

Computer Science

Brief Overview of the Course <i>(for further details, please see our Sixth Form Prospectus https://strschool.co.uk/sixthform/prospectus)</i>	
Exam Board: AQA Computer Science A Level 7517 Specification web link: https://www.aqa.org.uk/subjects/computer-science-and-it/as-and-a-level/computer-science-7516-7517	
Topics Covered: Year 12 <ul style="list-style-type: none">• Fundamentals of programming• Problem solving and theory of computation• Data Representation• Hardware and Software• Computer organisation and architecture• Communication technology <p>There is a Non Exam Assessment (Coding project) that takes place at the end of Y12 and beginning of Y13. The NEA is worth 20% of the final marks.</p>	Topics Covered: Year 13 <ul style="list-style-type: none">• Data structures• Common Algorithms• Regular languages• The Internet• Databases and Software development• Object Oriented Programming and Functional Programming <p>The Examinations consist of two papers, the first involves practical programming challenges, and the second is theory based.</p>

Please follow the instructions in the boxes below. The aim of these activities is to introduce you to the study of this subject at Advanced Level by:

- reinforcing your core knowledge and understanding of your chosen subject;
- encouraging you to think more deeply about your subject;
- supporting you to develop a deeper understanding of and appreciation for your subject as an academic discipline.

Core Knowledge and Understanding Task

Whether you have studied this subject before or not, there are elements of core knowledge and understanding that you must have prior to starting the A Level course.

Please provide a written answer to each of the following questions. There are links below to help you discover the answers.

All computer programs use algorithms – sets of instructions to achieve a specific task. There are some algorithms that are so common they are usually built into the programming languages, for example sorting and searching functions. It helps to know how these common algorithms work, so Task 1 is to produce a flow chart for each of these algorithms:

- Linear Search
- Binary Search
- Bubble Sort
- Merge Sort

Links to support Task 1 flow charts:

<https://www.bbc.co.uk/bitesize/guides/zm77xfr/revision/1>

<https://teachcomputerscience.com/gcse/algorithms/>

The Computer Science A Level course will require you to write some programs and eventually use your skills to create a solution to a problem (this will be the NEA project). It is therefore important that you know how to write a program. Here is a typical GCSE problem; your task is to write a program for this problem.

PIZZA ORDERS

Write a program to take orders for a pizza and calculate the total cost.

Your program should:

- Ask the user whether they want a medium pizza (£2) or a large pizza (£3).
- Offer the user a choice of six additional toppings and allow them to select up to three additional toppings (at 50p each).
- Tell the user the cost of the pizza and list the order details, eg: Large pizza with pineapple, jalapenos and mushrooms, cost is £4.50.
- Ask the user if they require delivery, and if they do add 10% delivery charge.
- Tell the user the final total cost.

If you wish to extend the program you could ask the user if they wish to order another pizza, and take the details for each extra pizza. You would then need to summarise the whole order, and give the total cost for the whole order.

You could write this program in any suitable language, for example C#, Python or Basic.

The Bigger Picture Task

As well as reinforcing your core knowledge and understanding, our A Level curriculum will expose you to what are called the 'established orthodoxies' within each subject, which can include key research, important people who have contributed to the field, as well as broader methods and theories that exist within the subject.

There are many computer programming languages and they can seem quite different, but all of them eventually reduce to a set of specific instructions for the processor to perform. Once you have learned one language you will find you can see similarities in the code for other or new languages. This next task looks at these similarities.

Here is some pseudo code using iteration in the form of a FOR loop to display the 7 times table:

```
FOR index ← 1 to 12
  Times ← index * 7
  OUTPUT index + " x 7 = " + Times
ENDFOR
```

Your task is to look up how to write this in three languages (C#, Python and Basic). You should compare the three pieces of code – how are they similar, how are they different?

Links to support:

The FOR loop is a fairly simple example and there are plenty of sources online that can help you. Rather than list these and make the task too easy, I'm going to make the search part of the task. You will find that, during the A level course, you will need to search for pieces of code and learning how to decide what is relevant and what isn't is an important skill.

For example, the website stackoverflow is a huge online coding resource and will usually provide code snippets quickly, but I have seen too many people just take the first example and use it without thinking. This has in fact caused some fairly serious cyber security breaches!

Things to look for:

- You are looking for the code for a FOR loop (not while and not foreach).
- FOR loops have some sort of indexing variable (often I for index)
- They usually start at a given value and go up to a higher given value
- You may need to specify the step to make for each iteration (eg +1, or +2, or -1 etc) If you don't specify the step most languages will assume you mean +1.
- You might see code using i++ as shorthand for i=i+1

Recommended Reading List and the Department's 'Top Pick' Title

As an A Level student, we want you to value academic endeavour (scholarship) and develop a thirst for learning in your chosen subject. Our curriculum will help you to understand that scholarship is not just about learning facts, it is about nurturing powerful knowledge.

We will help you with this by directing you to resources that will not only deepen your knowledge and strengthen your understanding of the A Level content, but also broaden it beyond that of the exam board specification.

Please find the full subject reading list alongside our prospectus on the Sixth Form section of the STRS website here: <https://strschool.co.uk/sixthform/prospectus>.

We would encourage you to explore as many of these titles as you can.

One of the best books about programming that I have come across is by Rob Miles. It is a free introduction to computer science using C# and is used as the textbook for the first year programming course at the Department of Computer Science in the University of Hull. The book is well written and quite readable. It starts with simple ideas and builds to some quite complex programming concepts so there is something to suit everyone. Even if you have never used C# before, remember what you learned in the Bigger Picture Task – many of the key concepts are the same between different programming languages, we just write the instructions using a slightly different syntax.

The C# Yellow Book is free, and can be downloaded here:

<https://www.robmiles.com/c-yellow-book/>.

In addition to reading the C# Yellow Book, I would like to recommend that you keep abreast with Computer Science in current affairs. There is so much debate at the moment about data use in tracing and tracking the COVID 19 pandemic, plus discussion of issues such as personal data protection. Computational models have influenced Government decision throughout the crisis. All of this is relevant to the course.

Outside of the news, the development of autonomous vehicles continues apace, with a lot of computational effort behind the scenes, and the Internet of Things grows rapidly with many homes now using digital assistants like Alexa. We've come a long way from the original Robot stories by Isaac Asimov, yet his Laws of Robotics are upheld as a standard for androids to come.

There is a lot of good and interesting information out there if you look for it. Read, think and enjoy!

Once you have read an interesting book or article, consider the following:

- What did you learn from the reading?
- Have you identified any patterns or made any connections?
- What unanswered questions has the reading left you with?
- Did you agree entirely with what you have read? If so, why? If not, why not?
- Are there any themes or topics that you would like to explore further?

Other Recommended Activities

Please find below a selection of suggested additional activities that the department feel it would be useful for you to explore prior to starting the A Level course in September.

You might also like to look at:

Computer Science For Fun (general and fun Computer Science stuff) www.cs4fn.org

The Bebras Challenge (computational thinking skills)

https://challenge.bebbras.uk/index.php?action=user_competitions

YouTube (TED Talks) for example:

<https://www.youtube.com/watch?v=EF692dBzWAs&list=PLF7032F8EB1A4F9E2>