



Year 9

Computing

4. Computing Hardware and Software

STUDENT	
TEACHER	
CLASS	

WORKING AT GRADE	
TERM TARGET	
YEAR TARGET	

GRADE FOR THIS TOPIC	
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The long answer questions in this booklet are designed to stretch and challenge you. It is important that you understand how they should be answered. You should structure your answer like this:

1st Paragraph – should explain the key term e.g. give a definition.

2nd Paragraph – should make a point (could be an advantage or disadvantage) and explain the point fully giving an example where necessary.

3rd Paragraph – should make another point (could be an advantage or disadvantage) and explain the point fully giving an example where necessary.

4th Paragraph – should make a point (could be an advantage or disadvantage) and explain the point fully giving an example where necessary.

You should have at least 1 advantage and 1 disadvantage.

Progress against termly target												
ABOVE												
ON												
BELOW												
TERM	1	2	3	4	5	6						

Learning Outcomes			
	Levels		
Lesson	5	6	7
1 Von-Neumann architecture	I know the concepts behind the fetch-execute cycle.	I know the von Neumann architecture in relation to the fetch-execute cycle, including how data is stored in memory.	I know that processors have instruction sets and that these relate to low-level instructions carried out by a computer.
2 Fetch - execute cycle	I know the concepts behind the fetch-execute cycle.	I know the von Neumann architecture in relation to the fetch-execute cycle, including how data is stored in memory.	I know that processors have instruction sets and that these relate to low-level instructions carried out by a computer
3 Addressable memory - LMC	I know the concepts behind the fetch-execute cycle.	I know the basic function and operation of location addressable memory.	I know that processors have instruction sets and that these relate to low-level instructions carried out by a computer.
4 Low level programming - LMC	I know the concepts behind the fetch-execute cycle.	I know the basic function and operation of location addressable memory.	I know that processors have instruction sets and that these relate to low-level instructions carried out by a computer.
5 Types of software	I know that there is a range of operating systems and application software for the same hardware.	I can justify the choice of and independently combine and I use multiple digital devices, internet services and application software to achieve given goals.	I can explain and justify how the use of technology impacts on society, from the perspective of social, economical, political legal, ethical and moral issues.
6 Assessment	Achieves a level 5 in the end of term assessment	Achieves a level 6 in the end of term assessment	Achieves a level 7 in the end of term assessment

1. Von-Neumann architecture



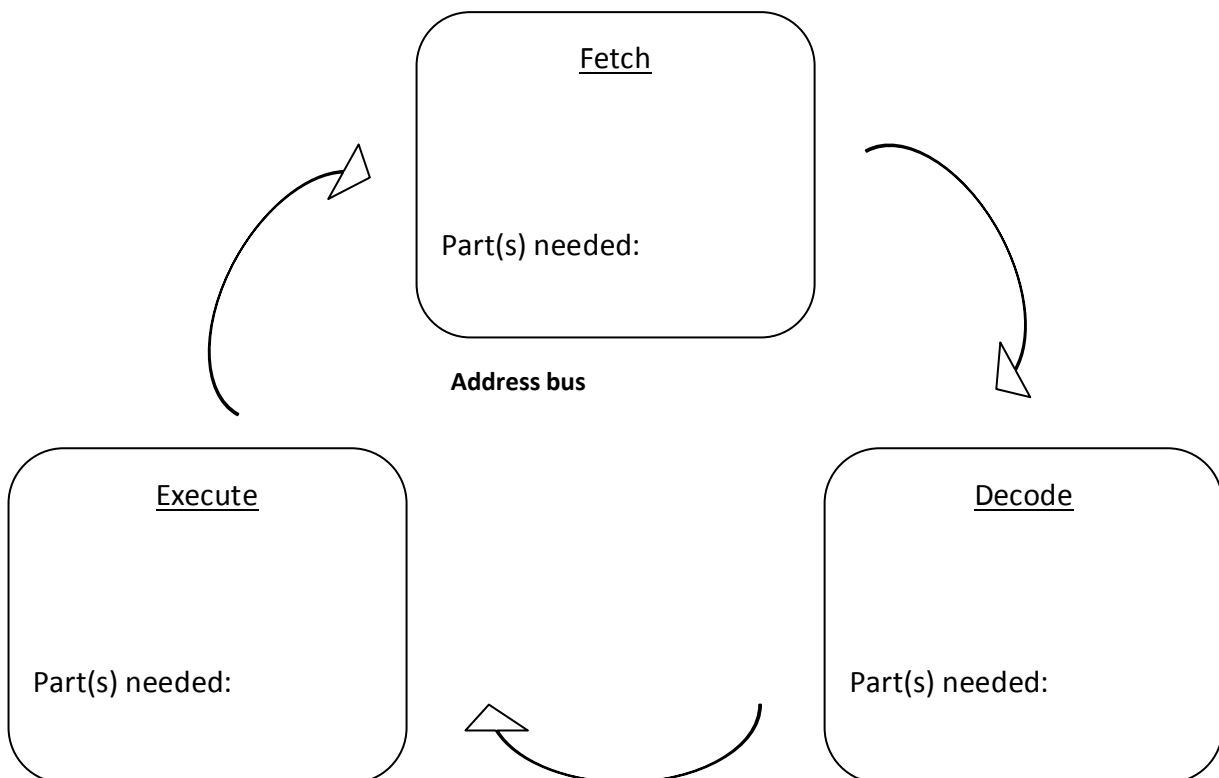
This term we will look more at how the internal components of a computer work—lets refresh your memory on what we covered in our last lesson.

