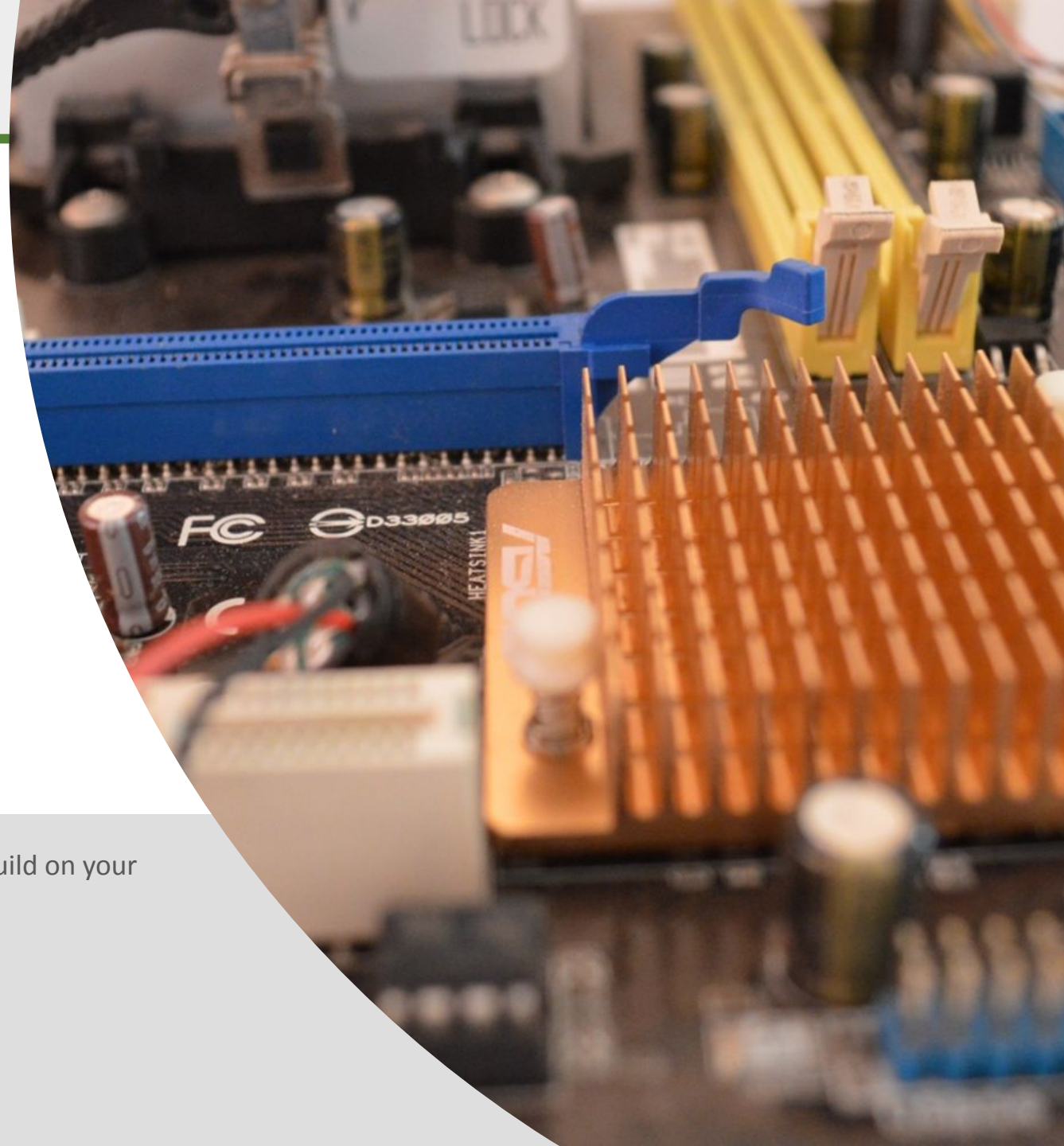
GCSE to A level

Computer Science Transition workbook

- The topic of **Computer Science** is at the heart of the modern world
- Studying it can make you extremely sought after in todays job market
- The transition from GCSE to A level is significant, this includes:
    - An increased emphasis on **technical content**
    - An increased emphasis **independent research**



This workbook is designed to allow you to practice some of these skills and build on your existing knowledge.

Please complete by your first lesson back in September.

1 “Tell me about yourself”

Craig’n’Dave

Why did you choose Computer Science?

In this simple task you get the opportunity to tell me your choices and reasons behind choosing to study Computer Science. Please answer all questions as best you can.

