Name:

Class Teacher:

Date:

OCR J276

GCSE Computer Science

REVISION BOOKLET

2.5 TRANSLATORS AND FACILITIES OF LANGUAGES

Content in J276 GCSE Computer Science:

1.1 Systems Architecture

1.2 Memory

1.3 Storage

1.4 Wireless and Wired Networks

1.5 Network Topologies, Protocols and Layers

1.6 System Security

1.7 Systems Software

1.8 Ethical, Legal, Cultural and Environmental Concerns

2.1 Algorithms

2.2 Programming Techniques

2.3 Producing Robust Programs

2.4 Computational Logic

2.5 Translators and Facilities of Languages
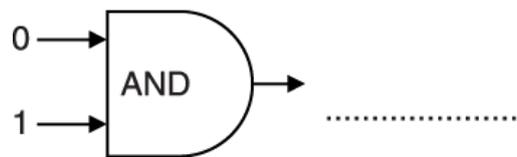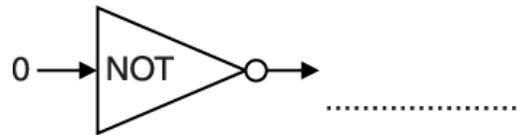
2.6 Data Representation

EXAM QUESTIONS

QUESTION 1

Complete the truth table below for the Boolean statement **p = NOT(A AND B)**.

1					2	1 mark for each correct answer in table.

A	B	P
		TRUE
		TRUE

QUESTION 2

State the output of each of the following logic circuits for the inputs given.

2	a		• 1 • 0. (respectively)		2	**Examiner's Comments** Most candidates answered correctly. As expected, some weaker candidates were less able to work with the logic gates in combination

Fig 1. is a circuit diagram.
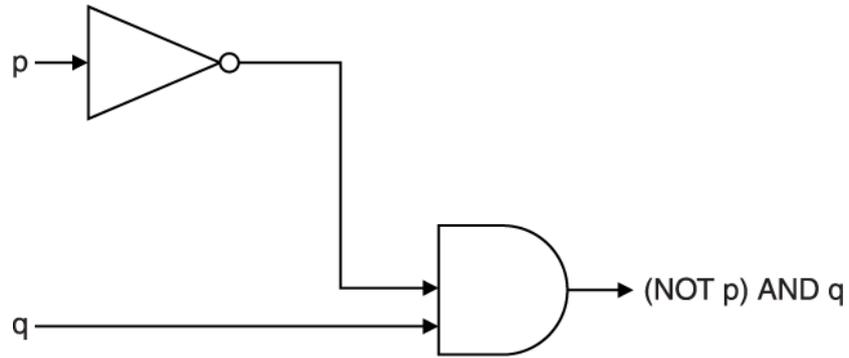
Fig. 1

Complete the truth table for Fig 1.

b			*Correct answer:* 	3	

Correct answer:

p	q	(NOT p) AND q
0	0	0
1	0	0
0	1	1
1	1	0

Award marks for

- Correct missing input cases (0 1, 1 1 or 1 1, 0 1)
- Output of 1 for 0 1
- Output of 0 for 1 1.

3

Examiner's Comments

As expected, some weaker candidates were less able to work with the logic gates in combination

QUESTION 3

The following logic diagram shows the expression **NOT (a AND b)**.

Complete the missing boxes in the truth table below to show the value of **NOT (a AND b)** that will be output for each possible set of values of a and b.

3			A	b	NOT(a AND b)		4	No follow through on row 4.
			0	0	1			**Examiner's Comments**
			0	1	1			This part was well answered by the majority of candidates, indicating that logic and truth tables – a core concept in computer science – is understood by most candidates.
			1	0	1			
			1	1	0			
			1 mark for row two and three. For row 4, 1 mark for correctly identifying 1 1 as the inputs, and 1 mark for the correct output 0)					

QUESTION 4

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.

4	a		• To convert it to binary / machine code • The processor can only understand machine code	1	Maximum 1 mark

Harry can either use 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.

	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.

QUESTION 5

The area of a circle is calculated using the formula $A = \pi r^2$, where π is equal to 3.142 and r is the radius. Finn has written a program to allow a user to enter the radius of a circle as a whole number, between 1 and 30, and output the area of the circle.

```
01    int radius = 0
02    real area = 0.0
03    input radius
04    if radius < 1 OR radius > 30 then
05    print ('Sorry, that radius is invalid')
06    else
07    area = 3.142 * (radius ^ 2)
08    print (area)
09    end if
```

Finn uses an IDE (Integrated Development Environment) to write his programs. Identify **two** features of an IDE that Finn might use.

