

- 1(a). Harry is planning to create a computer game using a high-level programming language.
State why the computer needs to translate the code before it is executed.

[1]

- (b). Harry can use either a compiler or an interpreter to translate the code.

Describe **two** differences between how a compiler and an interpreter would translate Harry's computer game.

[4]

2. Graeme is a freelance programmer. He has written a program for a client and gives the client both the high level code and the machine code of the program.

- i. Describe what is meant by

High level code

Machine code

- ii. State why Graeme needs a compiler.

[1]

3. Joseph is an author and programmer, and he needs to estimate how many pages his new book will have.

Each page has an average of 300 words. Each chapter starts with a chapter title page. The number of pages is estimated by;

- dividing the number of words by 300
- ignoring the decimal part of the division
- adding the number of chapters to this total.

Joseph uses the algorithm below to estimate the number of pages, but his algorithm does not give the correct result.

```
01 INPUT numberOfWords
```

```

02 INPUT numberOfChapters
03 CONST wordsPerPage = 300
04 numberOfPages = RoundDown(numberOfWords / wordsPerPage)
05 numberOfPages = numberOfWords + numberOfChapters
06 OUTPUT numberOfPages

```

Joseph has used a `RoundDown` function to remove the decimal part of the division, e.g. `RoundDown(6.2)` would return 6, `RoundDown(7.8)` would return 7.

Joseph's IDE allows him to use both a compiler and an interpreter.

Describe how Joseph could make use of a compiler and an interpreter when producing his program.

Compiler

:

Interpreter

:

[4]

4. Xander's tablet computer comes with system software, including an operating system and utility system software.

Xander also has a smart watch.

- i. Tick (✓) **one** box to show whether the smart watch or the laptop is an example of an embedded system.

	Is an example of an embedded system
Smart watch	

Laptop	
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[1]

- ii. Justify your choice to **part (i)**.

[2]

- 5(a). Gareth's Sat Nav contains an embedded system. Define what is meant by an 'embedded system'.

[1]

- (b). Identify **three** devices, other than a Sat Nav, that contain embedded systems.

[3]

6. Numbers can be represented in denary, binary or hexadecimal.

i. Convert the binary number 01101001 to denary, showing your working.

[2]

ii. Convert the denary number 154 to binary.

[2]

7. Convert the binary number **1011011** to denary. Show your working.

[2]

8. Convert the decimal number 191 into an 8 bit binary number.

[1]

9. Convert the decimal number 191 into 8-bit binary.

[1]

END OF QUESTION PAPER

Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		- To convert it to binary / machine code - The processor can only understand machine code	1	Maximum 1 mark
	b		- Compiler translates all the code in one go... ... whereas an interpreter translates one line at a time - Compiler creates an executable... ...whereas an interpreter does not / executes one line at a time - Compiler reports all errors at the end... ... whereas an interpreter stops when it finds an error	4	1 mark to be awarded for the correct identification and one for a valid description up to a maximum of 4 marks. No more than 2 marks for answers relating only to interpreters and no more than 2 marks for answers only relating to compilers.
			Total	5	
2		i	High level code : - human oriented code / written by programmers - contains words for commands / closer to English / natural language - Machine independent / Portable to different systems - Needs to be translated before it can be executed. - Problem based - One (high level) command equates to many machine code instructions. Machine code: - Code for the CPU to execute / not readily understandable by humans - binary instructions - specific to a particular (type of) computer / not portable to different systems - does not need to be translated [max 2 marks for each type of code]	4	Award marks for correct points about machine code made under high level code and vice versa. Do not accept Machine code is in Hex
		ii	- To translate the high level code into machine code - To pick up (syntax) errors	1	Translate to object code is acceptable. Accept "errors" on its own, but do not accept answers referring specifically to logic or runtime errors.
			Total	5	
3			Max 2 for compiler, 2 for interpreter Compiler - To convert to low-level in one go - Create an executable / export the file - To distribute the software - Users will have no access to source code... ...so no-one can edit / steal / copy the code / program - Use for error detection Interpreter	4	The uses must be different for compiler and interpreter Examiner's Comments This question was appropriate programming theory and techniques. Many candidates did not answer the question, instead giving definitions of compilers and interpreters, instead describing how they were used when producing a program. The most common answers involved checking for errors.

			- To convert to low-level line by line - To test the program / to find errors - stops running when it finds an error / shows the location of the error when found - it is quicker (compared to compiler) to re-interpret than recompile		
			Total	4	
4		i	Smart watch	1 AO2 1a (1)	CAO Examiner's Comments This question was answered correctly by the majority of candidates who were able to identify that a smart watch is an example of an embedded system.
		ii	1 mark per bullet for justification to max 2 - A smart watch is not a <u>general-purpose computer</u> ... which means the smart watch has one/limited/specific/dedicated function(s) - Smart watch has a microprocessor ... on a single circuit board - It is a computer system that is built within the watch - Runs firmware - Smart watch has built-in OS / difficult to change/manipulate the OS/function - Smart watch has few components all essential to its purpose - Smart watch has specific hardware required to function i.e. speaker/headphones	2 AO2 1b (2)	- Answers must be applied to scenario. Do not award generic definitions. - Allow opposite reasons for why a laptop is not an embedded system but do not allow repeated points. Examiner's Comments Candidates were able to gain marks for explaining why a smart watch is an embedded system or why a laptop is not or a combination of the two. The most common answers referred to the limited features of a smart watch, while a laptop is a general-purpose computer that can perform any number of tasks. Some candidates gave a generic definition of an embedded system which was insufficient because the question required candidates to apply their knowledge to the scenario.
			Total	3	
5	a		A computer system that is built into another device	1	
	b		Three devices from: - Dishwasher - MP3 player - Washing machine - Mobile phone - Manufacturing equipment	3	1 mark to be awarded for each correct example identified to a maximum of 3 marks. There are many other examples of devices with embedded systems which may be acceptable.
			Total	4	
6		i	$64 + 32 + 8 + 1$ 105.	2	
		ii	Answer: 10011010 <i>(one mark per nibble if partly wrong)</i>	2	Allow 1 mark for 01011001 Examiner's Comments ?? Candidates usually perform well at binary conversions and continued to do so this year which is pleasing to see. The majority of candidates obtained full marks
			Total	4	
7			1 mark per bullet to max 2 91 Correct working shown.	2 AO1 1b (2)	Award working mark independently of final answer but <u>must</u> be correct (e.g. $1+2+8+16+64$ / correct binary headings with correct binary underneath) Examiner's Comments As in previous years, conversions to and from binary are now done extremely well by the majority of candidates. This question used a 7-bit number. Candidates are expected to understand that this can be dealt with in

					many ways, including filling the unused 8th bit on the left with 0 or counting each digit from the right as increasing powers of 2. It was pleasing to see that so many candidates understood this and were able to give the correct answer of 91. Where mistakes were made, this involved candidates either adding a 0 to the right of the least significant bit or assigning bit values from 128 on the left which means that the answer is doubled.
			Total	2	
8			10111111	1	Correct Answer Only
			Total	1	
9			10111111	1	Examiner's Comments This question was answered well, with the majority of candidates getting this correct.
			Total	1	