What is an instruction

What are the two main parts of an instruction called?

Describe what each part of the instruction does.

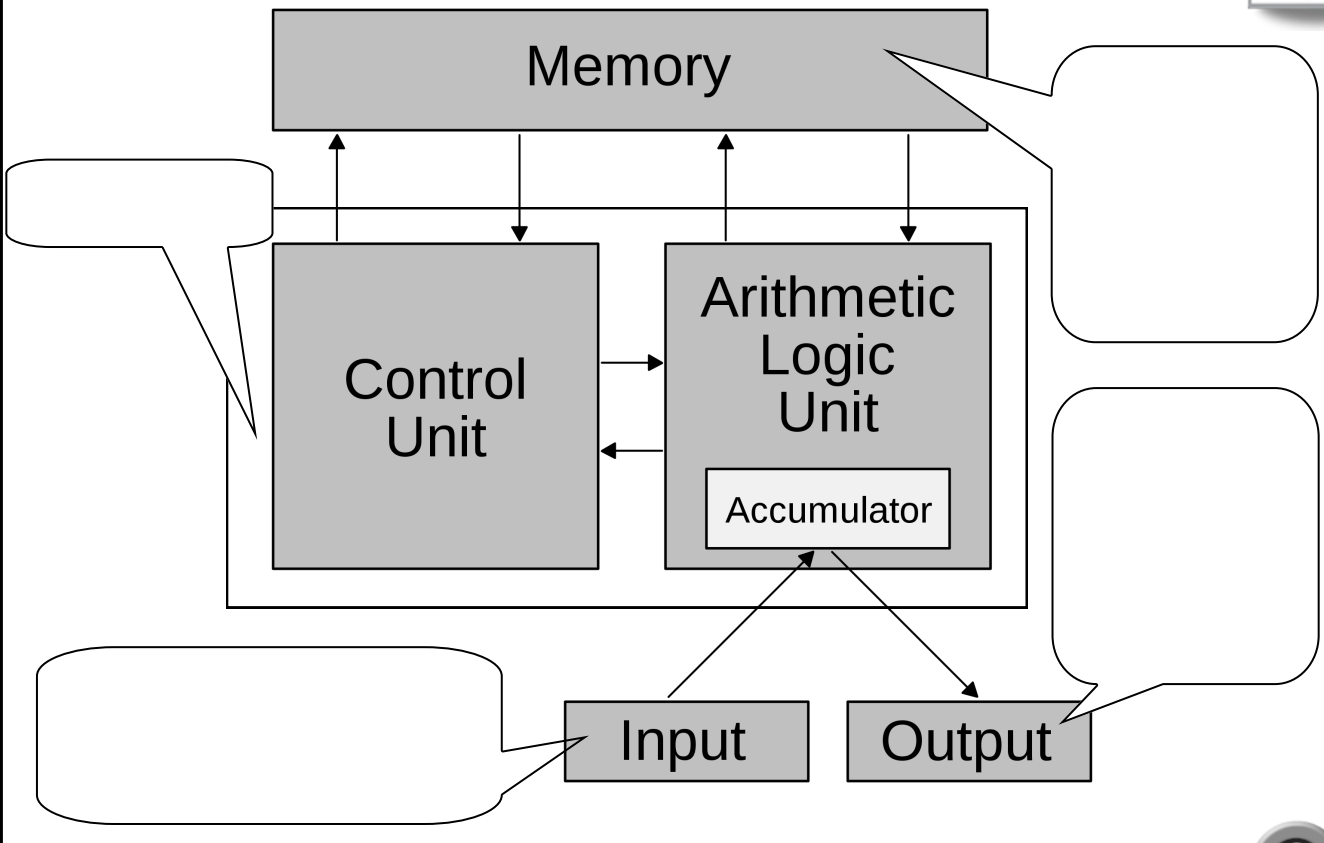
Below is a diagram of the fetch / execute cycle - explain what is involved in each step and what components are needed.