5			- Error diagnostics (any example) - Run-time environment - Editor (any feature such as auto-correct, auto-indent) - Translator - Version control - Break point - Stepping	2	1 mark per bullet to a maximum of 2 marks. Only 1 example per bullet, e.g. auto-correct and auto-indent would only gain 1 mark.

QUESTION 6

Jim is writing a program to calculate the wages of workers in a teddy bear factory. Jim uses an Integrated Development Environment (IDE) to create the program. Describe **two** tools in an IDE that can help Jim when creating the program.

6		e.g. • Editor • Allows Jim to enter the program code • Colour coding keywords • Auto-completes code as you type. • Compiler • Transforms the written source code into machine code. • Debugging tools • Highlights errors in the code • Suggests possible solutions. (2 marks per tool)	4	Do not accept me spell check **Examiner's Comments** It was pleasing to see that candidates were using their experience of programming to answer the question. Where they did not gain full marks, this could have improved by providing further detail about the tools, or especially by using correct technical terms to describe these tools.

QUESTION 7

A microwave oven is controlled by a small, specially built CPU. The table below shows some CPU instructions and what they mean.

CPU instruction	Meaning
00001000 00010100	Add 20 to the timer
00001000 00000001	Add 1 to the timer
00000100 00000001	Subtract 1 from the timer

Using examples from the instructions above, state what is meant by:

An opcode

7	a	i	• (Part of the instruction which) specifies the operation to be carried out • e.g. 00001000 = add to timer / 00000100 = subtract from timer	2	The answer must refer specifically to the operation to be carried out and not the instruction as a whole.

An operand

		ii	• (Part of the instruction which) supplies the data / address / value needed for an operation • e.g. the number to be added / subtracted from the timer / numerical example from the table (00010100 or 00000001)	2	For data, accept number / integer.

The time displayed on the microwave oven is represented as two 8-bit binary numbers, one for the minutes and one for the seconds. For example:

"8:20" is stored as 00001000 00010100

"15:45" is stored as 00001111 00101101

Show how the time **5:30** will be stored.

	b		00000101 00011110 1 mark per byte	2	All 8 bits must be correct for each byte.

00001000 00010100 can represent either the instruction for "Add 20 to the timer" or the data for the time "8:20". Explain how the CPU can determine whether it represents an instruction or data.

	c		• Instructions and data are fetched at different points of the fetch execute cycle • Instructions and data are kept in separate parts of the memory (by the operating system)	1	Award the mark for: • The program counter points to the address of instructions

QUESTION 8

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. Describe what is

8	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

State why Graeme needs a compiler.

		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.

QUESTION 9

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 is using an Integrated Development Environment (IDE) to produce the program. One tool in an IDE that Joseph uses is a translator. Describe **two** additional tools in an IDE that Joseph could use to help him produce his program.

<table>
<tr><td></td><td></td><td>1 mark for identification, 1 for matching description e.g.

• Error diagnostics / debugger
• … highlight errors / suggest changes

• Run-time environment
• … Lets you run / test the program</td><td></td><td>Do not allow auto-documentation.
Can get description mark, without identification / incorrect identification

Allow:

• Variable watch / window
• See how the values change</td></tr>
<tr><td>9</td><td>a</td><td>

• Text editor
• …highlight key words
• …auto-indent
• …to type / edit source code
• …Auto-complete
• …highlight syntax errors

• Versioning tools</td><td>4</td><td>Do not allow compiler / interpreter

Examiner's Comments

This question was appropriate programming theory and techniques.

This question was not answered well. Many candidates did not know what an IDE was, often giving utility programs as responses. A significant number of candidates gave compiler and interpreter as answers, showing that they did not understand that these are</td></tr>
</table>

			• …To allow for tracing back • …To create new files with changes • Stepping / breakpoints • …Allow tracing of algorithms		examples of the translator that was given in the question. The better candidates were able to name the tools, as given in the specification, and describe them. Marks were often given for descriptions of the tools, where they could not be named.

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.

	b		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 • 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	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 of describing how they were used when producing a program. The most common answers involved checking for errors.