

Computer Science

A Level (H446)

Rednock School Computer Science and ICT Department

TRANSITION PACK

Welcome to A-Level Computer Science! Firstly, congratulations on completing your GCSE's and well done for choosing Computer Science! Computer Science is a very challenging A-Level which involves lots of content and so you will need to take some time to read and prepare.

In this pack you will find plenty of materials to prepare you for your course. It is aimed for you to use once you have completed your GCSE's before starting you're A-Levels in September.

Consider this your summer work to get you ready and up to scratch! A-Levels are tricky qualifications to achieve and you need to ensure that you are fully prepared for them. The more work you do now, the easier you will find it when you start your course.

If you prefer taking hand written notes rather than using the computer, you will need a notepad and folder ready to keep your notes organised. However, the majority of the work will be completed on the computers and we will set up your folder structure in the first lesson.

[Expectations](#)

What students can expect from the Computer Science and ICT Department

You will receive 9 1-hour lessons each fortnight giving a total of 9 hours taught time. The syllabus will be split between two teachers. Each teacher will cover different aspects of the course and will give you homework to increase your understanding of Computer Science. You can expect to receive homework from both your teachers at least once per week.

All students are advised to use their time in school effectively to ensure they keep up to date with homework. In accordance with the school homework policy if you do not submit homework on time and to an acceptable standard you will be required to attend a homework detention to complete the work. Teachers will aim to mark homework promptly.

What the Computer Science and ICT Department expect from you

You will always complete work to the best of your ability and submit any work on time to your teacher for marking. If at any point you feel you do not understand a topic it is essential you make your teacher aware of this. Ideally this should be in class whilst the topic is being covered, however you could also approach the teacher outside the classroom if you feel more comfortable doing this. You are expected to work independently at home checking through notes and carrying out additional research and reading to supplement class work as part of your homework.

You may also be expected to attend open evenings to support the department.

Course structure

There are 3 components to the A-level course.

Paper 1 –

Computer Systems (01), 2.5-hour exam, 140 marks, 40% of total

Paper 2 –

Algorithms and programming (02), 2.5-hour exam, 140 marks, 40% of total

Programming project –

Coursework, internally assessed project (03), 70 marks, 20% of total

Teaching schedule for the year 2024-25

You will have 4 lessons of programming a fortnight with Mr Wells. These lessons will focus on developing your programming skills in Python and understanding key programming constructs.

You will then use these lessons to plan, prepare and complete your Project during year 12. The Project is split into the following sections:

1. Analysis of problem
2. Design of the solution
3. Developing the solution
4. Evaluation

During the transition time, you will need to think about the focus of your Project. You will need to find a situation or problem where technology can help, perhaps to make something more efficient or engaging. You will then need to research this topic to find a solution and begin to develop your idea on how to produce a solution to the problem.

The other 5 lessons a fortnight will be spent learning the theory side of the course with Ms Clements. You will focus on learning the content for the 2 externally assessed exams that you will sit at the end of year 13. These lessons will be a mixture of lecture-style lessons, note taking, tasks, worksheets, videos etc. You will spend 1 of these lessons focussing on the ethics of computing where you will be tasked with reading relevant articles to stay up-to-date with current trends and discussions within computing.

Useful websites

www.w3schools.com This is a great website with tasks, tests and projects to help you learn the basics on coding.

<http://www.teach-ict.com> This is an excellent resource for theory, worksheets

and revision activities. <http://www.revisionworld.co.uk/alevel>. You have to log on to use this website.

It appears to have a number of revision notes and tests you can do online.

<http://www.youtube.com>. This can be good for animations, however you can get lost in the videos! Use this website carefully or you will waste essential revision time and only use it if you know exactly what you're looking for.

<http://www.thestudentroom.co.uk>. This website is a general site for students and works like a chat room. You can download various revision notes as well as chat to other A-level Computer Science students about topics. Like you tube – be careful you don't waste valuable revision time on here chatting!