Von-Neumann architecture is based on the fetch-execute cycle.



Complete the diagram to show what parts of a computer system are involved in Von-Neumann architecture.

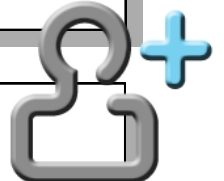


A computer does not just 'know' what to do. It has to look up what each instruction means in its:

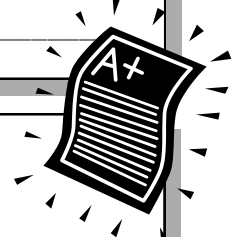
These instructions are written in:

For a word with 4 bits for an opcode and 6 bits for an operand

- How many different instructions could I fit into the instruction set?
- What is the largest number that I could use as data?



Self Assessment: R A G	Exit Ticket: what are the 3 stages of the fetch/execute cycle?
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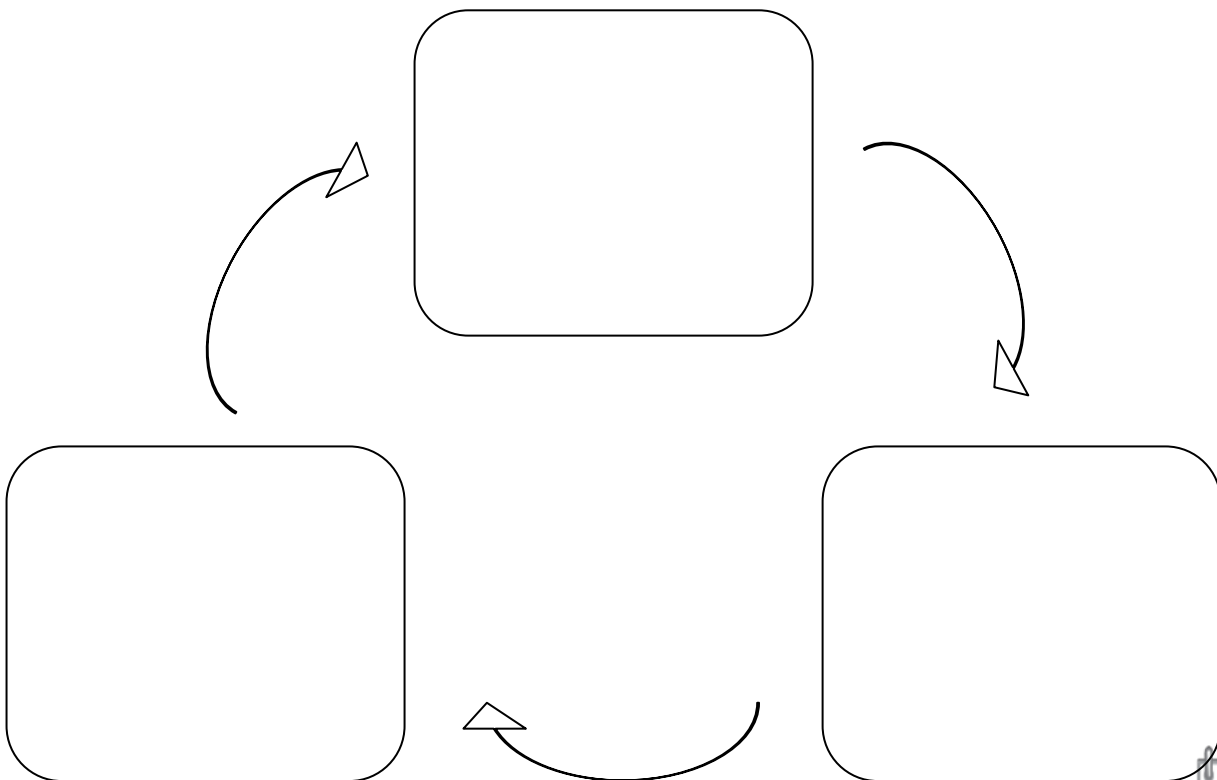


