SUBJECT – COMPUTER SCIENCE (0478)

CHAPTER – DATA REPRESENTATION

TOPIC – NUMBER SYSTEMS

PAST PAPER BOOKLET -1

(CONVERSIONS, BINARY ADDITION, TWO'S COMPLIMENT, USES OF HEXADECIMAL)

NUMBER SYSTEM

FM 2025/12

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]

ON 2024/12

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 .....

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2 .....

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[2]

FM 2024/12

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]

MJ 2022/12

4 All data needs to be converted to binary data so that it can be processed by a computer.

(a) Explain why a computer can only process binary data.

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..... [2]

MJ 2024/11

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]

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

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..... [2]

CONVERSIONS

ON 2024/11

(b) The character 'A' is represented by the denary ASCII number 65.

The character 'm' is represented by the denary ASCII number 109.

(i) Convert the **two** denary ASCII numbers to binary.

65 .....

109 .....

[2]

Working space

.....

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(ii) Convert the **two** denary ASCII numbers to hexadecimal.

65 .....

109 .....

[2]

Working space

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(c) The character 'y' is represented by the binary ASCII number 01111001.

(i) Convert the binary ASCII number to denary.

..... [1]

Working space

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(ii) Convert the binary ASCII number to hexadecimal.

..... [1]

Working space

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1. ON 2024/12

(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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ON 2024/13

(c) All data is converted to binary to be processed by a computer.

(i) Calculate the binary number for the denary number 175. Show all your working.

.....

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.....

..... [2]

(ii) Give the binary number for the given hexadecimal numbers.

15 .....

2D .....

091 .....

[3]

MJ 2024/11

(b) Denary numbers can be converted to hexadecimal.

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

20 .....

32 .....

165 .....

[3]

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]

(b) The denary values 64, 101 and 242 are converted to 8-bit binary values.

Give the 8-bit binary value for each denary value.

64 .....

101 .....

242 .....

[3]

(b) Denary numbers can be converted to hexadecimal.

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

20 .....

32 .....

165 .....

[3]

2. MJ 2024/13

3 A programmer is creating a computer game. One character is **not** moving correctly.

The programmer needs to debug the program. To do this they need to look at addresses that are locations in memory.

The addresses are displayed as hexadecimal numbers.

(a) One address is A2F.

(i) Convert the address to binary.

..... [3]

(ii) Convert the address to denary.

..... [1]

Working space

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(b) The binary number stored for another address is 000110011011.

(i) Convert the binary number to hexadecimal.

..... [3]

(ii) Convert the binary number to denary.

..... [1]

Working space

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USES OF HEXADECIMAL

(c) Give **one** reason why the addresses are displayed in hexadecimal instead of binary.

.....

..... [1]

(d) Identify **two** other ways that hexadecimal is used in computer science.

1 .....

2 .....

[2]

(b) HTML colour codes and Media Access Control (MAC) addresses are two examples of where hexadecimal is used in Computer Science. Give two other examples of where hexadecimal can be used in Computer Science.

Example 1 .....

Example 2 .....

[2]

(b) Give **two** benefits, to users, of converting binary values to hexadecimal.

Benefit 1 .....

.....

Benefit 2 .....

.....

[2]

(c) Hexadecimal is used to represent Hypertext Markup Language (HTML) colour codes in computer science.

Identify **three** other ways that hexadecimal is used in computer science.

1 .....

2 .....

3 .....

[3]

(b) When planning the game, the designer decided to use hexadecimal notation to represent the binary values.

Explain why the designer used hexadecimal notation.

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..... [2]

(c) State the hexadecimal equivalent of the binary value 1010110101

..... [3]

BINARY ADDITION

FM 2025/12

(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.

```
  10011011
+ 00010011
```

[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]

ON 2024/11

(d) The character 'T' is represented by the binary ASCII number 01010100.

The character 't' is represented by the binary ASCII number 01110100.

Add the **two** binary numbers using binary addition. Give your answer in binary. Show all your working.

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..... [3]

ON 2024/13

(d) Binary integers can be added together.

Add the **two** binary integers using binary addition. Show all your working. Give your answer in binary.

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

[4]

(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]

TWO'S COMPLIMENT

ON 2024/12

(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]

(e) Calculate the denary number for the two's complement binary integer 10001110. Show all your working.

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..... [2]

(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 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]

(e) The health value for a character in the computer game can sometimes be a negative value. The negative values are stored as two's complement 8-bit integers.

A character has a health value of –25.

Calculate the two's complement 8-bit integer for –25. Show all your working.

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..... [2]

LOGICAL SHIFTING

ON 2024/11

(iii) A logical right shift of two places is performed on the binary ASCII number 01111001.

Give the binary number after the logical right shift of **two** places is performed.

..... [1]

Working space

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ON 2024/12

(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]

3. MJ 2024/12

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]

4.ON 2019/12

4 An 8-bit binary register contains the value:

0	0	1	1	0	1	0	0

(a) Convert the binary value to denary.

.....

