1. The security code for an alarm system is a long binary number which begins

10001111100101111011 …

The technicians prefer to use hexadecimal to enter the security code.

i. When the number is converted into hexadecimal, the first two digits are 8F as shown below.

Complete the gaps to show the next three digits.

Binary:	1000	1111	1001	0111	1011
Hexadecimal:	8	F	.....	.....	.....

[3]

ii. Explain why the technicians prefer to use hexadecimal.

[2]

2. i. Convert the denary number **132** into an 8 bit binary number.

[2]

ii. Convert the binary number **10110101** to its hexadecimal equivalent.

[2]

iii. Show the effect of a binary shift right of two places on the binary number **00110100.**

[1]

iv. Describe a shift that can be used to double the value of the binary number **00100100.**

[2]

3. Convert the hexadecimal number **A3** to denary. Show your working.

[2]

4(a). There is a subroutine, HEX(), that takes a denary number between 10 and 15 and returns the corresponding hexadecimal number. E.g. HEX(10) would return "A", HEX(15) would return "F".

Write an algorithm, using the subroutine HEX(), to convert any whole decimal number between 0 and 255 into a 2 digit hexadecimal number.

[4]

(b). Convert the hexadecimal number 3E into a decimal number. You must show your working.

[2]

5. i. When sending text messages using a mobile phone, people can choose from hundreds of characters, called emoji, to insert in their message. An example of an emoji is 🙈.

The Unicode character code for the emoji 🙈in hexadecimal is 1F64A.

Convert the hexadecimal number 1F64A to binary.
The first three hexadecimal digits have been done for you.

Hexadecimal:	1	F	6	4	A
Binary:	0001	1111	0110	.....	.....

ii.

iii. **[2]**

iv. Explain why mobile phones that can send emoji would use Unicode instead of ASCII as their character set.

[2]

END OF QUESTION PAPER

Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1		i	Answer: 9 7 B *(one mark per hex digit)*	3	**?Examiner's Comments** **?**? The majority of candidates obtained full marks.
		ii	• it is 4 bits per hex digit / straightforward to convert • shorter number to remember / quicker to enter / less susceptible to error.	2	**?Examiner's Comments** Some of the weaker candidates showed a clear lack of understanding of the importance and relevance of hex, example by suggest that hex requires less memory to store than binary. In applying their understanding to the scenario, many candidates also gave vague answers su as stating that numbers in hex are "easier to understand than their binary equivalent.
			Total	**5**	
2		i	• 1000 0100	**2**	1 mark per nibble. Mark right to left. **Examiner's Comments** This question was answered correctly by the vast majo of candidates. Pleasingly, conversion of numbers to an from binary is now obviously a comfortable skill for candidates of all levels.
		ii	• B 5	**2**	1 mark per hex digit **Examiner's Comments** Slightly fewer candidates were able to answer this question successfully compared to 5(a)(i). Most were ab to split the binary number up into two nibbles, but then the conversion to binary for each nibble sometimes was incorrectly completed. Common wrong answers include 11 5 (which achieved 1 mark for 5 but did not recognise that 11 in denary equates to B in hexadecimal) or C5, where a mistake was made once the hexadecimal value went over 9. Very few answers showed a complete lack understanding, but where this was seen, candidates tended to simply convert the binary to denary and ignor the requirement to use hexadecimal. This achieved no marks.
		iii	1 mark per bullet, max 1. • 00001101 • Divides by 4	**1**	Accept 001101 / 1101. Allow any number of leading zer
		iv	1 mark per bullet, max 2. • Left shift • one place	**2**	Do not accept answers that simply show the number shifted. **Examiner's Comments** Candidates showed a good understanding of binary shifts, which is especially pleasing as this is a new poin that was not covered in the old GCSE Computing specification. The majority of candidates were able to both carry out a shift and describe a shift that matched give outcome. One common mistake was for candidate to describe the direction of a shift but not say how man places to shift (e.g. 'shift left' but missing 'by one place
			Total	**7**	
3			1 mark per bullet to max 2 • 163 • **Correct** working shown.	2 AO1 1b (2)	Award working mark independently of final answer but working must be correct (e.g. (16 x 10) + 3) **Examiner's Comments** This question asked candidates to convert a two-digit hexadecimal number to denary. Many answers were fully correct. Where mistakes were made, it was very common to see A being converted to and then this added to the 3, giving 13; this obviously misses out the crucial step of multiplying 10 by 16.

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>Where other sensible methods were used, such as converting to binary first, this was credited although candidates should be able to complete conversions directly between hexadecimal and denary (and vice ver without the need for the intermediary step.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>4</td><td>a</td><td></td><td>• Taking a number as input
• Using HEX subroutine correctly
• Calculating Digit 1
• Calculating Digit 2

INPUT decimal
digitl = decimal DIV 16
IF digitl>=10 THEN digit1 = HEX(digit1)
digit2 = decimal - (digit1*16)
IF digit2>=10 THEN digit2=HEX(digit2)</td><td>4</td><td>1 mark for each bullet.

There are no marks associated with data types or conversions of data types.

If used, a flowchart should represent the bulleted steps the answer column.</td></tr>
<tr><td></td><td>b</td><td></td><td>• Working; (3* 16) + 14 OR 00111110
• 62</td><td>2</td><td>1 mark for correct answer, 1 for valid method of workin</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>5</td><td></td><td>i</td><td>1 mark each<table><tr><td>F</td><td>6</td><td>4</td><td>A</td></tr><tr><td>1111</td><td>0110</td><td>0100</td><td>1010</td></tr></table></td><td>2</td><td>Allow 100 for 4

Examiner's Comments

This question was answered well, candidates were able correctly convert the numbers into hexadecimal. Those candidates who could not convert to hexadecimal were still often able to get the conversion of 4 correct.</td></tr>
<tr><td></td><td></td><td>ii</td><td>• Unicode has more characters / space (to store the emoji)
• Unicode is 16 bit / 1-4bytes compared to ASCII’s 7/8 bits</td><td>2</td><td>Allow the opposite for bullet 1 i.e. ASCII does not have enough space

Allow any acceptable format for Unicode e.g. 1, 2, 3 or bytes long Allow numeric quantities in place of bits / by for bullet 2

Examiner's Comments

Many candidates had a good understanding of the differences between the two languages, the most common response being that Unicode could have more characters. Fewer candidates went into further detail to explain why this was the case. Some candidates got these the wrong way, and stated that Unicode was use because it would take up less space.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
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