2. Fetch - execute cycle



Complete the diagram below to show how instructions are processed in a computer.

This called the _____ cycle.



Explain what each part of the CPU does:

Arithmetic Logic Unit

Programme counter

Control unit

Immediate Access Store

The Little man computer is a simulation of how Vonn-Neumann architecture works.

Complete the boxes to explain how each part relates to a part of a real computer.



Address bus

Little Man Computer - CPU simulator v3.3

Assembly Language Code

OUTPUT

RAM

Little Man Computer

0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0
10	11	12	13	14	15	16	17	18	19
0	0	0	0	0	0	0	0	0	0
20	21	22	23	24	25	26	27	28	29
0	0	0	0	0	0	0	0	0	0
30	31	32	33	34	35	36	37	38	39
0	0	0	0	0	0	0	0	0	0
40	41	42	43	44	45	46	47	48	49
0	0	0	0	0	0	0	0	0	0
50	51	52	53	54	55	56	57	58	59
0	0	0	0	0	0	0	0	0	0
60	61	62	63	64	65	66	67	68	69
0	0	0	0	0	0	0	0	0	0
70	71	72	73	74	75	76	77	78	79
0	0	0	0	0	0	0	0	0	0
80	81	82	83	84	85	86	87	88	89
0	0	0	0	0	0	0	0	0	0
90	91	92	93	94	95	96	97	98	99
0	0	0	0	0	0	0	0	0	0

CPU

PROGRAM COUNTER

INSTRUCTION REGISTER

ADDRESS REGISTER

ACCUMULATOR

0

INPUT

1 2 3

4 6

7 9 C

RESET LOAD SAVE

ASSEMBLE CODE INTO RAM RUN STEP

U

Load/edit a program then COMPILE & LOAD into RAM

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Data bus

How does the computer know where to look for data?





The language that a computer works in is called

This is all in:

Machine code	Assembly code
000000110101 =	Store 53

The table shows a machine code instruction and its assembly code equivalent. You can see that the assembly code instruction is made up of to parts. These are called:

When a program is written in assembly language the computer cannot run it directly. It has to convert it into

Using a

The computer looks up each assembly language mnemonic (the short word used to describe the action that instruction carries out) in the computers

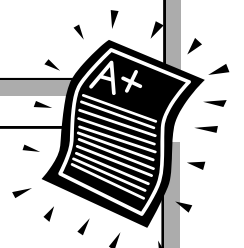
The assembly language mnemonics and the instruction set have what kind of relationship