..... [1]

(b) The contents of the register shifted one place to the right would give the result:

0	0	0	1	1	0	1	0

The contents of the register shown at the start of question 4 are shifted two places to the left.

Show the contents of the register after this shift has taken place.

[1]

(c) State the effect this shift has on the denary value in **part (a)**.

.....

..... [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]

PRACTICE QUESTIONS

1. MJ 2022/11 – Q4

(c) The hexadecimal values 42 and CE are converted to binary.

Give the binary value for each hexadecimal value.

42 .....

CE .....

[4]

Working space

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2. MJ 2022/12 – Q1, Q2

1 **(a)** Denary values are converted to binary values to be processed by a computer.

Draw **one** line from each denary value to the correctly converted 8-bit binary value.

Denary	8-bit binary
	00100001
41	10100110
	00101001
174	10000110
	10101110
86	01010110

[3]

Working space

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(b) Binary values can also be converted to denary values.

Give the correct denary value for the 12-bit binary value 000101010111
Show all your working.

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Denary value .....

[2]

2 Hexadecimal is used for Hypertext Markup Language (HTML) colour codes.

An HTML colour code is:

#2F15D6

Each pair of digits is stored as binary in an 8-bit register.

(a) Give the 8-bit binary value that would be stored for each pair of hexadecimal digits.

2F								
15								
D6								

[6]

Working space

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5. MJ 2022/13 Q2a, c

2 An aeroplane has a small display screen above each seat, to display the seat number.

(a) The seat number is a hexadecimal value. A 12-bit binary register is used to store the data to display each seat number.

Three seat numbers, 05A, 18C and 29F, are allocated to passengers.

Give the 12-bit binary value that would be stored for each hexadecimal seat number.

05A .....

18C .....

29F .....

[6]

Working space

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.....

(c) **Two** of the registers store the values 010000001101 and 000001111110

Give the hexadecimal seat number that would be displayed on the screen for each of these binary values.

010000001101 .....

000001111110 .....

[4]

Working space

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6. FM 2022/12 – Q1

1 A computer stores data in binary form. Binary numbers can be represented as hexadecimal and denary numbers.

(a) Convert the 8-bit binary number 01010101 to denary.

..... [1]

Working space

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(b) Convert the binary number 11000000 to hexadecimal.

..... [1]

Working space

.....

.....

.....

(c) Convert the hexadecimal number 1A to denary.

..... [1]

Working space

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(d) Binary numbers can be stored as bytes.

State how many bits are in **two** bytes.

..... [1]

7. ON 2021/11 Q1

1 Binary is a number system that is used by computers.

(a) Tick (✓) **one** box to show whether binary is a base-2, base-10 or base-16 number system.

Tick (✓)

☐ Base-2

☐ Base-10

☐ Base-16

[1]

(b) Hexadecimal and denary are number systems that can be used by programmers.

Convert these **four** hexadecimal values into denary values.

09 .....

10 .....

28 .....

A1 .....

[4]

Working space

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8. ON 2021/12 – Q1

1 **(a)** Denary is a number system that is used by programmers.

Tick (✓) **one** box to show whether denary is a base-2, base-10 or base-16 number system.

Tick (✓)	
☐	Base-2
☐	Base-10
☐	Base-16

[1]

(b) Hexadecimal values can be used to represent denary values.

Convert these **four** hexadecimal values into denary values.

05 .....

20 .....

1A .....

AB .....

[4]

Working space

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.....

(c) Hexadecimal values can also be converted to binary values.

Tick (✓) **one** box to show the correct 8-bit binary value for each hexadecimal value.

(i) Hexadecimal value 25

Tick (✓)	
☐	00011001
☐	00100101
☐	10100001

[1]

(ii) Hexadecimal value 1B

Tick (✓)	
☐	00011011
☐	10110001
☐	00011010

[1]

9. ON 2021/13 Q2

2 A sports stadium has an electronic counter that counts each person that enters the stadium.

The count is stored as binary in a 16-bit register.

A denary value of the count is displayed on a screen at the entrance.

(a) The screen currently displays:

0	0	7	1

Give the binary value that is stored in the register to display the count shown.

Binary value: .....

Working space

.....

.....

.....

[2]

(b) More people enter the sports stadium and the screen now displays:

0	2	5	7

Give the binary value that is stored in the register to display the count shown.

Binary value: .....

Working space

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.....

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[2]

(c) After everyone has entered the stadium, the register stores the binary value:

0000001000000100

Show what the screen will display when this binary value is stored.

Display:

[1]

Working space

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10. MJ 2021/11 – Q1

1 Benedict has a computer that is assigned an Internet Protocol (IP) address. The IP address is:

198.167.214.0

The IP address is represented as denary values.

(a) Convert the denary values 167 and 214 from the IP address to 8-bit binary.

167 | | | | | | | | |

214 | | | | | | | | |

Working space

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.....

[2]

11. MJ 2021/12 Q1

1 A denary value can be converted into hexadecimal and binary.

(a) Complete the table to show the hexadecimal and 8-bit binary values of the given denary values.