Others to try... www.iloveComputerScience.co.uk

<http://www.colchsfc.ac.uk/ict/ICTASCourse/ASTimeLine/Default.htm>

http://www.klbschool.org.uk/ict/as_a2/ <http://www.fatmax.org/>

http://www.thekjs.essex.sch.uk/yates/year_12.htm

<http://www.nchadderton.zen.co.uk/front.html>

<http://www.ictteacher.com/Alevel.html>

Useful books

OCR As and A Level Computer Science (PG online), written by PM. Heathcote and RSU Heathcote.

Tackling A Level Projects in Computer Science (PG online), written by C. Cattanachi-Chell.

My Revision Notes: OCR A level Computer Science, 2nd ed, written by G. Rouse, J. Pitt and S. O'Byrne.

The National Lottery

Details of play

To play the lottery you need to buy a ticket that cost £1. You pick six numbers between 1 and 49. On draw night the machine will pick six numbers and a bonus ball. You normally win money if you match 3, 4, 5 and 5 + bonus. Match all six numbers and you have won the Jackpot!

Write a program that simulates the lottery by asking the user for 6 numbers and then shows on the screen for x number of draws how many times they matched 3,4,5, 5 + bonus or 6 numbers.

The program will be marked out of eight; 4 for the basic program and up to a further 4 extra marks for the following extension tasks:

- Create a simulation of the 'lucky dip' (where numbers are picked at random for a player)
- Calculate the number of years to win the lottery
- Calculate the profit and loss (£1 per draw outgoings, winnings are counted as income)



Programming Challenge

Submit the following for marking in 1 document: -

1. Your code listing
2. Screenshots for suitable test data

Glossary:

256 - This is 2 to the 8th power. It is the number of different numbers that you can store in a byte (8 bits), usually ranging from 0 to 255. An 8 bit number can be represented by two hexadecimal digits or three octal digits.

AI - Artificial Intelligence.

ASCII - Pronounced as-key. Stands for the American Standard Code for Information Interchange. It is a 7bit code for characters. For example: the letter 'x' is represented as 1111000. Because it is only 7 bits long, an ASCII character can be stored in a byte.

Abstraction - Removing detail of something to focus on a subset of the features without confusing details.

Address - a) A location in memory or identifying a particular piece of memory.
b) An identification that allows access to something such as an internet address
which allows one to access a device on the internet.

Agent Based Modelling - A method of simulating the real world in which individual agents interact with their environment and each other to simulate real world behaviours and conditions. NetLogo is good at Agent Based Modelling.

Agent - Independent acting sections of code and data that represent active interacting pieces of a model or system.

Algorithm - A set of instructions for accomplishing a task that when executed will terminate.

Analog - Measured in continuous values. The audio signal from a microphone is analogue. A clock with hands is considered analogue.

Application - A runnable program that provides some service.

Argument - One of the pieces of data provided as input to a procedure or function through the call to the procedure or function.

Artificial Intelligence - The subfield of computer science that involves the creation of programs that attempt to do what was formerly believed to be able to be done by humans.

Autonomous - Controlled by computer programs and not people.

Bandwidth - Refers to the volume of information that can be transmitted or processed. It is usually measured in bits or bytes per time unit like "bits per second".

Big Data - The problem beginning in the 21st century of processing vast amounts of data coming at or refreshing at very high speed. For example satellite sensor data, city monitoring sensors, gene sequencing data, etc.

Binary - The base 2 number system. Integer can be encoded as binary which is a string of 0's and 1's. Binary is a place-value system in which each bit position denotes a power of 2 (unlike decimal which uses 10 symbols and powers of 10). k bits of information can represent 2^k different numbers. For example counting in 3 bits of binary you can count from 0 to 7: 000, 001, 010, 011, 100, 101, 110, 111.

Bit - A binary digit. The smallest unit of information represented by one of two states (usually 0 or 1). It is often denoted by a lower case 'b' as in Mbs (megabits per second). Or the amount of information gained when answering a yes or no question.

Boot Program - The program run when the computer hardware is powered up.

Boot - To restart a computer as if the computer had been powered down regardless of whether it was on and running or not.

Broadcast - In messaging passing it is to send the same message to all who can listen.

Bus - a) the main path for bits traveling in parallel in and out of a CPU. It is often many bits wide. b) Any pathway for bits to travel in parallel.