This means that

Self Assessment:

R A G

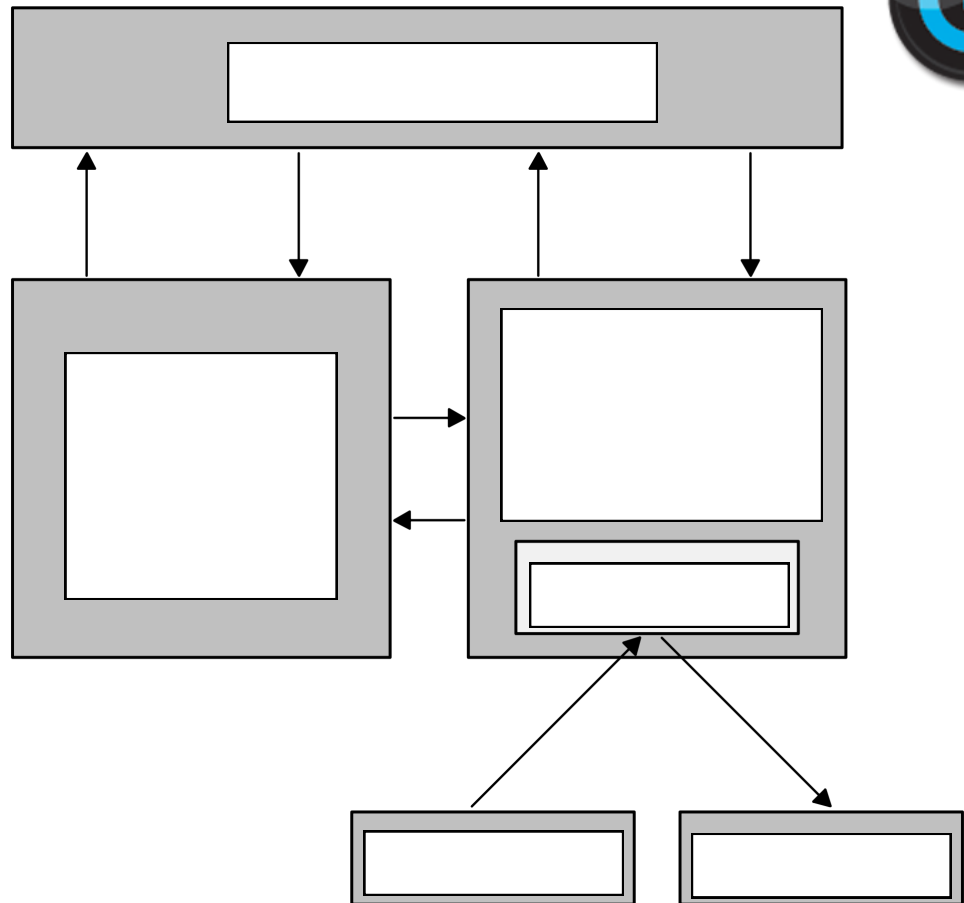
Exit Ticket: What happens in the ALU?



3. Addressable memory - LMC



Complete the diagram to show the main parts of von-Neumann architecture.



The LMC can be used to help you to understand how the fetch/ execute cycle works.



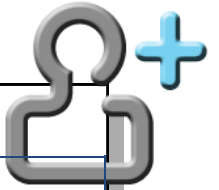
Use the LMC to help you to explain how each stage of the fetch execute cycle works. Try to focus on how the LMC uses addresses in it's RAM.

FETCH _____

DECODE _____

EXECUTE _____

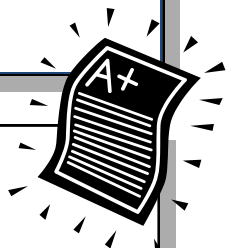
Just like the CPU of a real computer system the LMC has its own instruction set that is converted into machine code so the computer can run it.



Complete the table below to show what the machine code for each instruction would look like.