Denary	Hexadecimal	8-bit binary
49		
123		
200		

[6]

Working space

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12. MJ 2021/13 – Q1

1 Greta has a computer that she uses for schoolwork and leisure.

(a) The computer has the Media Access Control (MAC) address:

00:A0:C9:14:C8:29

(i) Tick (✓) to show whether the MAC address is initially assigned to the computer by the network, the manufacturer or the user.

	Tick (✓)
Network	☐
Manufacturer	☐
User	☐

[1]

(ii) The values in the MAC address are hexadecimal values.

Convert the **three** given hexadecimal values into 8-bit binary.

14 .....

A0 .....

C9 .....

[3]

Working space

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.....

.....

(iii) Convert the **two** given hexadecimal values into denary.

29 .....

C8 .....

[2]

Working space

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13. FM 2021/12 – Q1

1 A hockey club records the number of people that watch each match. An 8-bit binary register is used to store this value.

(a) 46 people watch the first match and 171 people watch the second match.

Show how the registers would store these denary values as 8-bit binary.

Denary value	8-bit binary							
46								
171								

[2]

Working space

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.....

(b) Give the largest denary value that can be stored in the 8-bit binary register.

..... [1]

(c) The hockey club wants to increase the number of people that can watch each match to 2000. The 8-bit binary register may no longer be able to store the value.

Give the smallest number of bits that can be used to store the denary value 2000.

..... [1]

Working space

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14. ON 2020/11 – Q2

2 Ron is attending a music concert. He has bought three tickets.

Each ticket number is displayed as a hexadecimal number.

(a) Complete the table to show the **12-bit binary** values and the **Denary** values for each Hexadecimal ticket number.

Hexadecimal ticket number	12-bit binary value	Denary value
028		
1A9		
20C		

[6]

Working space

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15. ON 2020/12

1 Tina is creating a website for charity events. She uses HTML to create the website.

(a) State what is meant by HTML.

Stands for hypertext mark up language and is used for designing and developing web pages. [1]

(b) She uses the hexadecimal colour code #43B7F0 as the background colour for her website.

(i) State whether background colour is an example of **structure** or **presentation**, in the website.

..... [1]

(ii) The hexadecimal colour code **#43B7F0** is stored in three **8-bit** registers.

Give the **8-bit binary** values for each part of the hexadecimal code.

43								
B7								
F0								

[6]

16. ON 2020/13

3 **(a)** **Four** denary to 8-bit binary conversions are given.

Tick (✓) to show if each denary to 8-bit binary conversion is **Correct** or **Incorrect**.

Denary	Binary Conversion	Correct (✓)	Incorrect (✓)
145	10010001		
179	10110101		
11	00010011		
100	01100010		

[4]

(b) Convert the **12-bit** binary number into hexadecimal.

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

..... [3]

17. MJ 2020/12

7 **(a)** Give the **denary** value of each of the three 12-bit binary values.

(i) 000000001100

..... [1]

(ii) 000011000110

..... [1]

(iii) 010011000001

..... [1]

Working space

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(b) 12-bit binary values can also be represented as hexadecimal values.

Give the **hexadecimal** value of the 12-bit binary value.

000011101001

..... [3]

18. MJ 2020/13

1 Pradeep is reading hexadecimal values for a project he is working on.

(a) The first three hexadecimal values he reads are **15**, **102** and **A9**.

Give the **denary** values for the three hexadecimal values.

15 .....

102 .....

A9 .....

[3]

Working space

.....

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.....

(b) Pradeep has two 8-bit binary values that he needs to convert to hexadecimal values for his project.

Give the **hexadecimal** values for the two 8-bit binary values.

01010000 .....

00111101 .....

[4]

19. FM 2020/12

5 Programmers can use denary and hexadecimal values. These values are stored in a computer system using binary.

(a) Explain why binary is used to store data in a computer system.

.....

.....

.....

..... [2]

(b) Complete the table to show how the denary value would be stored as binary in an 8-bit register.

Denary value	8-bit register
129	
56	

[2]

Working space

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.....

.....

.....

.....

(c) Complete the table to show how the hexadecimal value **3A9** would be stored as binary in a 12-bit register.

[3]

(d) Identify **two** uses of hexadecimal values in computer science.

1 .....

2 .....

[2]

20. ON 2019/11

2 An electronic guessing game compares denary integer values input by a user with pre-stored values. The pre-stored values are held in 10-bit binary format.

(a) Convert the binary values in the table to denary.

Binary	Denary
0001001110	
0110110111	
1000000001	

[3]

21. ON 2019/13

(c) The library has a website that customers can use to search for a book.

(i) The website has a background colour with the hexadecimal colour code #F92A10

The colour code is stored in two 12-bit binary registers.

Show how the colour code would be stored in the registers.

F92												
A10												

[6]

22. MJ 2019/11

1 Hexadecimal is used for MAC addresses.

Part of a MAC address is given:

97 – 5C – E1

Each pair of digits is stored as binary in an 8-bit register.

(a) Show what the binary register stores for each pair of the given digits.

