Candidate Name	Centre Number					Candidate Number				
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AS COMPUTER SCIENCE

UNIT 1

FUNDAMENTALS OF COMPUTER SCIENCE

SPECIMEN PAPER

2 hours

ADDITIONAL MATERIALS

The use of a calculator is permitted in this examination.

INSTRUCTIONS TO CANDIDATES

Answer **ALL** question(s).

Write your name, centre number and candidate number in the spaces at the top of this page.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

The total number of marks available is 100.

Assessment will take into account the quality of written communication used in your answers.

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

Unit 1
*Answer **all** questions*

1. Discuss the differences between RAM and Cache memory. [6]

2. Describe the functional characteristics of two contemporary secondary storage devices. [6]

3. (a) Describe the use of the DHCP and HTTP protocols. [2]

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(b) Explain why the FTP protocol is unsuitable for streaming a live video feed. Suggest a more suitable protocol for this purpose, justifying your choice. [6]

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(c) Giving an example, explain the role of handshaking. [2]

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4. The 8 bit binary number 00000001_2 is used in a masking process.

   (a) State what logical operation is used during masking and draw a truth table for this logical operation. [2]

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   (b) State the effect that the 8 bit binary number given in (4.) would have when masked with any 8 bit binary number. [1]

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5. Explain the terms serial transmission and parallel transmission in a computer system and give one advantage of each type of transmission. [4]

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6. Related data stored on a computer system can become fragmented over time.

(a) Explain what is meant by the term fragmentation, give one possible effect and explain defragmentation. [4]

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(b) Discuss the issues surrounding the defragmentation of a Solid State Drive (SSD). [3]

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7. Explain file backup, generations of files and transaction logs. [6]

8. (a) Using binary addition, calculate the number that would result from adding 00110110_2 and 00101110_2.

Convert the result into hexadecimal. [2]

(b) Assuming that 1 is used to indicate a negative number, show how the negative number -12_{10} will be represented using sign/magnitude in an 8 bit register. [1]

(c) Integers can also be represented using two's complementation.

Using the binary number 00001011_2 as an example, explain how two's complement is derived. [3]

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(d) (i) Give a disadvantage of using floating point form rather than integer form. [1]

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(ii) Real numbers stored in floating point form can be stored using 16 bits as shown below:

Mantissa (12 bits in two's complement form. The binary point in the mantissa is immediately after the left bit.)	**Exponent** (4 bits in two's complement form.)

Convert the number 23.75_{10} into this floating point form. [2]

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(iii) In a different computer system, the following is a floating point representation of a number, using an 8 bit mantissa and a 4 bit exponent:

$0 \bullet 1011000_2 \ 0101_2$

Calculate the mantissa, exponent and decimal equivalent of the number. [3]

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9. (a) Complete the following Boolean expression to illustrate the distributive law. [1]

$$A . (B + C)$$

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(b) Clearly showing each step, simplify the following Boolean expression. [5]

$$A.B + A.(B + C) + B.(B + C)$$

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10. Below is an algorithm that determines whether a positive whole number greater than 2, input by a user, is a prime number or not.

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1  Num is Integer
2  Divisor is Integer
3  Prime is Boolean
4  startmainprog
5     set Prime = TRUE
6     set Divisor = 2
7     output "type in a number"
8     input Num
9
10    repeat
11          if Num MOD Divisor = 0 then
12             set Prime = FALSE
13          endif
14          set Divisor = Divisor + 1
15    until (Prime = FALSE) OR (Divisor = Num)
16
17    if Prime = TRUE then
18          output Num, "is a prime number"
19    else
20          output Num, "is NOT a prime number"
21    Endif
22
23 Endmainprog
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(a) Name the logical operator used in the algorithm: [1]

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(b) Give an example of selection from the algorithm above and explain its purpose. [2]

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(c) Give an example of repetition from the algorithm above and explain its purpose. [2]

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(d) Give two examples of test data that would test that the algorithm on page 13 works as intended. [2]

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11. Customers can obtain quotations for car insurance via email by completing an on-line application form. Verification and validation checks are carried out on the data input.

(a) The customer has to create an account so that the insurance quotation can be stored and retrieved at a later date. As part of this process, the customer has to input a password which is verified.

Describe one method of verification that could be applied to the password.

[1]

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(b) The number of whole years since the driver made an insurance claim is validated. Excluding a presence check, describe a suitable validation check that would be carried out on the number of whole years giving an example of invalid data that would be detected by this check. [2]

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(c) Describe a different suitable validation check that could be carried out on the customer's email address giving an example of invalid data that would be detected by this check. [2]

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12. A weather station records monthly rainfall figures in millimetres (mm) for a year.

Write an algorithm, using pseudo-code or a high level programming language, which will use these twelve monthly rainfall figures as input. The program should output:

- the total rainfall for the year
- the mean monthly rainfall for the year
- the month numbers (1 for January, etc) where the rainfall was above the mean.

Your algorithm should contain meaningful identifiers. [6]

13. (a) Before new computer systems are introduced in an organisation, they are tested to ensure they meet the intended requirements. Describe the different types of system testing that will typically be carried out on the system. [3]

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(b) Following the installation of the new system, it will need to be maintained. Giving suitable examples, discuss the different types of system maintenance that will need to be carried out on the system. [3]

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14. Identify and describe the principal stages involved in the compilation process. [8]

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15. Explain lossy and lossless data compression techniques. [8]