The LMC instruction set (**NOTE:** where machine code has XX this is the operand of the instruction)

Mnemonic	Description	Machine code (Decimal)	Machine code (binary)
INP		901	
OUT		902	
STA		3XX	
LDA		5XX	
HLT		000	
ADD		1XX	
SUB		2XX	
BRA		6XX	
BRZ		7XX	
BRP		8XX	
DAT			



Self Assessment:

R A G

Exit Ticket: How is each instruction stored so it can be fetched?

4. Low level programming - LMC



Match up the correct definition to the keyword.

Arithmetic operation	The part of an instruction that tells the processor what to do.
Instruction set	The part of an instruction that identifies the data to be handled by the operator.
Logical operation	A comparison between two items of data.
Operand	The total collection of instructions that a processor can carry out.
Operator	A computer programming language consisting of binary or instructions which a computer can respond to directly
Machine code	A mathematical process that is performed on data.

Low level programming is a way of writing software that is specific to the CPU of the computer it will be run on. Printer drivers are written in low level programming languages as they have to be specific to the type of CPU that they will be working with. Otherwise you wouldn't be able to get a printer from the super market and be able to use it on lots of different computers.

The instruction set of each CPU relates directly to the mnemonics that can be used in the low level programming language. Comment the code below to show what the machine code for each instruction will be.

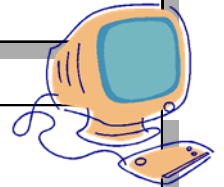


```
INP
STA price1
INP
STA price2
ADD price1
OUT
HLT
price1 DAT
price2 DAT
```

Explain how the fetch / execute cycle relates to the instructions you have written for the LMC



Complete the table below to show how each instruction relates to a memory box location.



Instructions	Instruction is stored in mailbox number	Data will be stored in / loaded from mailbox number
INP		
STA price1		
INP		
STA price2		
SUB price1		
OUT		
HLT		
price1 DAT		
price2 DAT		

Which part of an instruction contains the mailbox number?



Which part of an instruction contains the actual instruction?





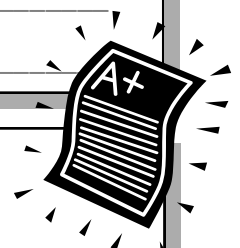
How many instructions does the LMC instruction set have?

What is the number of instructions in an instruction set limited by?

Could the LMC instruction set be extended?

Have a go at getting the LMC to multiply two numbers together. What do you notice?

Why does software need to be specific to the instruction set of the computer it will be run on?



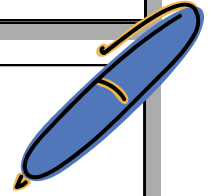
Self Assessment:

R A G

Exit Ticket: What is low level programming?

STRENGTH	TARGET	ACTION	EFFORT

Green Pen Activity:



5. Types of software



Make a list of as many different pieces of software as you can

Software is vital to your computer, without it you wouldn't be able to do anything on your PC or tablet!

Explain why there is more than one choice of application software and operating system for the same hardware.



There are two main types of software, these are:

This type of software is normally included in your operating system as a bundle of programs

This type of software does what?



Below are some of the common utility software types which are often bundled with your operating system. Complete the table to demonstrate your understanding of what they do.

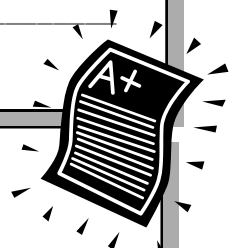


	Computer	House	Similar because
Security	Anti-virus	Using soap, bleach washing powder & anti-bacterial kitchen surface cleaner	Kills things that would make you get sick.
	Firewall	Lock doors & windows, prevent unauthorised access to the building.	
	Spyware detection	Close the curtains to stop people staring in to see you working on your laptop/iPad	
File Organisation	Archiving, backup & restore	Tidying your bedroom (putting books back on shelves, clothes away in drawers). Putting boxes of old toys in the garage, putting Christmas decorations away.	
Clean-up	Delete tmp, cache, internet files, downloads & installers, recycle bin	Empty all bins in house on 'bin day'. Throwing away or recycling packaging, wrappers, tin cans, post-it notes, wipe chores from chalkboard.	
Diagnostics	Task manager, disk usage viewer	Calendar, chalk board? Chores list on fridge? Monthly family meeting?	
Customisation & Add-ons	Eye-candy: change the appearance of an app without changing its functionality Helper apps, add new features to existing apps, make them	Ornaments, paint, wallpaper Kitchen gadgets	

There are legal, moral and ethical issues surrounding the use of software. Name one.



