Computer Science 9608
Topical Past Papers

Topic: 1.1.1 Number Representation

5. (a) The name and address are stored as ASCII characters. Explain what is meant by an ASCII character. **[2]**

4. (a) (i) Explain what is meant by the character set of a computer. **[1]**

 (ii) Describe how the character set is represented in the computer system. **[2]**

6. (a) Represent

    (i)   +102,
    (ii) +117

 as 8-bit numbers in two's complement form **[2]**

6. (a) Express the denary value 109 as

    (i)   a binary number using an 8-bit byte;
    (ii) a hexadecimal number. **[4]**

7. (a) Express the denary number 78 as

    (i)   a binary number stored in an 8 bit byte,
    (ii) a hexadecimal number,
    (iii) a number stored in binary coded decimal (BCD). **[6]**

(c) (i) Convert -63 and -94 into 2's complement, 8 bit, binary numbers. **[2]**

7. The communications system used by the company uses circuit switching for the transmission of data between head office and the copywriters.

(b) When texts are transferred large amounts of data are transmitted.

(i) The characters are sent as ASCII characters.

Explain what is meant by an ASCII character. **[2]**

Topic: 1.1.1 Number Representation

Oct/NOV 2006.P3

5. (a) Express the decimal number 109 as

    (i)   a binary number stored in an 8 bit byte; **[2]**

    (ii) a number in binary coded decimal (BCD); **[2]**

    (iii) a hexadecimal number. **[2]**

(b) A particular computer stores numbers as 8 bit, two's complement, binary numbers.

  01011101 and 11010010   are two numbers stored in the computer.

    (i)   Write down the decimal equivalent of 11010010. **[2]**

Oct/NOV 2007.P1

2. A variety of goods are stored in a warehouse.

All goods enter and leave the warehouse at a specific point.

All goods are bar coded.

(a) The number of each item in the warehouse is stored as a binary number.

Change 83 into a binary number stored in an 8 bit byte. **[2]**

May/June 2008.P3

4. (a) (i) Express the number 93 as an 8 bit binary number. **[2]**

(iii) Express the number 93 as a number in hexadecimal. **[2]**

(b) (ii) Describe the connection between binary representation and hexadecimal. **[2]**

May/June 2009.P3

6. (a) Show how the denary number –90 can be represented, using 8 bits, in:

(ii) two's complement. **[1]**

Topic: 1.1.1 Number Representation

Oct/NOV 2009. P12

3. A library stores details of members on the member file.

(a) Members' names are stored as strings of characters using ASCII.

(i) State what is meant by a character set. **[1]**

(ii) Describe how the ASCII character set is represented. **[3]**

(c) The number of visits made by a member during the year is stored as an integer in a single byte. Mr Jyu has visited 135 times.

Change 135 into the binary representation for the computer to store. **[2]**

Oct/NOV 2009. P32

9. (a) Express the denary number 94 as:

(i) a BCD value, **[2]**

(iii) a hexadecimal value. **[2]**

May/June 2011. P11

3. (a) (i) Explain what is meant by the character set of a computer.

(ii) Explain how a character is represented in a computer. **[4]**

(b) Explain the representation of integers in a computer. **[3]**

May/June 2011. P12

3. (a) (i) Explain what is meant by the character set of a computer.

(ii) Explain how a character is represented in a computer. **[4]**

(b) Explain the representation of integers in a computer. **[3]**

May/June 2011. P13

3. (a) Explain how a character is represented in a computer. **[2]**

(b) Explain how integers are represented in a computer. **[3]**

(c) Explain how a Boolean value is stored in a computer. **[2]**

Topic: 1.1.1 Number Representation

May/June 2011. P31

May/June 2011. P32

7. Part of the information stored in the data dictionary describes the type of data which is being stored.

A particular piece of data is 10010110.

