1 A toy store gives each of the toys it sells a unique code. The codes are 3-digit hexadecimal codes, for example A4B.

A computer is used to store a database of the codes. The computer has 12-bit registers.

(a) Give the largest hexadecimal number that can be stored in a 12-bit register.

..... [1]

(b) Give the largest denary number that can be stored in a 12-bit register.

..... [1]

(c) Two toys have the hexadecimal codes 429 and 1A3.

Convert the **two** hexadecimal codes to 12-bit binary numbers.

429 .....

1A3 .....
[2]

Working space

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(d) Two binary numbers that are stored in the registers are 100010100001 and 011100001011.

Convert the **two** binary numbers to hexadecimal numbers.

100010100001 .....

011100001011 .....
[2]

Working space

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(e) The hexadecimal code for each toy is stored in a barcode that is displayed on each toy.

Each time a customer buys a toy, the barcode is scanned and the amount of stock stored in the database for that toy is reduced by 1.

An item of hardware is used in this system to receive the hexadecimal code from the barcode scanner and find it in the database. The item of hardware is built into a single chip.

(i) Identify the name of the item of hardware.

..... [1]

(ii) Tick (✓) **one** box to show whether a barcode scanner is a type of input, output, process or storage device.

A input ☐

B output ☐

C process ☐

D storage ☐

[1]

(iii) The barcode scanner contains a sensor.

Identify the type of sensor that the barcode scanner could contain.

..... [1]

(iv) A backup of the database is made at the end of each day using optical storage.

Describe how the database is written to the optical storage.

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..... [4]

2 Two binary numbers are stored in a computer.

(a) Add the **two** binary numbers using binary addition.

Give your answer in binary. Show all of your working.

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  11110101
+ 00111001
```

[4]

(b) A logic right shift of **three** places is performed on the binary number 11110101.

Give the denary number for the binary number that would be stored after the logical shift of **three** places has occurred. Show all of your working.

Working space .....

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Denary number .....

[3]

1 **(a)** Complete the sentences about number systems.

Use the items from the list.

Some of the items in the list will **not** be used. You should only use an item once.

A	B	C	D	E	F	G
H	W	X	Y	Z	0	1
2	4	8	10	16	127	128
255	256					

The binary number system is base ..... . The smallest denary number that can be represented as an 8-bit binary number is ..... . The largest denary number that can be represented as an 8-bit binary number is ..... .

The hexadecimal number system is base ..... . Each hexadecimal digit is equivalent to ..... bits. The numbers 1 to 9 are used and the number 10 is represented by ..... . The hexadecimal number system continues up to the number 15, which is represented by ..... .

[7]

(b) Two 8-bit binary numbers are given.

Add the two 8-bit binary numbers using binary addition.

Give your answer in binary. Show all your working.