Byte - 8 bits. It is often denoted by a capital B as in MB (mega-bytes). **Call** - A statement in a language that starts or invokes a procedure or function.

CPU intensive - A program that spends most of its time running on the CPU with a disproportionately small amount of time waiting for data from memory.

CPU - Central Processing Unit. Where the computer instructions are executed.

Cache - Is memory used to speed memory access that stores data that is anticipated to be used next or was just used and may be used again. For example: cache may exist on slow physically rotating discs to save information of data that is near to the data just accessed or to hold data without writing it to disc until it is likely not to change again.

Card - A circuit board which can be plugged into your computer motherboard.

Central Processing Unit - Processing unit that takes streams of bits as data and instructions and executes the instructions on the data yielding more data and possibly instructions.

Character - A single letter or symbol that is represented by a small set of bytes in the computer. See ASCII and Unicode.

Chip – An integrated electronic circuit generally with from thousands to billions of components such as transistors and capacitors that perform complex functionality such as addressable memory, CPU, I/O functions.

Clock - The internal “drummer” or heartbeat that keeps the CPU activities across the chip and across the motherboard in sync. Often measured in megahertz or gigahertz.

Cloud Computing - Rather than computation occurring “locally” on one’s own computer the computation is on distant machines accessible via the internet.

Cloud Storage - Rather than the information being stored “locally” on one’s own computer the information is stored on distant machines accessible via the internet.

Cloud - In the phrase “in the cloud” refers to information being stored not on one’s own computer but on a distant mass storage device accessible via the internet.

Cluster Computer - Also known as a cluster is a supercomputer made up of many smaller computers such as PCs connected with very fast network hardware.

Compiler - A program for translating a program written in one language into code that can be executed.

Computer science - a) the study of process, data and computation. b) A very cool profession. (No bias here. ;-)).

Computer - An electronic device for storing and processing information based on programs stored in the computer.

Control structure - Code that changes the order of execution for instance an ifstatement conditionally executes code while a loop may perform a section of code repeatedly.

Core - A processor on a chip. Usually used when there are more than one processor on a single chip.

Customer Base - The set of loyal customers a company or other software supplier supports.

Data Mining - Using algorithms to infer complex results for masses of data such as sensor data or the world's web pages. Generally to be data mining most of the data available is not relevant but large enough amounts are that it is nontrivial to draw conclusions.

Data intensive - A program that spends most of its time waiting for data from memory rather than computing. Sometimes called memory intensive.

Database - An organized collection of data and services to access them in a variety of ways relevant to the data.

Device - A unit or piece of hardware with a specific purpose such as a disk, keyboard, audio board, etc.

Digital Divide - The societal advantages for those with internet or computer access over those who do not have access.

Digital - Measured in a set of discrete steps. The audio signal on a CD or in an mp4 file is digital. cf. Analog.

Disk - A magnetic storage device that records data on a spinning disk. The bulk of long term storage on a today's computers is "on the disk".

Drone - An unmanned flying vehicle (See UAV). May be remote controlled or autonomous.

Executable - A file that can be executed by the operating system.

External hard drive - A disk that is a peripheral.

File Extension - when naming a file there is often a part after the last period in the file name called the file extension that indicates the type of the file such as pdf, jpg, txt, etc.

File - a single block of information allocated by an operating system for retention beyond the execution time of any program.

Floating Point Number - A number with a decimal in it like 3.141592653589.

Functional Abstraction - Abstraction to what a section of code will do rather than the details of how it does it. A function definition allows for abstracting the contained code to a function call.

Function - A standalone segment of code with a clear set of inputs and output that performs a specific function and returns a value. It is essentially a procedure that returns a value.

Global variable - A variable that is accessible from anywhere in the code. It is also persistent for the duration of the program.

Graphics card - Is a circuit board containing a CPU that processes instructions specifically targeted at graphics processing. This is especially useful for games and simulation programming.

Graphics processing - Image construction and manipulation.

HSV - Stands for "Hue, Saturation, Value". It is a way of specifying a colour by giving the amount of each of three contributing factors to make the colour: Hue is the colour in the colour wheel, Saturation is the amount of colour versus white, Value is how bright the colour is or distance from black. HSV is also sometimes called HSB.