State what the data stands for if the data dictionary describes it as:

(i) a two's complement binary number;   **[1]**

(iii) a binary coded decimal number.   **[2]**

May/June 2011. P33

7. (a) Express the denary number -95 as a two's complement integer in an eight-bit byte.   **[2]**

Oct/NOV 2011. P31

3 (b) Convert the following denary numbers into 8-bit, two's complement, binary numbers:

    (i)   +93   **[2]**
    (ii)   -69   **[2]**

(c) (ii) Using the binary values from part (b), work out 93 - 69, giving your answer in two's complement form using 8-bit binary. You must show your working.   **[4]**

Oct/NOV 2011. P32

3 (a) Convert the denary number 395 into

    (i)   a binary coded decimal number (BCD)   **[3]**
    (ii)   a hexadecimal number   **[3]**

Oct/NOV 2011. P33

3 (b) Convert the following denary numbers into 8-bit, two's complement, binary numbers:

    (i)   − 3   **[2]**
    (ii)   − 47   **[2]**

May/June 2012. P11/12

7 (a) (i) Change the denary integer 278 into a binary number, using 10 bits.   **[1]**

(ii) Change the binary number 10101100 into a positive denary integer.   **[1]**

Topic: 1.1.1 Number Representation

May/June 2012. P13

7 (a) (i) Change the denary integer 222 into a binary number, using 10 bits. **[1]**

(ii) Change the binary number 01101100 into a positive denary integer. **[1]**

May/June 2012. P31/32

2 A binary pattern can be used to represent different data used in a computer system.

(a) Consider the binary pattern: 0101 0011
The pattern represents an integer.
What number is this in denary? **[1]**

(b) Consider the binary pattern: 0001 0101 0011
The pattern represents a Binary Coded Decimal (BCD) number.
What number is this in denary? **[1]**

(c) Consider the binary pattern: 1001 0010
This represents a two's complement integer.
What number is this in denary? **[1]**

May/June 2012. P33

2 A binary pattern can be used to represent a variety of different data used in a computer system.

(a) The pattern could represent an ASCII character code.
The table shows part of the ASCII code table.
ASCII Code Table

Character	Decimal	Character	Decimal	Character	Decimal
<Space>	32	I	73	R	82
A	65	J	74	S	83
B	66	K	75	T	84
C	67	L	76	U	85
D	68	M	77	V	86
E	69	N	78	W	87
F	70	O	79	X	88
G	71	P	80	Y	89
H	72	Q	81	Z	90

Consider the binary pattern: 0100 1110.

(i) What character is represented by this binary pattern? **[1]**

(ii) What is the hexadecimal for this binary pattern? **[1]**

(b) (i) A computer system needs to be able to store positive and negative integers.

Two possible representations are:

- sign and magnitude
- two's complement.

Describe two advantages of using two's complement. **[2]**

(ii) The integers -13 and +59 are to be added using two's complement addition.

Show your working. **[3]**

Oct/NOV 2012. P31

2 (a) Binary representation is used for many different data values.

Consider the binary pattern 1001 0100

What is its value if it represents:

(i) an 8-bit two's complement integer? **[1]**

(ii) a binary coded decimal (BCD) number? **[1]**

Oct/NOV 2012. P32

2 (a) A binary pattern can be interpreted in a number of different ways.

Consider the binary pattern 1001 1010

(ii) What denary number is this if it represents a two's complement integer? **[1]**

(iii) Describe one advantage of using two's complement representation rather than sign and magnitude. **[1]**

Oct/NOV 2012. P33

2 (a) Binary representation is used for many different data values.

Consider the binary pattern 1010 0110

What is its value if it represents:

(i) an 8-bit two's complement integer? **[1]**

(iii) a hexadecimal number? **[1]**

Topic: 1.1.1 Number Representation

Oct/Nov 2013.P13

2 (a) (i) A positive integer is represented in binary as 10101101. What is the denary value? **[1]**

(ii) How would the denary value 73 be represented as a positive binary integer? **[1]**

(b) Explain what is meant by the character set of a computer. **[2]**

(c) Explain how a character is represented in a computer. **[2]**

Oct/Nov 2013.P31

3 (b) (i) Convert the hexadecimal number 7A to denary. **[1]**

(ii) Convert the binary number 0101 1100 to hexadecimal. **[1]**

(iii) Why do computer scientists often write binary numbers in hexadecimal? **[1]**

Oct/Nov 2013.P32

3 (b) (i) Convert the denary number 60 into hexadecimal. **[1]**

(ii) Convert the hexadecimal number 10F into denary. **[1]**

(iii) Why do computer scientists often write binary numbers in hexadecimal? **[1]**

