OCR ERL Interpreter Project

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Analysis of the problem

# Problem Identification

## Establishing the Problem

All programming code given in the OCR Computer Science GCSE will be presented using the OCR Exam Reference Language (ERL), so it is important that the students have a solid understanding of the syntax of the language in order to be able to successfully answer many of the questions. Additionally, for questions where the student is required to write their own code, students are given the choice to respond with either the ERL or a high-level programming language.

Despite the code-based questions being written in ERL, a large proportion of GCSE students choose to answer writing questions with a high-level programming language instead of the ERL because of how unfamiliar they are with OCR’s Language. This brings up the question of whether students in school should be primarily taught with the ERL or a high-level programming language of the school’s choosing.

### Which option is better?

It is of course important that students are taught the basics of a high-level programming language in school, due to its real-life application in their future. However, in terms of the exam papers themselves, there are advantages in using the ERL instead of an alternate language.

#### syntax differences

The syntax of the ERL differs in some ways from high-level programming languages, which can create confusion during the exam. Although the exam board is lenient, allowing small changes from the formally defined ERL syntax and instead focusing on the logic behind the code, there are some large differences which can cause confusion and for marks to be lost in an exam.

🡺 INCLUSIVITY AND EXCLUSIVITY  
One difference between ERL and many high-level programming languages is very prominent with counter-controlled loops. Take these code snippets below:

|  |  |
| --- | --- |
| A black background with white text  Description automatically generated |  |

A screen shot of a computer code

Description automatically generatedDespite both using the same numbers, ERL will print “Hello World” 4 times, whereas Python will only print it 3 times. This is due to ERL being an inclusive language, which therefore can create confusion with students using Python, a very popular choice, and can cause errors throughout the paper.

This issue is not unique to Python, in languages with C-like style of creating for loops, including Java, PHP and JavaScript, the standard is to create for loops with a < operator, rather than <=, therefore also being naturally exclusive. With ERL being a rare case of inclusivity, this can easily cause issues, especially with “fill-in-the-gaps” style questions and for students who attempt to use ERL without a thorough understanding of it in writing questions, where this difference can easily lose a student marks.

🡺 SUBSTRINGS  
There is a drastic change to the formatting of producing substrings in ERL compared to the standard for many other programming languages. This can also be a source of confusion in the exam.

|  |  |
| --- | --- |
|  |  |

The OCR ERL has an unorthodox substring syntax, with the first argument remaining as the initial index, but the second argument being the length of the returned substring in characters, instead of the standard of the final character position +1. Again, an unfamiliar student may get caught out in an exam.

🡺 MISCELLANIOUS CHANGES  
There are also many small, but still potentially dangerous changes between languages.

* The use of “MOD” and “DIV” instead of symbols in typical languages
* The use of ^ as an exponent (\*\* is used in Python, a very commonly chosen language)
* .upper and .lower are properties rather than methods (have no brackets afterwards)
* The use of closing keywords such as endif and endswitch (uncommon in modern languages)

Although many of these minor changes will generally be overlooked by an examiner during the marking process, a student who is fluent in the syntax will feel much more comfortable in the exam when occurring the custom syntax which they might be unfamiliar with.

#### Learning Resources

A close-up of a book

Description automatically generatedA paper with text and a questionnaire

Description automatically generatedEven though it can be argued that a high-level programming language can be interchangeable with ERL in the exam itself, many of the textbooks which are given to students use ERL in their explanations and exercises for students to do. This is as there is no set high-level language that any given school teaches, and the studied language is chosen by the school itself. Therefore, ERL is used within resources as a universal language utilised by the majority of textbook. This means many programming concepts, such as sequence, selection and iteration, as well as algorithms, such as linear search and bubble sort, will have their code written in ERL and this is how students will encounter and learn these key concepts for the exams.

This therefore presents ERL as a superior language than any alternative for the OCR GCSE, due to its syntax aligning with the mark scheme, and its wide usage within resources which are taught to pupils.