97								
5C								
E1								

[6]

(c) Give **two** other examples where hexadecimal can be used.

Example 1 .....

.....

Example 2 .....

.....

[2]

23. MJ 2019/13

1 Victoria is building a website for her cake design business.

(a) She uses the hexadecimal colour code #D2E3F5 as the background colour for her website.

The colour code is stored in two 12-bit binary registers.

Show how the code would be stored in the registers.

D2E | | | | | | | | | | | | |

3F5 | | | | | | | | | | | | |

[6]

(b) Victoria uses HTML to create her website.

State what is meant by HTML.

.....

..... [1]

2 **(a)** A computer can have both a MAC address and an IP address.

Four statements are given about MAC addresses and IP addresses.

Tick (✓) to show whether each statement is **True** or **False**.

Statement	True (✓)	False (✓)
A MAC address is unique to a computer on a network		
Once an IP address has been set it cannot be changed		
A MAC address is made up of the computer's serial number and the IP address		
If a computer does not have an IP address it cannot communicate with another device using the Internet		

[4]

24. FM 2019/12

3 **(a)** A long distance running race uses an electronic counter that counts each competitor who finishes the race.

The count is stored as binary in a **12-bit** register.

A denary value of the count is displayed on a screen above the finish line.

(i) The screen currently displays:

0	0	3	9

State the binary value that is currently stored to display the count shown.

.....

..... [2]

(ii) More competitors cross the finish line and the screen now displays:

0	3	5	0

State the binary value that is currently stored to display the count shown.

.....

..... [2]

(iii) At the end of the race the binary value stored is:

011011000111

Give the denary value that would be displayed on the screen at the end of the race.

Show your working.

.....

.....

.....

.....

Screen display:

[2]

25. ON 2022/11 – Q3

3 Error codes for a computer are often displayed as hexadecimal values. Each error code is stored in a 12-bit binary register.

(a) The error code 404 means 'file not found'.

Give the 12-bit binary value that would be stored for the hexadecimal error code 404

.....

Working space

.....

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.....

[2]

(b) The error code 12B means 'hardware fault'.

Give the 12-bit binary value that would be stored for the hexadecimal error code 12B

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Working space

.....

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.....

[2]

(c) Hexadecimal values can also be represented as denary values.

The hexadecimal error code 022 means 'file system error'. The hexadecimal error code 0AC means 'insufficient memory'.

Convert the hexadecimal error codes 022 and 0AC to denary values.

022 .....

0AC .....

Working space

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[2]

(d) The register stores the binary value 100111100000

Give the hexadecimal error code that would be displayed for the binary value 100111100000

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Working space

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.....

[2]

(e) Give **two** reasons why error codes are represented in hexadecimal, instead of binary.

Reason 1 .....

.....

Reason 2 .....

.....

[2]

26. ON 2022/12

(f) The computer uses 12-bit binary registers to store data whilst it is being processed.

Customers are given a denary ticket number.

(i) Give the 12-bit binary value that is stored in the register for each denary ticket number.

100 .....

235 .....

301 .....

Working space

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.....

.....

[3]

(ii) Show the denary ticket number that would be given to the customer for each 12-bit binary value.

000000010110 .....

000001110111 .....

001101011001 .....

Working space

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.....

.....

.....

[3]

(iii) Binary values can also be represented as hexadecimal values.

Show the hexadecimal value that represents each of the **two** 12-bit binary values.

000010010101 .....

101011010001 .....

Working space

.....

.....

.....

[4]

27. ON 2022/13

2 (a) Denary values are converted to binary values to be processed by a computer.

Draw **one** line from each denary value to the correctly converted 8-bit binary value.

Denary	8-bit binary
	11110101
72	01110010
	11100101
245	00010101
	00001111
15	01001000

Working space

.....

.....

.....

.....

[3]

(b) Binary values can be converted to hexadecimal values.

Give the hexadecimal value for the 16-bit binary value 0000100110101110

.....

Working space

.....

.....

.....

[3]

28. FM 2023/12

6 A company is involved in robotics.

One of its robots is designed to make a specific movement depending on a binary value.

(a) The table gives some of the movements for the robot.

Complete the table by writing the missing binary, denary or hexadecimal value for each movement.

Movement	Binary	Denary	Hexadecimal
forward 1 step	00011111	31	
back 1 step		140	8C
turn right	01011010		5A
turn left		120	78

[4]

Working space

.....

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.....

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.....

.....

SPECIMEN PAPER A

1 A school network has several computers.

Each computer in the network has a media access control (MAC) address.

Hexadecimal is used for MAC addresses.

Part of a MAC address is given.

97–5C–E1

Each pair of digits is stored as binary in an 8-bit register.

(a) Complete the binary register for these two pairs of digits.

97								
5C								

[4]

(b) Describe what is meant by a MAC address.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Give **two other** uses of hexadecimal in computer science.

1 .....

2 ..... [2]

(d) Another value is stored as binary in a register.

0	1	0	1	0	0	1	0

(i) A logical left shift of two places is performed on the binary value.