Oct/Nov 2013.P33

3 (b) (i) Convert the hexadecimal number 7F into denary. **[1]**

(ii) Convert the denary number 291 into hexadecimal. **[1]**

(iii) Why do computer scientists often write binary numbers in hexadecimal? **[1]**

Topic: 1.1.1 Number Representation

9 A vending machine dispenses drinks and has a number of drinks options.

drink	option with code			
tea	black 10	+ milk 11	+ sugar 12	+ milk + sugar 13
coffee	black 20	+ milk 21	+ sugar 22	+ milk + sugar 23
cappuccino	normal 30	+ extra milk 31	+ sugar 32	+ extra milk + sugar 33
chocolate	normal 40	+ extra milk 41	+ sugar 42	+ extra milk + sugar 43
cold drinks	coke 50	orange 51	lemon 52	mango 53
water	normal 60	cold 61	cold fizzy 62	hot 63

The vending machine is controlled by a microprocessor.

If a customer keys in 23 then they will receive a cup of coffee with milk and sugar.

A selected code is stored in a 7-bit register:

So 23 will be stored as

0	0	1	0	1	1	1

If an invalid code is keyed in, an error message is displayed. (a) A customer selects a lemon drink.

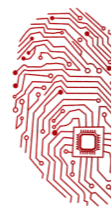Show how the code for this selection is stored in the 7-bit register:

[1]

(b) Name the drink selected if the register contains:

0	1	0	1	0	1	1

[1]

Page **8** of **21**

03-111-222-ZAK
OlevelComputer
AlevelComputer
@zakonweb
zak@zakonweb.com
www.zakonweb.com
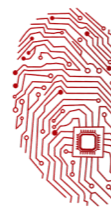
(c) State what would happen if the customer keys in a code which results in the following 7-bit register content:

1	0	1	1	0	1	1

[1]

Topic: 1.1.1 Number Representation

May/June 14. P13

1 The following diagram shows **five** questions on the left and **eight** numerical values on the right.

Draw arrows to connect each question to the correct numerical value.

| | 10 |

| How many bits are there in 3 bytes of data? | | 12 |

| If 2^x bytes = 1 kilobyte, what is the value of x? | | 14 |

| If the binary pattern 00010010 represents a positive integer, what is its denary value? | | 16 |

| How many possible binary input combinations are there in a 4-input logic circuit? | | 18 |

| | 20 |

The next change to the stack is to remove an item.

Which one?

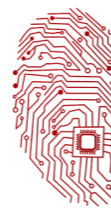| 14 |
| 18 |
| 20 |

| 22 |

| 24 |

[5]

Topic: 1.1.1 Number Representation

9 A tall office building has 60 floors. The building has 22 lifts (elevators), which operate between these floors. A computer is used to ensure efficient use of these lifts.

Each lift has its status stored in its own 12-bit register.

• The leftmost 5 bits represent the lift number.

• The next 6 bits represent the floor level where the lift is currently located.

• The rightmost bit represents whether the lift is going up (1) or going down (0).

(a) The register for one particular lift contains the following values:

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

In each case below, give the information being represented.

lift number (in denary)

current floor level (in denary)

lift going up or down   **[3]**

(b) State what the register for lift 17 would contain if it is currently on the 25th floor and is going up.

                                                                                      [3]

(c) (i) A member of staff is on the 11th floor and wishes to go up.

She presses the "up" button next to the lifts.

Identify the criteria the computer program will use to determine which lift should be sent to the 11th floor.   **[2]**

(ii) Which of the following four lifts (A, B, C, D) should be chosen by the computer program to go to the 11th floor to allow the member of staff to go up? Give a reason for your choice.
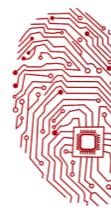
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | **A**
|---|---|---|---|---|---|---|---|---|---|---|---|

| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | **B**
|---|---|---|---|---|---|---|---|---|---|---|---|

Topic: 1.1.1 Number Representation

| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | **C** |

| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | **D** |

lift

reason for choice **[2]**

(d) The member of staff gets into the lift and selects the 40th floor.

A second person gets in this lift at the 20th floor and selects the 28th floor and a third person gets in the lift at the 24th floor and selects the 38th floor.

The destination floors are now 40, 28 and 38.