Write a report on this, explaining both sides of the argument. Submit on Edmodo.



Self Assessment: Exit Ticket: What are the two main types of software called?

R A G

6. Assessment lesson



Software and hardware keywords

O H I R E B V E J B E M E R O C H C K B	BINARY
U N W C J C V S E T V N N D W M Y V E W	CODE
L T D P Q K O P E R A N D K W J S L N E	CPU
A F N O I T A R E P O N X N O D L C I Y	CLOCK
Z P N P P V E H T V Z P F C I W W Z H B	SPEED
C L I E L E C H F Z G E H G B E Y M C N	CORE
L X N R T A R O V C I T E M H T I R A Q	CPU
O U S A C Z W A C W F C P V J U L W M R	CACHE
C U T T C F Q M T Y F C U E C C X O E T	CYCLE
K R R O M F M X Z I L B Y P R E C X D F	DENARY
G R U R K E E J C E O I L X C X A X E F	NUMBER
W C C N E R M Y G S G N M M R E C K N I	CACHE
F F T J P L Y O E T I A E C I - H G A J	MEMORY
E H I C I F C N R C C R M F Z H E F R L	PRIMARY
D V O Y V M A N U Y A Y O E L C Y C Y F	MEMORY
O N N N D O Z T H M L F R V P T C Z S M	RAM
C Y M J Z M Y U F A B V Y U M E W M L R	ROM
I X X O O B B Q I Z H E T H Q F K F C M	ARITHMETIC
B H C R X H E G M Q R M R Y R A M I R P	OPERATION
E X W S S R U T D E E P S W O J C O D E	INSTRUCTION
	SET
	LOGICAL
	OPERATION
	OPERAND
	OPERATOR
	MACHINE
	CODE

End of term assessment

1. Name the three stages of the fetch / execute cycle

1. _____
2. _____
3. _____

(3 marks)