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

[1]

(ii) State **one** effect this logical shift has on the binary value.

.....

..... [1]

(e) Negative **denary** numbers can also be represented as binary using two's complement.

Complete the binary register for the denary value −54.

You must show all your working.

Working space .....

.....

.....

.....

Register:

[2]

SPECIMEN PAPER B

1 Binary is a number system used by computers.

(a) **(i)** Four 8-bit binary values are given.

Tick (✓) **one** box to show which 8-bit binary value is the correct conversion for the **denary** value **50**.

A 00101010 ☐

B 00110010 ☐

C 01001100 ☐

D 01010000 ☐

[1]

(ii) Four 8-bit binary values are given.

Tick (✓) **one** box to show which 8-bit binary value is the correct conversion for the **hexadecimal** value **90**.

A 00001001 ☐

B 01011010 ☐

C 10010000 ☐

D 01100100 ☐

[1]

(b) Explain why a computer system can only process data in binary form.

.....

.....

.....

..... [2]

(c) Two 8-bit binary values are given.

Add the two 8-bit binary values.

Give your answer in binary. Show all your working.

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

[3]

(d) Two 8-bit binary values are added.

The result of this calculation needs to be stored in an 8-bit register.

The denary result of this calculation is 301. This generates an error.

State the name of this type of error and explain why this error occurs.

Error name .....

Explanation .....

.....

.....

.....

[3]

BLANK PAGE

1. ON 2017/11

1 A washing machine has a small display screen built into it.

One use of the display screen is to show an error code when a problem has occurred with a washing cycle.

(a) State whether the display screen is an **input**, **output** or **storage device**.

.....[1]

(b) The display screen shows a hexadecimal error code:

E04

This error code means that the water will not empty out of the washing machine.

Convert this error code to binary.

[3]

(c) State why hexadecimal is used to display the error code.

.....

.....

.....

.....[1]

2. ON 2017/12

3 **(a)** Explain the differences between the binary number system and the denary number system.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) Explain the process of converting the binary number 1010 into a denary number.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

3. MJ 2017/11

1 The memory of a computer contains data and instructions in binary.

The following instruction is stored in a location of the memory.

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

(a) Convert the instruction into hexadecimal.

.....

.....

..... [2]

(b) Explain why a programmer might prefer to read the instruction in hexadecimal rather than in binary.

.....

.....

.....

..... [2]

(c) Give **two** other uses of hexadecimal.

Use 1 .....

.....

Use 2 .....

.....

[2]

4. MJ 2017/12

5 **(a)** The denary number 57 is to be stored in two different computer registers.

Convert 57 from denary to binary and show your working.

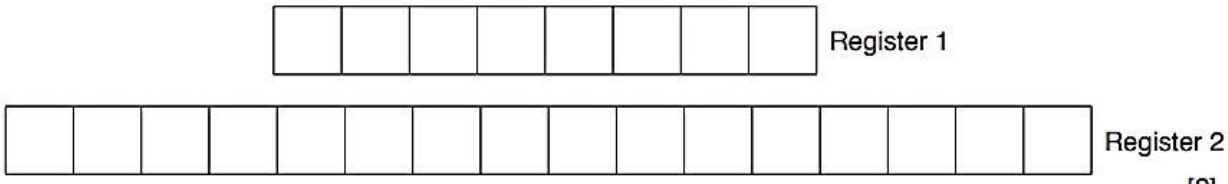
.....

.....

.....

.....[2]

(b) Show the binary number from **part (a)** as it would be stored in the following registers.



[2]

(c) A binary number stored in a register can have many different uses, for example an address in main memory.

Give **two** other uses for a binary number stored in a register.

Use 1 To store a part of an image.....

Use 2 To store character or text.....

[2]

To store sound or audio

(c) A binary number stored in a register can have many different uses, for example an address in main memory.

Give **two** other uses for a binary number stored in a register.

Use 1 .....

Use 2 .....

[2]

(d) A register in a computer contains binary digits.

0	0	1	1	1	0	1	0

The contents of the register represent a binary integer.

Convert the binary integer to hexadecimal.

.....

.....[1]

5. FM 2017/12

8 A register in a computer contains binary digits.

0	0	1	1	0	1	1	1

(a) The contents of the register could represent a binary integer.
Convert the binary integer to denary and hexadecimal.

Denary ....55....

Hexadecimal ....37....

[2]

(b) The contents of the register could represent the ASCII value for the single denary digit '7'.
Write down the ASCII value for '9' in binary, denary and hexadecimal.

Binary ....00111001....

Denary ....57....

Hexadecimal ....39....

[3]

(c) Write in Register X the binary number you would use with AND gates to convert the ASCII value of '7' to its binary integer value.

0	0	1	1	0	1	1	1	ASCII
								Register X

[1]

12 **(a)** Identify **three** uses for hexadecimal and for each one give an example of hexadecimal that matches the use.

Use 1 ....To represent error codes....

....

Example ....0 x 5 Access Denied....

Use 2 ....To represent IPV6 address....

....