Explain how the computer program ensures that the lift stops at the floors in the correct logical sequence. **[2]**

May/June 14. P31

May/June 14. P32

5 (a) A computer system stores integers in 8-bit two's complement form.

Give the denary number represented by Byte 1 and Byte 2.

Byte 1   Byte 2

| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |

[2]

(b) Two bytes together are used to represent a Binary Coded Decimal (BCD) number.

State the denary number represented by Byte 3 and Byte 4.

Byte 3   Byte 4

| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |

[2]

(c) Byte 5 and Byte 6 together represent a 16-bit colour code used in a drawing program.

The drawing program displays a colour code as a hexadecimal number.

State the hexadecimal number for this code.

Byte 5								Byte 6							
0	1	1	0	1	0	1	0	1	1	1	1	0	1	0	1

[2]

May/June 14. P32

5 (a) A computer system stores integers as an 8-bit two's complement integer.

Give the denary number represented by Byte 1 and Byte 2.

Byte 1								Byte 2							
1	0	1	0	0	0	0	1	0	1	1	0	1	1	1	1

[2]

(b) Two bytes together are used to represent a Binary Coded Decimal (BCD) number.

State the denary number represented by Byte 3 and Byte 4.

Byte 3								Byte 4							
0	1	0	0	0	0	0	0	0	1	0	1	0	1	1	1

[2]

(c) Byte 5 and Byte 6 together represent a 16-bit colour code used in a drawing program.

The drawing program displays a colour code as a hexadecimal number.

State the hexadecimal number for this colour code.

Byte 5								Byte 6							
0	1	1	0	1	1	1	0	1	1	1	1	1	0	0	1

[2]

Topic: 1.1.1 Number Representation

Oct/Nov 14.P11

Oct/Nov 14.P13

5 The table below represents a data structure. It is called BinaryNumber and stores:

• the place values for a binary integer, in the locations represented by the first row of the table

• the bits of a binary number, in the locations represented by the second row of the table

128	64	36	16	8	4	2	1
0	1	1	0	1	0	1	1

(a) What is the denary value of this binary number? [1]

Oct/Nov 14.P12

5 A microprocessor-controlled alarm clock uses the 24-hour clock. The current time is stored in two 8-bit memory locations:

• the hours value is stored in memory location **A**

• the minutes value is stored in memory location **B**

(a) State the time currently stored in **A** and **B**.

A

0	0	0	1	0	0	1	0

:

B

0	0	1	1	0	1	0	1

Hours: …………………………………………………. Minutes: …………………………………………………

[2]

(b) Two 8-bit memory locations, **C** and **D**, store the hours **(C)** and minutes **(D)** of the alarm time.

The alarm has been set for 07:30. Show how 07:30 would be stored:

C

0	1	1	0	1	0	1	1

:

D

0	1	1	0	1	0	1	1

[2]

Oct/Nov 14.P33

4 (b) The given table of instructions shows the binary number used for each instruction's opcode.

All instructions in machine code are stored as a 16-bit pattern, with the opcode as the first 8 bits and the operand as the second 8 bits.

(ii) Consider the instruction:

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

(iii) Programmers prefer to write machine code instructions in hexadecimal. Explain why.   **[1]**

(iv) What is the hexadecimal number for the instruction shown in part (b)(ii)?   **[1]**

Oct/Nov 14.P32

4(a) The given table of instructions shows the binary number used for each instruction's opcode.

All instructions in machine code are stored as a 16-bit pattern, with the opcode as the first 8 bits and the operand as the second 8 bits.

(ii) Consider the instruction:

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

(iii) Programmers prefer to write machine code instructions in hexadecimal. Explain why.   **[1]**

(iv) What is the hexadecimal number for the machine code instruction shown in part (b)(ii)?   **[1]**

May/June 15. P11

6 The output, X, from the logic circuit is sampled every 30 seconds by a computer.

The sequence of output values is stored in a block of 1 byte memory locations. Each byte stores seven samples, filling from position 0 to position 6. Position 7 is reserved as a parity bit.

(b) (i) Give the denary value if the byte contains:

0	1	1	1	1	0	0	0

                [1]

Topic: 1.1.1 Number Representation

(ii) Show what binary value must be stored in the byte to represent the denary value 43.

