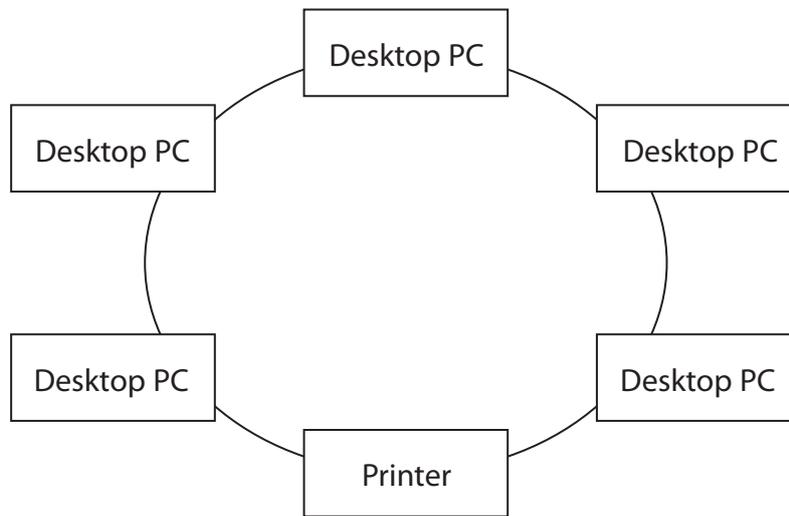


Figure 3

(i) Explain **one** benefit of this network topology.

(2)

(ii) The internet is the world's largest mesh network.

Explain **one** reason why a mesh topology is essential for the internet.

(2)

(b) Santiago works on his laptop whilst travelling by train.

There is a free Wi-Fi connection on the train, but Santiago doesn't use it.

He prefers to set up a network between his smartphone and his laptop to connect to the internet.

(i) Name this type of network. (1)

(ii) Explain **one** advantage for Santiago of using the network he has set up to connect to the internet, rather than the free Wi-Fi connection. (2)

(c) Santiago uses audit trails to help protect the network.

(i) State what is meant by an **audit trail**. (1)

(ii) Give **one** way the data from audit trails can be used to help keep the network secure. (1)

(d) Santiago wants to find and fix network vulnerabilities before the reputation of the company suffers.

Discuss the methods he can use.

You should consider:

- ethical hacking
- commercial analysis tools
- review of network and user policies.

(6)

(Total for Question 6 = 15 marks)

TOTAL FOR PAPER = 80 MARKS