HTML - Hypertext Markup Language. A language used to write internet based documents that can refer to each other.

HW - abbreviation for hardware.

Hard drive - A disk. A spinning disk of magnetic media for storing data.

Hardware - Physical components of a computer or related equipment. **Hertz** - A cycle or oscillation per second. A second hand on a standard analogue clock ticks at 1 hertz. The clock on most computers is currently on the order of 1 gigahertz.

Hexadecimal - The base 16 number system (compare with binary). It is often used to express binary numbers in shorter strings than binary or octal.

Counting to 20 using two hex symbols: 01, 02, 03, 04, 05, 06, 07, 08, 09, 0a, 0b, 0c, 0d, 0e, 0f, 10, 11, 12, 13, 14.

Hex - Short for Hexadecimal.

High Level Language - A language that is NOT similar to the one that runs on the hardware and deals more complex data types and control structures than the hardware. Languages like Java, C, C++, Python...

I/O - Input and output.

IDE - Integrated Development Environment. A software tool to help you write software. Examples include the open source: Eclipse and NetBeans and the proprietary Microsoft Visual Studio.

IT - Information Technology. This refers to general hardware, OS, and network design and support.

Instruction - a) A single executable action for the CPU b) the binary encoded form for the instruction.

Integer - A whole number, that is, with no fractional part. Maybe be positive, negative, or zero.

Interface - The formal way in which two things interact. In particular how humans and machines interact or two pieces of software interact.

Interpreter - A combination of a compiler and runtime environment that translates and executes a program.

Kilo - A thousand, as in a kilobyte.

Kilobyte - may be 1000 bytes or 210 bytes which is equal to 1024 bytes depending on situation.

Linux - An operating system authored by Linus Torvalds as a free operating system. Companies that distribute Linux make their money in configuration and support. It is based on the UNIX operating systems.

Local variable - A variable that is accessible only in a portion of the code. Generally, within a procedure and is created as you enter a procedure and destroyed as you leave.

Loop - A control structure in the code that causes repeated execution of a section of code.

Machine Instructions - The instructions executed by a CPU. The bit level instructions of a computer.

Memory - Addressable storage for storage and retrieval of bytes of data. Memory generally refers to the memory that is off CPU. Cache memory is on .

Message Passing - A way to pass information between processes, machines, or threads that are running in parallel.

Motherboard - The main circuit board generally connecting most major components of a computer such as CPU, memory, I/O devices.

Multi-Core processor - a chip with multiple processors and cache memory to speed execution.

Nano- - a) a billionth, as in a nanosecond or a nanometre. b) a very small thing like nanotechnology.

Network an interconnected set of computers that can share information.

Northbridge - connects the CPU to high speed data components such as memory and graphics cards.

OS - Operating System.

Object Oriented programming - A programming style in which variables and functions are associated in an object and visibility of the contents of the object

is constrained. For example in Scratch, a sprite “owns” its own local variables and scripts/threads.

Object - A collection of variables and functions brought together in a programming system to represent a physical thing, its data and its function.

Octal - The base 8 number system (compare with binary). It is often used to express binary numbers in shorter strings. Counting to 10 using two octal symbols: 01, 02, 03, 04, 05, 06, 07, 10, 11, 12.

On Chip - Generally means the functionality is on the CPU chip or the chip under discussion. Can refer to hardware as in “The north bridge can now be found on chip” or refer to execution as in “the data and instructions are cached on chip”.

Open Source - An application or software in which is provided with the source code usually with few restrictions for repurposing or augmenting.

Operating System - The program that runs on the computer hardware creating information objects such as files and processes and assures the fair and secure allocation of processor time for processes, access to files, access to devices, and other resources.

PC - Personal Computer or sometimes stands for a Personal Computer running the Windows operating system.

Pairs Programming - A programming methodology that has two programmers set down at a single keyboard and display to program as a team effort. Producing more and better working code.

Parallel Computing - The field of Computer Science that deals with algorithms, techniques and hardware that enables simultaneous execution of many streams of instructions.

Parallel - processes run in parallel means they are executing at the same time on different CPUs or cores.

Peripheral - A physical device used by a computer that is not part of the physical box containing CPU and memory. A printer is an example.

