Candidate Name	Centre Number					Candidate Number				

AS COMPUTER SCIENCE

COMPONENT 1

Fundamentals of Computer Science

SPECIMEN PAPER

2 hours

INSTRUCTIONS TO CANDIDATES

Answer ALL questions.

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. You are advised to divide your time accordingly.

The total number of marks available is 100.

You are reminded of the need for good English and orderly, clear presentation in your answers.

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

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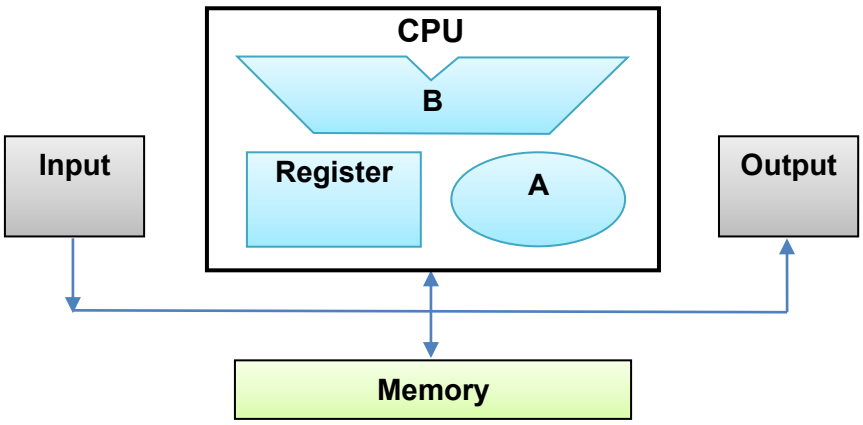
Answer *all* questions

1. Below is an incomplete diagram of a typical Von Neumann architecture computer.



(a) Identify and explain the function of components A and B above. [4]

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(b) The following data is stored in a 16-bit register.

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1001 0110 1101 1011
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Name the logical operation and draw the truth table required to clear this register. Include a worked example of clearing the register with the data above. [3]

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2. *(a)* Describe the importance of standard network protocols. [2]

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(b) Describe the use of the following protocols: [3]

(i) **IMAP:** ……

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(ii) **DHCP:** ……

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(iii) **UDP:** ……

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

(a) Explain what is meant by the term fragmentation and give one possible effect. [2]

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

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4. *(a)* Different data transmission methods are used by computer systems. Identify the most suitable transmission method for the following scenarios and explain their suitability.

(i) Sending sound to a speaker system. [3]

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(ii) A video conferencing call. [3]

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(b) Describe what is meant by the terms multiplexing and switching. [3]

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(c) Identify three typical items contained in a TCP/IP packet and describe their purpose. [6]

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5. *(a)* Using binary addition, calculate the number that would result from adding `00100101` and `00111100`

Convert the result into hexadecimal. [2]

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(b) Assuming that 1 is used to indicate a negative number, show how the negative number -13_{10} will be represented using sign/magnitude in an 8 bit register. [1]

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

Describe, using an example, how the two's complement of a binary number is derived. [2]

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(d) (i) Give an advantage and disadvantage of using floating point form rather than integer form. [2]

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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 63.25 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•1011000 0101

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

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6. Using Boolean algebra, simplify the following:

$$(A + C).(A.D + A.\overline{D}) + A.C + C$$

[7]

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7. When writing a program, a programmer could use a low level language or a high level language.

Give three advantages for each of these approaches.

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8. Scientists monitoring the level of a pollutant in the air take a number of readings and use a computer to analyse the data.

Write an algorithm, using pseudo-code, with the following inputs:

- the number of readings to be analysed
- the readings themselves as whole numbers

The algorithm should read the readings into an array then output:

- the mean of the readings
- how many readings were above the mean
- the highest reading

Your algorithm must be written using self-documenting identifiers.

[7]

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9. Explain the role of an Integrated Development Environment (IDE). Describe the purpose of **three** typical features of an IDE. [4]

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10. *(a)* Explain how a bubble sort operates. [2]

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(b) An algorithm is written for a bubble sort in one particular application. The input to the algorithm is a set of 6 positive integers.

One set of data which would test this algorithm is:

BubbleSortArray

45	32	5	35	19	62
(0)	(1)	(2)	(3)	(4)	(5)

Write down two other sets of data which will more fully test the algorithm. [2]

DataSet1

(0)	(1)	(2)	(3)	(4)	(5)

DataSet2

(0)	(1)	(2)	(3)	(4)	(5)

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11. Summarise how an operating system manages computer resources. [8]

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12. An organisation is responsible for paying its employees and calculating their tax and national insurance. Each employee is paid a different hourly rate.

The employee pay details, including their hourly rate are stored in a master file. The number of hours each employee works each month is entered and stored in a transaction file.

At the end of each month the hours worked by the employee and the hourly rate are used to calculate the month's pay, tax and national insurance.

(a) Explain why sequential file organisation is the most suitable for the master file and why serial file organisation is the most suitable for the transaction file. [2]

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(b) Give one item of data that would appear in both the transaction file and the master file. [1]

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(c) Draw a clearly labelled diagram below which shows how the transaction file and the master file are used to produce a pay slip for every employee. [4]

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13. Before new computer systems are introduced in an organisation, different methods of changeover are considered.

Compare two methods of changeover and consider processes that would protect the security and integrity of data during changeover.

You should draw on your knowledge, skills and understanding from a number of areas across your Computer Science course when answering this question. [13]

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END OF PAPER

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