[1]

May/June 15. P12

10 A microprocessor-controlled timing device is used to time runners over a 20 km course.

A runner's time is recorded in two 8-bit registers:

• register A stores the minutes

• register B stores the seconds

(a) Calculate this runner's time:

A

0	0	1	1	1	1	0	1

:

B

0	0	0	1	1	1	0	0

Minutes: …………………………………………………   **Seconds: …………………………………………………..**

[2]

(b) Show how 110 minutes and 50 seconds would be stored:

A

:

B

[2]

Topic: 1.1.1 Number Representation

May/June 15. P13

6 A satellite television receiver has a number of channels:

Category	Channels
News	10 to 19
Film	20 to 29
Plays and documentaries	30 to 39
Sport	40 to 49
Comedy	50 to 59
Special interest	60 to 69
Motoring and leisure	70 to 79

A user keys in a choice of channel using a handset.

The handset and the receiver are each controlled by a microprocessor.

When a user keys in 34, this value is stored in an 8-bit register as shown below:

	0	1	0	0	0	1	0

↖ the 8ᵗʰ bit is the parity bit
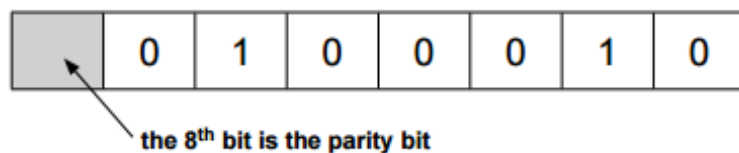
(a) A user keys in 47.

Show the value stored in the 8-bit register.

[1]

(b) Calculate which channel has been selected if the 8-bit register contains:

	1	0	0	1	0	1	1

[1]

Topic: 1.1.1 Number Representation

(c) Describe what could happen if the handset transmits the following selection:

	1	0	1	0	1	0	0

[1]

May/June 15. P31

May/June 15. P32

5 A computer system stores integers in a single byte using two's complement representation.

(a) State the denary integer represented by the following two bytes.

Give the hexadecimal representation of each integer.

(i)

0	1	1	0	1	1	1	1

[2]

(ii)

1	1	1	0	0	0	1	1

[2]

(b) State the most negative denary integer that can be represented. [1]

(c) Why do computer scientists often write binary numbers in hexadecimal? [1]

(e) Integers can be represented in Binary Coded Decimal (BCD).

(i) State what denary number is represented by this 2-byte BCD number.

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

[1]

Topic: 1.1.1 Number Representation

May/June 15. P33

5 A computer system stores integers in a single byte using two's complement representation.

(a) State the denary integer represented by the following two bytes.

Give the hexadecimal representation of each integer.

(i)

1	1	1	0	1	0	0	1

[2]

(ii)

0	1	1	0	1	0	1	1

[2]

(iii)   State the largest positive denary integer which can be represented.   **[1]**

(iv)   Why do computer scientists often write binary numbers in hexadecimal?   **[1]**

(c) Integers can be represented in Binary Coded Decimal (BCD).

(i)   State what denary number is represented by this 2-byte BCD number.

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

[1]

(ii)   A second BCD 2-byte number has been copied incorrectly.

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

Without converting the whole pattern, how can you identify that this cannot be a valid BCD representation?

[1]

Topic: 1.1.1 Number Representation

9608

1 (i) Convert the following binary number into hexadecimal.

1 0 1 1 1 0 0 0

[1]

(ii) Convert the following denary number into BCD format.

9 7

[1]

(iii) Using two's complement, show how the following denary numbers could be stored in an 8-bit register:

114 | | | | | | | | |
|---|---|---|---|---|---|---|---|

-93 | | | | | | | | |
|---|---|---|---|---|---|---|---|

[2]

1 (a) (i) Using two's complement, show how the following denary numbers could be stored in an 8-bit register:
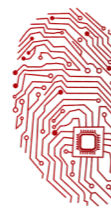
124 | | | | | | | | |
|---|---|---|---|---|---|---|---|

-77 | | | | | | | | |
|---|---|---|---|---|---|---|---|

[2]

(ii) Convert the two numbers in part (a) (i) into hexadecimal. [2]

(b) Binary Coded Decimal (BCD) is another way of representing numbers.

   (i)   Write the number 359 in BCD form. **[1]**

   (ii) Describe a use of BCD number representation. **[2]**