2. Explain what happens in each stage of the fetch / execute cycle.

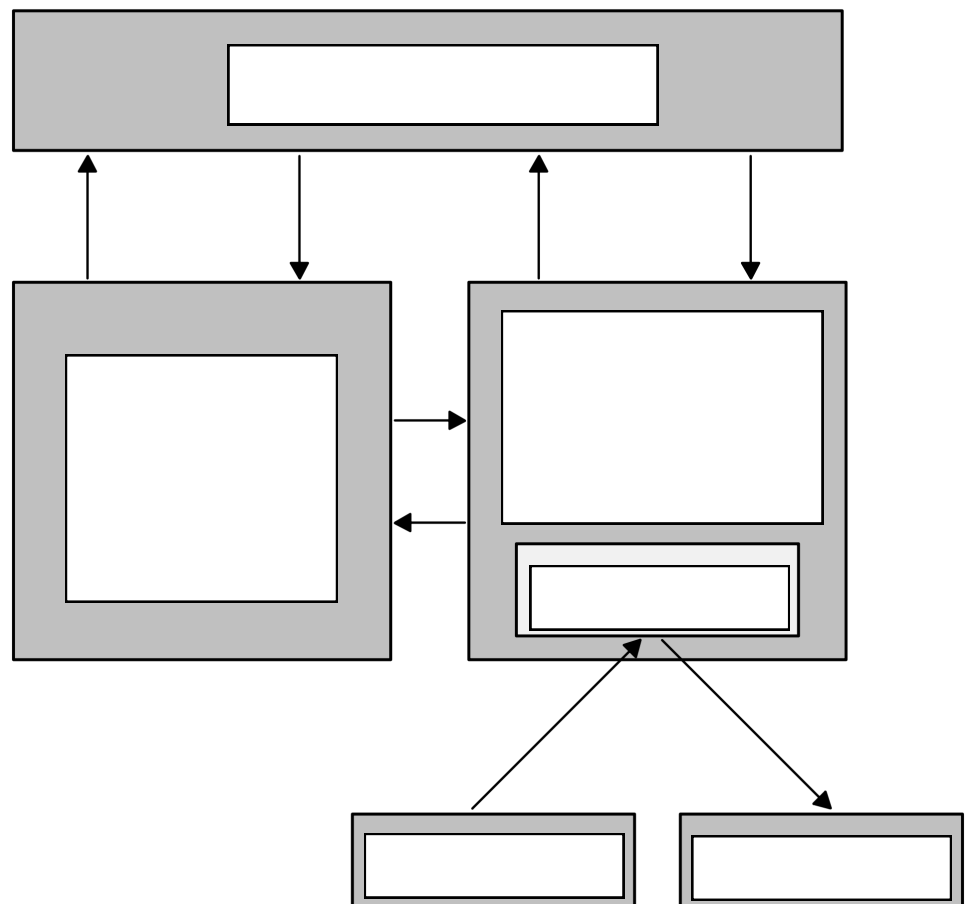
1. _____

2. _____

3. _____

(3 marks)

3. Complete the diagram



(6 marks)

4. Name the diagram above:

(1 mark)

5. Name the two parts of an instruction and explain what each relates to.

1. _____

2. _____

(4 marks)

6. Explain how a computer uses location addressable memory to process instructions.

(4 marks)

7. Fill in the addresses (mailbox numbers) for the following code (where there is an _____)

Instruction	Instruction in machine code	Stored in mailbox number
INP	901	_____
STA var1	3 _____	_____
OUT	902	_____
HLT	000	_____
Var1 DAT		_____

(6 marks)

8. The name for all of the instructions a CPU can carry out is:

(1 mark)

9. What is low level programming?

(2 marks)

10. Explain how a low level programming language relates to a CPU's instruction set.

(2 marks)

11. Name two operating systems

(2 marks)

12. Can you only get one operating system for all computer systems?

(1 marks)

13. What software would you use to write a letter?

Explain two reasons why you have chosen this software for this task

(3 marks)

14. Suggest one moral or ethical issue that might be involved in the use of software

(1 marks)



Keywords

Binary code	The code in which all data and instructions in a computer are stored. This is made of the digits 0 and 1.
Central Processing Unit (CPU)	The main component of the computer. It carries out all the processing by fetching and executing instructions.
Clock speed	The speed at which the processor carries out instructions, measured in Megahertz (MHz) or Gigahertz (GHz).
Core	Each single processor circuit capable of fetching and executing instructions.
CPU cache	Memory buffer on the processor that stores instructions which have been fetched before and allows them to be fetched more quickly the next time.
Fetch–Execute cycle	The process by which programs are run on a computer. The processor repeatedly fetches the instructions of the program from memory and executes them.
Denary number	A number that uses the denary digits from 1 to 10.
Cache memory	This is a buffer of memory in the processor that is used to store copies of items that are most often fetched from the memory, so that they can be fetched more quickly.
Primary memory	Memory that can be addressed and accessed directly by the processor.
Random Access Memory (RAM)	Memory that is used to store the programs and data currently in use by a computer. It is volatile, which means that it gets erased when the computer is switched off.
Read-Only Memory (ROM)	Memory that is used to store programs permanently and in the same location, such as the boot-up program. This memory is non-volatile and is not deleted when the computer is switched off.
Arithmetic operation	A mathematical process that is performed on data.
Instruction set	The total collection of instructions that a processor can carry out.
Logical operation	A comparison between two items of data.
Operand	The part of an instruction that identifies the data to be handled by the operator.
Operator	The part of an instruction that tells the processor what to do.
Machine code	A computer programming language consisting of binary or instructions which a computer can respond to directly