1. Why did you choose to study A level Computer Science?

2. What other courses have you chosen to study at Key Stage 5, and what made you choose this combination?

3. What are you hoping to achieve from studying Computer Science?

4. How would you describe yourself as a learner at GCSE? What skills where you good at, what areas would you like to improve on?

5. What are your other hobbies and interests outside of school? Anything related to Computing?

2 Independent research task

Craig'n'Dave

Emerging computer technology

In this task you get to investigate any area of emerging computer technology which interests you.

You can pick any area which interests you, but examples could be:

- Artificial intelligence
- Robotics
- Automated self driving cards
- Quantum computing

In no more than ONE side of A4 summarise the area you have chosen under the following four headings:

1. What is it?
2. What are the possible Social, Moral, Cultural and Ethical **benefits** of this technology on society
3. What are the possible Social, Moral, Cultural and Ethical **risks** of this technology on society
4. My conclusion on this technology and what it will mean for our world 10 years from now

Additional help:

For additional help and support in structuring your answer you might like to watch some of the videos from the following Craig 'n' Dave playlists:

OCR:
SLR 17 – Ethical, morale and cultural issues
https://student.craigndave.org/videos/slr-17-ethical-moral-and-cultural-issues

AQA:
SLR 19: Moral, social, legal, cultural issues
https://student.craigndave.org/videos/slr19-moral-social-legal-cultural-issues

4 Note taking practice task

Craig'n'Dave

The Cornell method of note taking

The expectation to do independent research at A Level will increase dramatically from GCSE.

There is a real skill to taking decent notes outside of lesson which are of value. Research has proven that one of the most effective methods is the "Cornell" note taking method.

1. To start download the "Cornell note taking template" from Craig n Dave:
    - https://craigndave.org/cornell-note-taking/

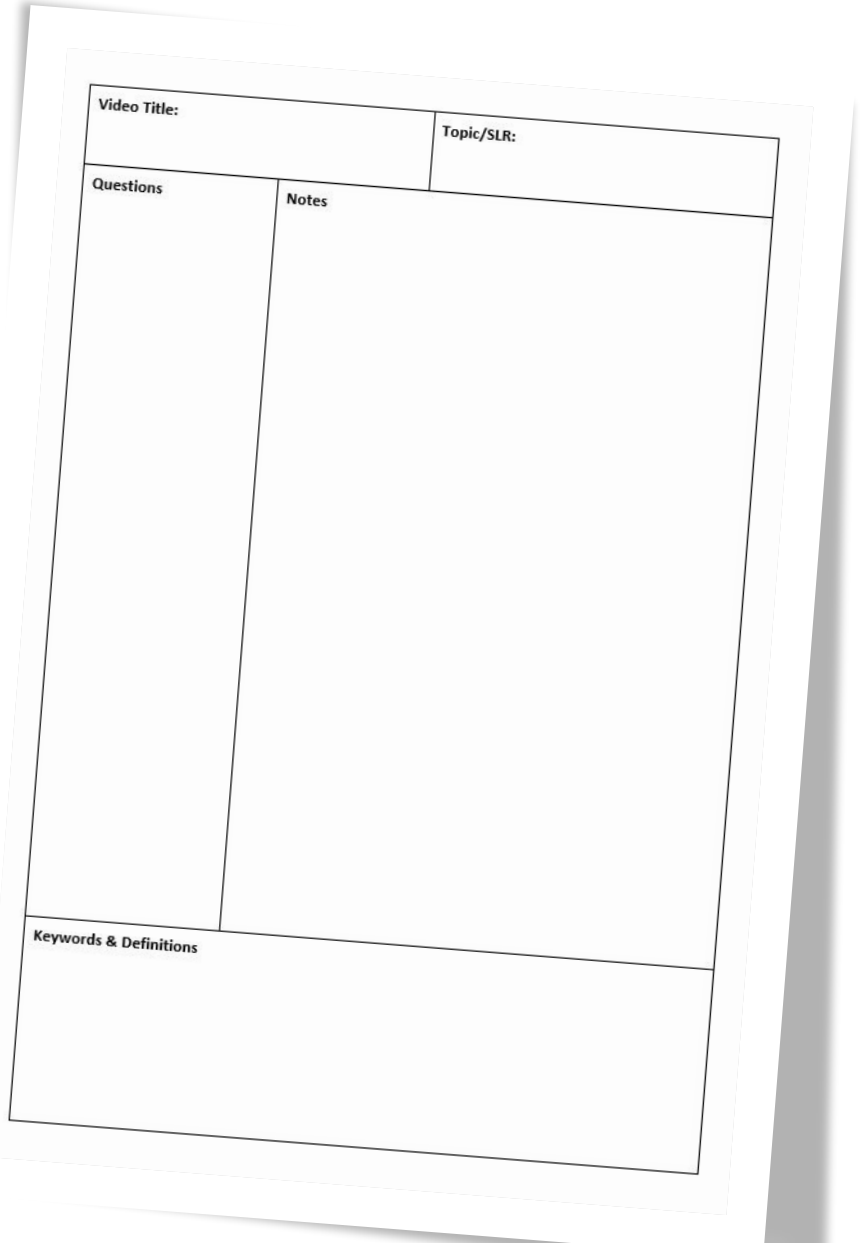
2. Pick any two of the following videos from Craig 'n' Dave:
    - OCR: https://student.craigndave.org/videos/ocr-alevel-slr01-alu-cu-registers-and-buses
    - OCR: https://student.craigndave.org/videos/ocr-alevel-slr04-paging-segmentation-and-virtual-memory
    - OCR: https://student.craigndave.org/videos/ocr-alevel-slr05-stages-of-compilation
    - OCR: https://student.craigndave.org/videos/ocr-alevel-slr14-data-structures-part-2-graphs