Example ....A856:FF00:B789:811D:ABC3:ABCD:EF67:0014....

Use 3 ....To represent to MAC address....

....

Example ....FF-03-12-A0-CD-4A....

[6]

(b) Explain why hexadecimal is used to represent binary numbers.

It is easier for the user to read, write and understand as it uses more values i.e uses numbers 0 to 9 alphabets A to F rather than only 0's and 1's in binary. Its a shorter representation as 4 bits are equivalent to 1 hexadecimal digits, therefore its takes up less space on the display screen.

Easier to debug and less error prone.

.....[2]

ON 2016/11

10 **(a)** A manufacturer of aeroplane engines assigns a denary identification number (ID) to each engine.

One engine has the ID: 0431

(i) Convert this denary number to a 12-bit binary format.

[2]

(ii) Show how this number would be represented in hexadecimal.

.....

.....

[3]

ON 2016/12

5 A computer uses an 8-bit register.

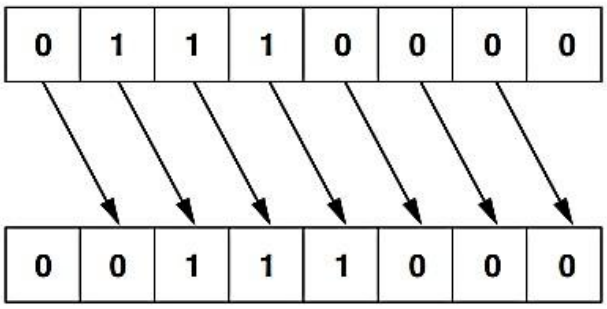
The 8-bit register contains binary integers.

(a) Write the denary (base 10) value represented by:

128	64	32	16	8	4	2	1
0	1	1	1	0	0	0	0

.....[1]

(b) All the bits in the register are shifted **one** place to the **right** as shown below.



Write the denary number that is represented after this shift.

.....[1]

(c) State the effect the shift to the right had on the original denary number from **part (a)**.

.....[1]

(d) The original number in **part (a)** is shifted **three** places to the **right**.

(i) Show the new binary number:

[1]

(ii) Write the equivalent denary number.

.....[1]

(e) Describe the problems that could be caused if the original binary number in **part (a)** is shifted **five** places to the **right**.

.....

.....

.....

.....

.....[2]

ON 2016/12

11 A security system is installed in a house. A hexadecimal number is entered to activate or deactivate the alarm.

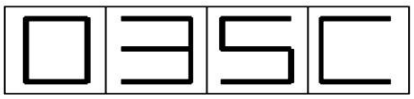
(a) The alarm code is set to hexadecimal number **2 A F**

Show how this number would be stored in a 12-bit binary register.

[3]

MJ 2016/11

7 Each seat on a flight is uniquely identified on an LCD above the seat. For example, seat 035C is shown as:



The first three characters are digits that represent the row.
The fourth character is the seat position in that row. This is a single letter, A to F, that is stored as a hexadecimal value.

Each of the four display characters can be stored in a 4-bit register. For example, 0 and C would be represented as:

	8	4	2	1
0:	0	0	0	0
C:	1	1	0	0

(a) Show how the 4-bit registers would store the remaining two characters, 3 and 5.

3				
5				

[2]

(b) Identify which seat is stored in the following 4-bit registers.

0	0	0	1	→ .....
1	0	0	1	→ .....
0	1	0	0	→ .....
1	1	1	0	→ .....

[2]

(b) The barcode in **part (a)** contains the denary value 2 6 4 0

Convert this value to hexadecimal.

.....

.....

Write the value as a 12-bit binary number.

[4]

MJ 2016/12

3 **(a)** Convert the following hexadecimal number into 12-bit binary:

4 A F

[3]

(b) The 2016 Olympic Games will be held in Rio de Janeiro. A timer that counts down to the opening of the Games is shown on a microprocessor-controlled display.

The number of hours, minutes and seconds until the Games open are held in three 8-bit registers.

The present register values are:

0	1	1	0	1	0	0	1	105 hours
0	0	1	0	0	0	0	0	32 minutes
0	0	0	1	0	1	0	0	20 seconds

The timer will count **down** in seconds.

(i) Show the values in each 8-bit register **30 seconds** after the time shown above:

								hours
								minutes
								seconds

[3]

(ii) Write the hexadecimal value of the **minutes** register from **part (b)(i)**.

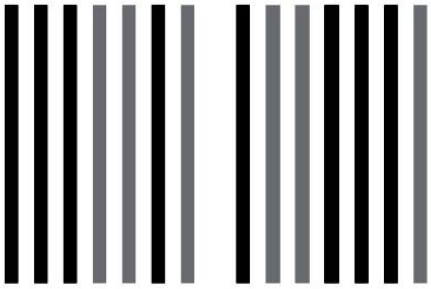
.....[1]

9 In the following barcode, each binary number is made up of seven bars.

Each bar is black or grey.

A black bar is interpreted as a "1" and a grey bar is interpreted as a "0".