```
  1 0 0 1 1 0 1 1
+ 0 0 0 1 0 0 1 1
```

[3]

(c) Binary addition can result in overflow.

Tick (✓) **one** box to show the correct definition of overflow in binary addition.

A The answer has created a negative number that cannot be represented in binary addition. ☐

B The answer is the result of a logical shift that cannot be performed in binary addition. ☐

C The answer is too large to represent in the number of bits available. ☐

D The answer is too small to represent in the number of bits available. ☐

[1]

3 A user enters data that is hexadecimal into a computer system. The data is converted to binary to be processed by the computer.

(a) (i) Give **one** similarity between hexadecimal and binary.

.....

..... [1]

(ii) Give **two** differences between hexadecimal and binary.

1 .....

.....

2 .....

.....

[2]

(b) Data that is denary can also be converted to binary.

Give the binary number for each of the **three** denary numbers.

15 .....

180 .....

235 .....

[3]

Working space

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(c) Denary numbers can also be converted to hexadecimal.

Give the hexadecimal number for each of the **three** denary numbers.

14 .....

100 .....

250 .....

[3]

Working space

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(d) A binary integer that is stored in a register in the computer has a logical left shift performed on it.

(i) Describe the process of the logical left shift that is performed on the binary integer.

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..... [2]

(ii) State what effect this will have on the binary integer.

.....

..... [1]

(e) A negative binary integer needs to be stored in a register in the computer.

Give the name of the number system that can be used to represent negative binary integers.

..... [1]

2 Hypertext markup language (HTML) colour codes can be represented as hexadecimal.

(a) Tick (✓) **one** box to show which statement about the hexadecimal number system is incorrect.

A It uses the values 0 to 9 and A to F. ☐

B It can be used as a shorter representation of binary. ☐

C It is a base 10 system. ☐

D It can be used to represent error codes. ☐

[1]

(b) Denary numbers can be converted to hexadecimal.

Convert the **three** denary numbers to hexadecimal.

20 .....

32 .....

165 .....

[3]

Working space

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3 The binary number 10100011 is stored in random access memory (RAM).

A logical left shift of **three** places is performed on the binary number.

(a) Give the 8-bit binary number that will be stored after the shift has taken place.

..... [1]

(b) Tick (✓) **one** box to show which statement about a logical left shift of **two** places is correct.

A It would divide the binary number by 2. ☐

B It would multiply the binary number by 2. ☐

C It would divide the binary number by 4. ☐

D It would multiply the binary number by 4. ☐

[1]

(c) 10100011 can be stored as a two's complement integer.

Convert the two's complement integer 10100011 to denary. Show all your working.

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.....

.....

..... [2]

(d) The binary number is measured as a byte because it has 8 bits.

State how many bytes there are in a kibibyte (KiB).

..... [1]

3 Binary is a base 2 number system.

(a) Give the name of the number system that is base 16.

..... [1]

(b) **Three** denary numbers are entered into a computer. The computer converts the numbers and stores them as binary.

(i) Give the binary number that would be stored for each of the denary numbers.

10 .....

50 .....

201 .....

[3]

Working space

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(ii) Explain why the data is converted to binary by the computer.

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..... [2]

(c) The two binary integers 00110000 and 01100110 are added together.

Add the binary integers using binary addition and show your answer in binary. Show all your working.

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..... [3]

(d) The denary integer –32 is stored as a two's complement integer.

Calculate the two's complement integer that would be stored.

Show all your working.

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..... [2]

1 Computers represent different types of data in binary.

(a) Tick (✓) **one** box to show the reason why computers use binary to represent data.

A Computers only allow 1s and 0s to be entered. ☐

B Computers are made of switches and gates that can only be on or off. ☐

C Binary does **not** need to be converted into other forms of data to be displayed. ☐

D Both computers and humans can quickly process binary data. ☐

[1]

(b) One form of data is characters.

The American standard code for information interchange (ASCII) denary number for the character 'N' is 78.

(i) Tick (✓) **one** box to identify the ASCII denary number for the character 'Q'.

A 81 ☐

B 80 ☐

C 79 ☐

D 77 ☐

[1]

(ii) Give the binary number for the ASCII denary number for 'N'.

..... [1]

Working space

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(iii) Explain how the word 'RED' is represented using a character set.

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[2]

(c) Sound can be represented as binary.

(i) Explain why recording sound with a higher sampling resolution creates a more accurate recording.

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..... [2]

(ii) Give **one** other way that the accuracy of a sound recording can be improved.

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..... [1]

8 **(a)** Hexadecimal can be used to represent binary numbers.

(i) Convert the denary number 236 into hexadecimal.

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..... [1]

Working space

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(ii) Give **one** benefit of using hexadecimal instead of binary to represent data.

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..... [1]

(b) Two's complement can be used to represent positive and negative binary integers.

(i) Convert the two's complement integer 10110111 into denary.

Show all your working.

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..... [2]

(ii) Convert the denary number 45 into an 8-bit two's complement integer.

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..... [1]

Working space

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(c) Logical shifts are performed on binary integers.

State the mathematical effect of a right shift of **four** places on a positive binary integer.

.....

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..... [2]

2 A register stores the binary number:

1	1	1	0	0	0	1	1

(a) Give the denary number for the binary number stored in the register.

..... [1]

Working space

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.....

(b) Give the hexadecimal number for the binary number stored in the register.

..... [2]

Working space

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.....

.....

(c) A logical left shift of **two** places is performed on the binary number stored in the register.

Complete the binary register to show its contents after this logical left shift.

[1]

(d) The negative denary number −99 needs to be stored in the register.

Complete the register to show the binary number that would be stored, using two's complement. Show all your working.

Working space .....

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.....

Register:

[2]

(e) The number 01001100 is added to 11100011

Add the two 8-bit binary numbers, using binary addition.

Give your answer in binary. Show all your working.

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..... [4]