3. Write the title of the video and its topic in the top boxes (use a different sheet for each video).

4. In the main "Notes" section, write notes from the video. You can do this in any way you like, a suggestion might be to rewind slightly when the canvas changes, thinking carefully about what was important in the previous few minutes.

5. Having recorded the notes, review them:
    - Turn each part into a question in the section on the left.
    - For example, the notes may say, "The value of the program counter is passed to the memory address register".
    - The question then becomes, "which register is the value of the program counter passed to?"
    - Sometimes these questions are easy, and at times they are more difficult to write.
    - There may also be more than one valid question.
    - You will need to decide for yourself which are the most appropriate questions for revision.

6. Finally pull out all the key words and their definitions words the notes and list them in the bottom section.



5 Key terms task

Craig'n'Dave

Getting to grips with terminology

An important aspect of being successful with your study of Computer Science is getting to grips with subject related terminology. There are over 240 specific terms you will need to learn!

Below are a handful of the key terms you will need to become familiar with.

Control Unit	**Register**	**Busses**
Von Neuman Architecture	**Optical Storage**	**Operating System**
Intermediate Code	**Device Driver**	**Compiler**
Assembly Language	**Machine Code**	**Lossy Compression**
Hashing	**Normalisation**	**TCP/IP Stack**
Packet Switching	**ASCII**	**Problem Decomposition**

1. Research each of the key terms and write a definition.

2. Resist the urge to simply cut and paste a definition from the first website you find. Many definitions found on The Internet are overly complicated and wordy.

3. Ask yourself:
   - Does my definition make sense?
   - Is it succinct, to the point?
   - Does the definition have appropriate depth and detail for A'Level?
   - Could I give this definition to another student so they could revise from it?

C# basics

1. Download JetBrains Rider: https://www.jetbrains.com/rider/download/?section=windows
2. Head over to the web site: https://learn.microsoft.com/en-us/training/paths/get-started-c-sharp-part-1/
3. Complete:
    - Write your first C# code
    - Store and retrieve data using literal and variable values in C#
    - Perform basic string formatting in C#
    - Perform basic operations on numbers in C#
    - Guided project - Calculate and print student grades
    - Guided project - Calculate final GPA

Looking under the hood of the processor

The CPU "Central Processing Unit" is the central core of any computer system. You will study what it contains and how it works it in depth at A Level.

1. Start by watching the following 3 videos from Craig 'n' Dave (choose from OCR or AQA exam board)
    1. **OCR:** https://student.craigndave.org/videos/ocr-alevel-slr01-alu-cu-registers-and-buses
    2. **OCR:** https://student.craigndave.org/videos/ocr-alevel-slr01-fetch-decode-execute-cycle
    3. **OCR:** https://student.craigndave.org/videos/ocr-alevel-slr01-performance-of-the-cpu
    4.

2. Produce a fully annotated diagram on a single sheet of A4 / A3 paper which shows how the CPU works.

3. Make sure the diagram includes and covers:
    - Major CPU components and what they are for:
        - Arithmetic Logic Unit (ALU)
        - Control Unit (CU)
        - Cache
    - The main registers
        - Program Counter (PC)
        - Memory Address Register (MAR)
        - Current Instruction Register (CIR)
        - Memory Data/Buffer Register (MDR / MBR)
    - Fetch-decode-execute cycle
    - Include annotations which explain how the performance of a CPU can be improved by:
        - Increasing the clock speed
        - Increasing the cache size
        - Increasing the number of cores

Operating systems

Operating systems are arguably the most important piece of software installed on a computer.