(a) Write the binary numbers that would be produced from this barcode:



Binary number A **Binary number B**

Binary number A: | | | | | | | |

Binary number B: | | | | | | | |

[2]

(b) This barcode system uses odd parity.

Write the parity bit for each of the binary numbers in **part (a)**:

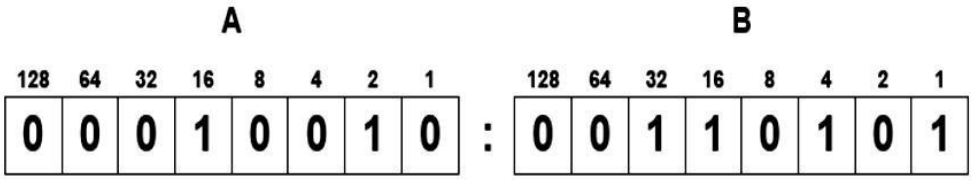
	Parity bit
Binary number A:	
Binary number B:	

[2]

MJ 2015/11

8 An alarm clock is controlled by a microprocessor. It uses the 24 hour clock. The hour is represented by an 8-bit register, **A**, and the number of minutes is represented by another 8-bit register, **B**.

(a) Identify what time is represented by the following two 8-bit registers.

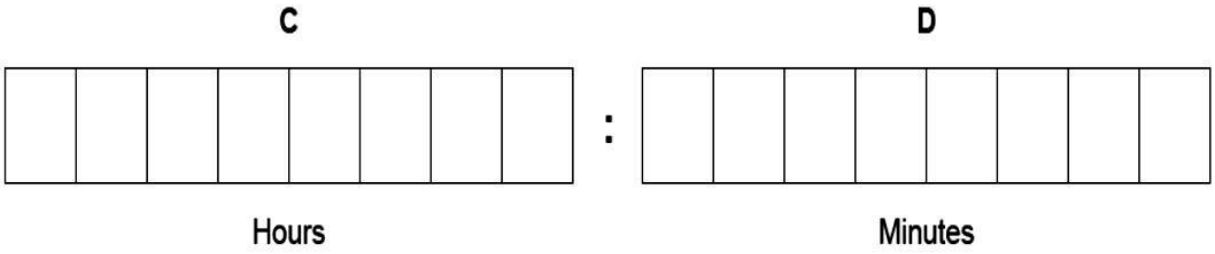


Hours ..... Minutes .....

[2]

(b) An alarm has been set for 07:30. Two 8-bit registers, **C** and **D**, are used to represent the hours and minutes of the alarm time.

Show how 07:30 would be represented by these two registers:



[2]

(c) Describe how the microprocessor can determine when to sound the clock alarm.

.....

.....

.....

.....

.....

.....[3]

9 Draw a line to connect each question to the correct answer.

Question	Answer
What is the denary (base 10) equivalent to the hexadecimal digit **E**?	8
If 1 GB = 2^x then what is the value of X?	12
How many bits are there in one byte?	14
If the broadband data download rate is 40 megabits per second, how many seconds will it take to download a 60 MB file?	19
What is the denary (base 10) value of the binary number 0 0 1 0 0 1 0 0 ?	30
What hexadecimal value is obtained when the two hexadecimal digits **C** and **D** are added together?	36

[5]

ON 2015/12

4 (a) (i) Convert the following **two** hexadecimal numbers into binary:

F A 7
D 3 E

F A 7 ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

D 3 E ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

[4]

(ii) Now perform the AND (logic) operation on each corresponding pair of binary bits in the two numbers from **part (i)**.

☐☐☐☐ ☐☐☐☐ ☐☐☐☐

[2]

(iii) Convert your answer in **part (ii)** into hexadecimal.

.....

.....

[2]

(b) (i) The following code shows HTML 'tag' pairs on either side of the text stating the colour that each creates.

```
<font color " # F F 0 0 0 0 " > RED </font>
<font color " # 0 0 F F 0 0 " > GREEN </font>
<font color " # 0 0 0 0 F F " > BLUE </font>

<font color " #      X      " > YELLOW </font>
<font color " #      Y      " > MAGENTA </font>
<font color " #      Z      " > CYAN </font>
```

Yellow is a combination of red and green, magenta a combination of red and blue and cyan a combination of green and blue.

State what 6-digit hexadecimal values should replace X, Y and Z in the above code.

X .....

Y .....

Z .....

[3]

(ii) Describe how other colours, such as a darker shade of blue, are created.

.....

.....

.....

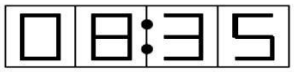
[2]

SPECIMEN PAPER

4 A digital alarm clock is controlled by a microprocessor. It uses the 24-hour clock system (i.e. 6 pm is 18:00).

Each digit in a typical display is represented by a 4-digit binary code.

