Welcome to OCR A Level Computer Science

Computer Science is a challenging A Level course, with elements of Mathematics. The ability to program is important, but there is also an emphasis on computational thinking as a discipline.

During the summer, you could be looking at the following concepts: **binary, logic gates, programming concepts and data structures**. Revising these topics would be advisable.

The tasks below should be completed and submitted during your first Computer Science lesson in September 2019.

If you have not already had programming experience, or are not a confident programmer, you need to access CodeAcademy (https://www.codecademy.com/learn/learn-python) or Python School (http://pythonschool.net/) and work through topics such as:

- Variable and string manipulation
- Conditionals and functions
- Lists and dictionaries
- Looping – iterating over data structures
- Bitwise operators
- Object Oriented Programming (OOP)
- File input/output

You may also find The Hitchhikers Guide to Python (http://docs.python-guide.org/en/latest/intro/learning) useful as a reference.

Task 1: Extended Writing

Read the following article:

Driverless cars - Who should die in a crash? – https://www.bbc.co.uk/news/technology-45991093

Use the article above as a starting point, complete further research on driverless cars and dissect the subject area using the following framework.

Stakeholder:	Technology involved:
- Anybody involved either directly or indirectly - How are they effected and to what extent? - Who is financially involved? - Does it affect the public/private sector?	- Any technology and how it relates to the problem/topic - Different technologies that are related - How the technology works with the context - Comparisons
Moral/Social/Cultural/Legal Issues:	**Solutions:**
- How the issue relates to any moral, social or cultural context - What are the legal issues - How are the stakeholders affected? - How does the technology relate? - Is the technology helping or causing a problem, for whom and to what extent?	- Have you answered the question? - Any technological or other solution, and how it solved the problem - Analysis of the solution and its effects on stakeholders - How it all fits together

Once completed, use this framework to complete the following question in 500 words.

"Technology is changing too quickly for the law to keep up."
Discuss to what extent you agree with the statement above. In your discussion you should explain which laws regulate the use of technology and how advancements in technology have made the laws difficult to enforce/implement.

Note: you need to submit the completed framework and your 500 word answer.

Task 2: Algorithms

Sorting and searching are very important algorithms in Computer Science. For each of the algorithms below:

- Explain how the algorithm works
- Describe the situation in which this algorithm is the most efficient. You might want to consider the input when you think about the situation
- Write a program in a language of your choice to demonstrate the algorithm. If you don't know any programming languages, write a step by step set of instructions of how this algorithm works.

Algorithms:

- Bubble sort
- Insertion sort
- Merge sort
- Quick sort
- Binary search
- Linear search

Note: be prepared to demonstrate and explain your algorithm. In addition to this demonstration, please submit a word processed document with evidence of the task included.

Task 3: Programming (complete 3 at least)

Program 1
On many major roads, average speed checks are in place. Two sensors are placed a known distance apart and vehicle number plat recognition is used to identify a vehicle and the time it enters the section of road being monitored. The time is recorded when the vehicle leaves the monitored section.

By using the time taken to travel the known distance, the average speed of a vehicle can be calculated.

Write a program for calculating the average speeds for a vehicle travelling through a section of road. (Speed limits for roads are 20, 30, 40, 60 and 70mph).

Program 2

In the UK most vehicle registrations are in the format:

- Two letters
- Two numbers
- Three letters

For example, AZ01 XYZ.

The vehicle number plate recognition system will provide this information as a string of characters.

Write a program that will determine whether a string entered meets these requirements or not and alerts the user to the correct use of the string.

Program 3

When a customer has a problem with a product, automated troubleshooting programs are available to help them.

If a problem with a mobile device occurs, then a troubleshooting process is invoked, with the user responding to a series of questions that lead to a solution or advice to contact the supplier directly.

For example, a conversation might proceed as follows:

System: 'Has the phone got wet?'
User: 'No'
System: 'Has the phone been dropped?'
User: 'No'
System: 'Is the phone fully charged?'…

Write a program that will create a troubleshooting tree for a mobile device. Not all of the questions need to have yes or no responses but each response will need to lead to a supplementary question or a solution. This should be a demonstration version of the system with around 10 possible outcomes.

Program 4

A primary school teacher wants a computer program to test the basic arithmetic skills of her students. The program should generate a quiz consisting of a series of random questions, using in each case any two numbers and addition, subtraction and multiplication.

Write a program that will ask the student's name, then ask 10 random questions, output if the answer to each question is correct or not and produce a final score out of 10.

Program 5

Average calculator – the user should be able to enter a series of numbers, and the program should print the average of these numbers. You can use floating-point number variables, or store the input in a list.

Write a program that will achieve the above. Your program might be used to calculate average temperatures for a week, or a batting average for a cricket team, among others. You could even expand the program to print the mean, median and mode averages.

Program 6

RGB colour converter – when making websites, one way of thinking about different colours is by their RGB values. RGB stands for Red, Green and Blue. Every colour can be 'made' by combining different amounts of Red, Green and Blue. Each part of the colour has a value between 0 and 255. Here are some examples:

(255, 0, 0) = RED - This is a colour made up of 'full' red, and no green or blue. This makes red.

(0, 139, 139) = TEAL – This is a colour made up of no red, some green and some blue. This makes teal.

Another way of representing colour is by hexadecimal code. This is the same RGB combination, but with 2 hex digits (00 - FF) representing each of the three component colours: #FF0000 = RED, #008B8B = TEAL.

Write a program to convert from a decimal RGB colour code to its hexadecimal code equivalent.

Note: please be ready to demonstrate each of your working programs and be able to justify your code.