Carry out some research into the following areas:

- The purpose of operating systems
- The roles of operating systems
- The purpose of interrupts
- How interrupts work as part of the fetch-decode-execute cycle

Complete the tasks on the following slides.

Additional help:

For additional help and support in structuring your answer you might like to watch some of the videos from the following Craig 'n' Dave playlists:

OCR: SLR 4 – Operating systems – Systems software
https://student.craigndave.org/videos/slr-4-operating-systems-systems-software

Operating systems

1. List at least 8 different roles an Operating System perform.

The purpose and roles of an Operating System

<Enter answer here>	<Enter answer here>	<Enter answer here>	<Enter answer here>	<Enter answer here>	<Enter answer here>	<Enter answer here>	<Enter answer here>

Representing negative numbers in binary

In GCSE computer science you will have learnt how to represent positive whole numbers in binary e.g. 47

At A Level you will need to know how to represent negative as well e.g. -47

Start to recapping (or learning if you didn't do the GCSE) how to represent positive whole numbers between 0-255 in binary

Now research how to represent negative numbers in binary using the method known as:

- Two's complement

Complete the tasks on the following slides.

Additional help:

For additional help and support in structuring your answer you might like to watch some of the following videos from Craig 'n' Dave:

GCSE recap: How to represent positive binary values 0-255
https://student.craigndave.org/videos/aqa-gcse-slr13-number-bases

A Level: Representing negative binary values using Two's Complement
https://student.craigndave.org/videos/aqa-alevel-slr11-twos-complement

Representing negative numbers in binary

1. Write out the positive binary number 107, the answer should be displayed in 8 bits.

128	64	32	16	8	4	2	1	Binary weighting
								Binary value

2. Write out the negative binary number -107 using Two's Complement, the answer should be displayed in 8 bits.

								Binary weighting
								Binary value

3. How would you represent the lowest negative number possible using Two's Complement, given 8 bits.

								Binary weighting
								Binary value

4. How would you represent the largest positive number possible using Two's Complement, given 8 bits.

								Binary weighting
								Binary value

Converting between base-2, base-10 and base-16

As humans we have use the decimal or denary number system (base-10), made up of the unique digits 0-9.

Computer systems at the most basic level use only binary 1's and 0's (base-2).

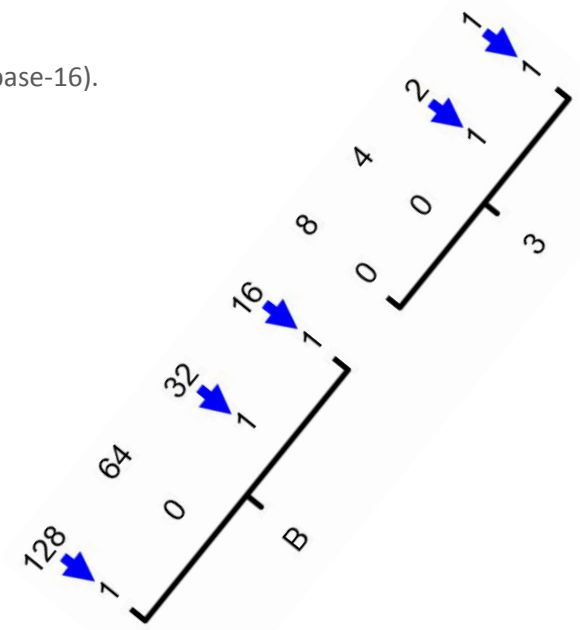
As a computer scientist you will also need to become familiar with the hexadecimal number system (base-16).

You will also need to be comfortable with converting numbers between these three base systems.

Research the following areas:

- Base-2 binary number system
- Base-10 decimal/denary number system
- Base-16 hexadecimal number system
- How to convert between base-2, base-10 and base-16

Complete the tasks on the following slides.



Denary	Binary	Hexadecimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
10	1010	A
11	1011	B
12	1100	C
13	1101	D
14	1110	E
15	1111	F

Additional help:

For additional help and support in structuring your answer you might like to watch some of the following videos fro. aig 'n' Dave:

Base 2, 10 and 16 number systems:
https://student.craigndave.org/videos/aqa-alevel-slr10-base-2-10-and-16-number-systems

Converting between binary, hex and decimal:
https://student.craigndave.org/videos/aqa-alevel-slr11-aqa-converting-between-binary-hex-and-decimal

Converting between base-2, base-10 and base-16

1. Convert the base-2 binary number 11000101 into base-10 and base-16.
(Show all your working)

2. Convert the base-16 hexadecimal number 9F into base-2 and base-10.
(Show all your working)

You may wish to cut and paste this standard binary weighting line to help lay out parts of your answer

128	64	32	16	8	4	2	1	Binary weighting
								Binary value