### WHy are alternative languages more commonly used?

The main issue with the ERL is the lack of a way for students to use it. ERL is not a pseudocode, and is an equivalent to a high-level language, so has been written in a way where it is interchangeable with real, functional code. However, there is no translator available which allows students to write and consolidate their skills with the ERL. This alone makes using the ERL mainly redundant, as students can only become familiar and comfortable with a language after using it for a prolonged period, as it this process of trial and debugging that allows their code to be reliable and ensures that they can produce accurate and correct code during the exam.

**Therefore, our problem is that students have no way to practice ERL, so are unfamiliar with it by the time the exam occurs.**

## Stakeholders

The target audience for our solution would be, obviously, for students partaking in the OCR Computer Science GCSE, however more specifically, they would likely be:

* First time programmers, with little or no prior programming experience.
* Using restricted school devices or poor-performance home devices.
* Unable to install and setup any complex software.
* Require a very intuitive solution with lots of help at disposal.

In order to gain a greater insight into the experiences of potential stakeholders, I have interviewed 3 different individuals to understand their experience with programming. I will also return to these stakeholders later to ask for their needs towards a solution I decide on.

### current gcse student

* Past experiences with programming?
* Familiar with the ERL?
* Plans for revision?

### past gcse student

* Did they use ERL or high-level in GCSE?
* How did they practice using ERL?
* Find the experience easy/difficult?
* Potential solution would have aided revision?

### Computer Science teacher

* Programming focused on high-level or ERL?
* Limitations on using ERL?
* Potential solutions be useful towards teaching?

We will return to our stakeholders later to ask for their needs in a potential solution.

# Problem Research

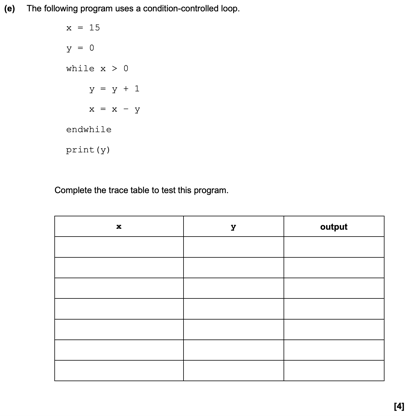
There are many other problems with pre-existing solutions, which can be analysed to provide useful insight into what my potential solution can be.

## Solutions FOR Erl

Initially, the focus will be on pre-existing ways that students can run ERL code.

### trace tables

A white sheet with black text

Description automatically generatedStudents should already be familiar with trace tables, as there are questions in the exam papers, for example this one from the sample paper, of students being required to use them to “run” ERL code. However, when used to run a student’s own code, it presents a slightly different task.

#### Advantages

🡺 Students are taught about trace tables, so it is an easy and familiar method for them to use on their own code, and it allows them to check if the logic behind their program is functional.

🡺 It serves as a form of debugging, as it allows students to analyse the logic behind the program that they have written and allows them to track the values of the variables throughout – much like a debugger – which can help produce more accurate code.

🡺 It does not require any software, just a pen and paper so it is a very feasible solution which can be done anywhere, making it very accessible.

#### disadvantages

🡺 There is no syntax checking at all, so whether the code is accurate cannot be determined as it is down to the students understanding of the language and may be incorrect in an exam.

🡺 This is also true of the logic, as if a student has a flawed understanding of how the logic of the language works, as they are the interpreter in this scenario it means that they may unintentionally gain an incorrect solution which they believe to be correct, as they have interpreted it based on their inaccurate knowledge of the language due to their unfamiliarity, and would lose them marks during an exam.

🡺 The task is very slow and tedious, especially when it comes to longer programs, so there becomes a point where it is intangible to use a trace table when the program reaches a certain size, because the number of variables becomes too tedious to track, and a much faster solution would be preferable.

#### What can i apply to my solution

Although, overall, a trace table is a horribly unreliable and slow method of running a program, it does teach lessons about ease of use which are very important to my own program, in order to make it available to beginners. Also, the very accessible nature is of importance, as there is no use of coming up with a better solution if it is unavailable to a vast number of students.