For example:



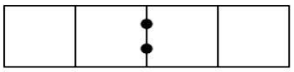
(clock display)

is represented by:

0	0	0	0	1st digit (0)
1	0	0	0	2nd digit (8)
0	0	1	1	3rd digit (3)
0	1	0	1	4th digit (5)

(a) What time is shown on the clock display if the 4-digit binary codes are:

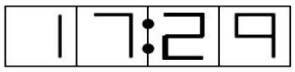
0	0	0	1
0	1	1	0
0	1	0	0
1	0	0	1



(clock display)

[2]

(b) What would be stored in the 4-digit binary codes if the clock display time was:



	1st digit
	2nd digit
	3rd digit
	4th digit

[4]

(c) The clock alarm has been set at 08:00.

Describe the actions of the microprocessor which enable the alarm to sound at 08:00.

.....

.....

.....

.....

..... [2]

13 When a key is pressed on the keyboard, the computer stores the ASCII representation of the character typed into main memory.

The ASCII representation for A is 65 (denary), for B is 66 (denary), etc.

There are two letters stored in the following memory locations:

Location 1	A
Location 2	C

(a) (i) Show the contents of Location 1 and Location 2 as binary.

Location 1 .....

Location 2 ..... [2]

(ii) Show the contents of Location 1 and Location 2 as hexadecimal.

Location 1 .....

Location 2 ..... [2]

(b) The following machine code instruction is stored in a location of main memory:

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

Convert this binary pattern into hexadecimal.

..... [4]

(c) Explain why a programmer would prefer to see the contents of the locations displayed as hexadecimal rather than binary, when debugging his program that reads the key presses.

.....

.....

.....

..... [2]

MJ 2015/12

10 Letters from the alphabet are represented in a computer by the following denary (base 10) values:

A = 97
G = 103
I = 105
L = 108
N = 110

The word "**A L I G N**" is stored as: 97 108 105 103 110

(a) Convert each of the five values to binary. The first one has been done for you.

Letter	Denary value							
A (97):	0	1	1	0	0	0	0	1
L (108):								
I (105):								
G (103):								
N (110):								

[2]

(b) An encryption system works by shifting the binary value for a letter one place to the left. "A" then becomes:

1	1	0	0	0	0	1	0

This binary value is then converted to hexadecimal; the hexadecimal value for "A" will be:

C 2

For the two letters "L" and "G", shift the binary values one place to the left and convert these values into hexadecimal:

									hexadecimal
L:									.....
G:									.....

[4]

ON 2015/11

10 Characters can be represented in a computer by a numerical code.

The following list shows 16 characters with their numerical codes in denary:

a = 97	e = 101	k = 107	t = 116
b = 98	g = 103	m = 109	u = 117
c = 99	h = 104	o = 111	w = 119
d = 100	i = 105	r = 114	

. = 46 (code for the full stop)

Web addresses can be written using hexadecimal rather than denary. Hexadecimal codes are preceded by a % sign. For example, the word "**c a g e**" is written as:

either	99	97	103	101	(in denary)
or	%63	%61	%67	%65	(in hexadecimal)

(a) Complete the conversion of the following web address into hexadecimal:

w	w	w	.	c	i	e	.	o	r	g	.	u	k
%77	%77	%77											

[3]

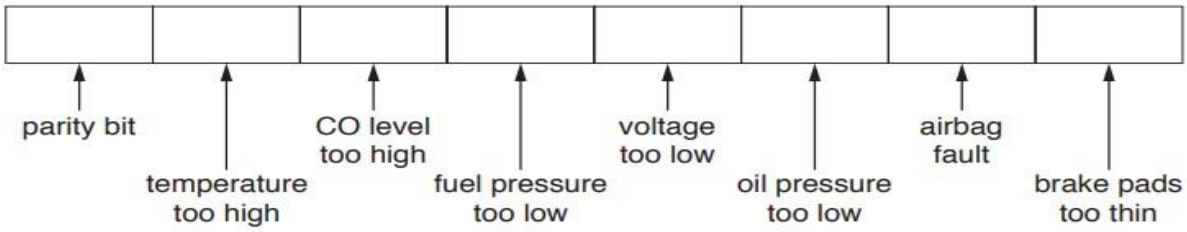
(b) Complete the web address from the given hexadecimal codes:

%77	%77	%77	%2E	%72	%6F	%63	%6B	%69	%63	%74	%2E	%63	%6F	%6D
w	w	w												

[3]

ON 2015/13 – Q2

(b) The information from seven sensors is sent to an engine management system in the car. The status of each sensor is stored in an 8-bit register; a value of 1 indicates a fault condition:



For example, a register showing **0 1 0 1 1 0 0 0** indicates:

- temperature too high
- fuel pressure too low
- voltage too low

(i) Identify the fault condition(s) that the following register indicates:

0	**0**	**1**	**0**	**0**	**1**	**0**	**1**

.....

.....

.....[2]

(ii) The system uses **odd** parity.

Write the correct parity bit in each register.

	1	**1**	**1**	**0**	**0**	**1**	**0**

	0	**0**	**0**	**1**	**1**	**1**	**0**

[2]

(iii) A car has a faulty airbag and the CO level is too high.

Write what should be contained in the 8-bit register.

[2]

(iv) Give the hexadecimal value of the binary number shown in **part (iii)**.

.....

.....[1]

END