Port - A socket on a computer for attaching the computer to external devices

such as a printer or a router.

Powers of Two - A number that is the product of two multiplied together many times. The kth power of two is denoted 2^k . Powers of two are very important in computing because k bits can be used to number 2^k things in binary. The first few powers of two are: 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096.

Procedure - A standalone segment of code with a clear set of inputs and output that performs a specific function. Compare with function.

Process - A running program.

Programming - Constructing a program; usually in a high level language. The art of instructing computers how to store, retrieve, and process data automatically.

Program - An implementation of an algorithm.

Proprietary - Owned by an individual or company and whose use generally requires payment.

Protocol - A standard for communication between pieces of hardware or between pieces of software that allows information and commands to be exchanged.

RAM - Random Access Memory. Generally refers to memory that is not in the CPU.

RGB - Stands for "Red, Green, Blue". It is a way of specifying a colour by giving the amount of each of three contributing primary colours to make the desired colour.

Reboot - To restart a computer as if the computer had been powered down even though it was turned on and possibly running.

STEM - Science Technology Engineering and Mathematics - The set of fields many educational institutions and governments are focusing on to improve enrolments and retention.

SW - abbreviation for software.

Scalable Computing - An application supported on an amount of hardware that automatically adjusts to the size of the demand thereby saving money by using less hardware when demand is light and more when the demand is heavy.

Semantics - The meaning of statements in a language as distinct from the syntax.

Server - A computer that provides some service and is accessible over the internet.

Simulation - Modelling the behaviours and conditions of the real world.

Software - A set of information that includes at least one program and optionally many programs and data files. The set of information is generally related and used with a specific goal in mind such as image processing software.

Solid state disk (SSD) - Uses chips to emulate a disk but with no moving parts. Much faster than rotating mechanical disks but currently not as much storage and more expensive.

Southbridge - connects the CPU to lower speed data components such as internet, keyboard, audio, USB, etc.

Speed of Light - Generally means the speed of light in a vacuum. It is about 1 foot per billionth of a second.

String - a) An ordered sequence such as a string of bits or characters. b) a string of characters.

Supercomputer - A computer with a much higher than average performance.

Syntax - The grammar for a language or the rules to decide if a statement is in the language but not the meaning.

Telepresence - A set of technologies which allows a person to feel as if they were present, to give the appearance of being present, and/or to have an effect as if present.

Text - a) just the set of bits that represents a stream of symbols in a language.

It does not include any formatting information such as font or color. b) any representation of a set of symbols. c) text encoded in ASCII.

Thread - A thread is a “lightweight” subunit of execution of a process that can run in parallel with other threads in the process. It is a way to have parts of a process run simultaneously.

Time sharing - Fairly splitting up time between running processes.

Type - The kind of data that can be stored or referred to and has a specific set of operations that apply to it such as addition is an operation that is used on integers. Popular types are int, float, boolean. Processing supports types like colour and string as well.

UAV - Unmanned Aerial Vehicle and autonomous drone.

UNIX - A variety of operating system that originated in the 70s as an independent project in Bell Labs and has grown to be the basis of many of today’s operating systems including Linux and Apple distributions .

USB - Universal Serial Bus. A popular standard for creating a data path between computers and peripherals. It includes the capability of powering a device. More recently USB has been used as a power source alone, disregarding its data protocols.

Unicode - A method for encoding a string of symbols as bits. This set of schemes can be used to represent nearly any symbol including Chinese. However, Klingon (plqaD) is not currently in the standard. However:
[http://en.wikipedia.org/wiki/ConScript Unicode Registry](http://en.wikipedia.org/wiki/ConScript_Unicode_Registry).

Virtual Machine - A virtual machine is a software implementation of a machine that executes programs like a physical machine. The machine that is mimicked need not really have a hardware implementation but only exist as a virtual machine.

Visibility - Said of a variable. A variable is visible if its contents can be accessed by its name. A local variable in one function might not be visible from inside another function.

Vi - The classic text editor on a UNIX machine. Generally available on all UNIX based operating systems. The modern version of vi is vim.

Windows - The proprietary operating system distributed by Microsoft.