### translation to other languages

This method, though not official, involves a student writing the original code in ERL, then translating it to a high-level language of choice in order to compile it

### Conclusions

The overall result of this analysis is that an interpreter for the ERL is required, as otherwise running ERL is such a time-consuming process for the student.

## Solutions for other languages

There is an abundance of interpreters available for other languages, and I will be analysing them based on their application towards our stakeholders as alternatives, not for their typical users.

### NOde.JS in Terminal

This is a command-line interpreter for JavaScript which can be run in a terminal on a device by calling it with “node” with no separate application.

#### Advantages

A computer screen shot of a code

Description automatically generated🡺 The obvious first advantage, is that it successfully runs JavaScript code when entered. This may sound irrelevant to mention as a solution, but as there is no option for ERL that does this, it already presents this interpreter as much superior to any ERL methods that could be chosen.

A screen shot of a computer

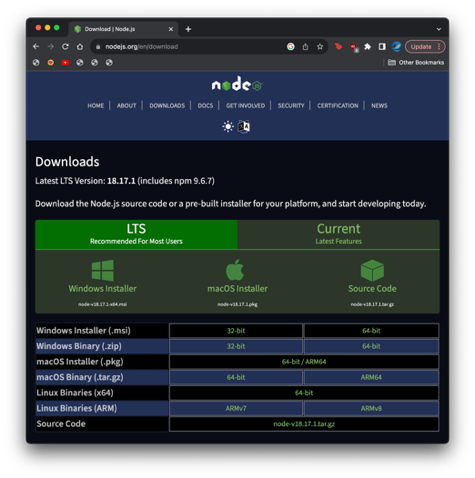
Description automatically generated🡺 It also contains error handling, referencing both the error type and where it occurred, which is very useful for anybody writing code, especially to students who are prone to mistakes, making learning the language much easier as well as aiding debugging.

A screenshot of a computer error

Description automatically generated🡺 Multiple use modes allow the students to use the program depending on their needs. The shell, for a few lines of code to be run individually; the editor for when a longer program is required, to all be interpreted as once; and the ability to select a file in local storage and run it. This makes the interpreter much more diverse and can adapt to the need of the user.

🡺 The basic help feature allows the user to be able to fluently use the compiler, as a reminder on how to operate it with the command-line interface.

#### Disadvantages

🡺 Lacking a graphical user interface of any type, this makes it very difficult to use, especially for the stakeholders who are first-time programmers. A command-line interface is very complex, and the terminal is often blocked on school devices, making it unapplicable for our student stakeholder who need to use it.

🡺 Installation is also difficult, requiring installation from the command line or downloads from the website, meaning a student requires an administrator to be able to access it, which reduces the scope of the interpreter.

🡺 The poor user experience stems from the command-line interface. Users must memorise many commands to access the different features of the interpreter. Although this makes it much faster to use for experienced programmers, for beginners it becomes much more tedious, and could do with a much more intuitive solution, as well as the shell being slightly clunky to use at points,

#### what can i apply to my solution?

🡺 Ensure that error handling is implemented as it is very important in an interpreter  
🡺 Provide an intuitive interface as the interpreter is intended for beginner students.  
🡺 Prioritise accessibility and that it is available to many.

### Python Idle

I will be building upon the previous analysis of node.js for this analysis, as many of the basic features, such as running and error handling are taken for granted, so will not be mentioned.

#### Advantages

A screenshot of a phone

Description automatically generated🡺 The user experience is vastly improved, with use of the ribbon to introduce a greater array of options that the programmer can use, allowing equal if not greater functionality than node without the need to memorise all the commands, making it vastly easier to use for beginners.

🡺 Includes a debugger, with persistent breakpoints, stepping, and viewing of global and local namespaces, which can aid

### Replit

## Solutions FOR Erl

# Proposed solution

The obvious solution to our problem is to create an interpreter which can run ERL to allow students to practice using the language.

## Stakeholder Needs

### Current gcse students

### past gcse student

### computer science teacher