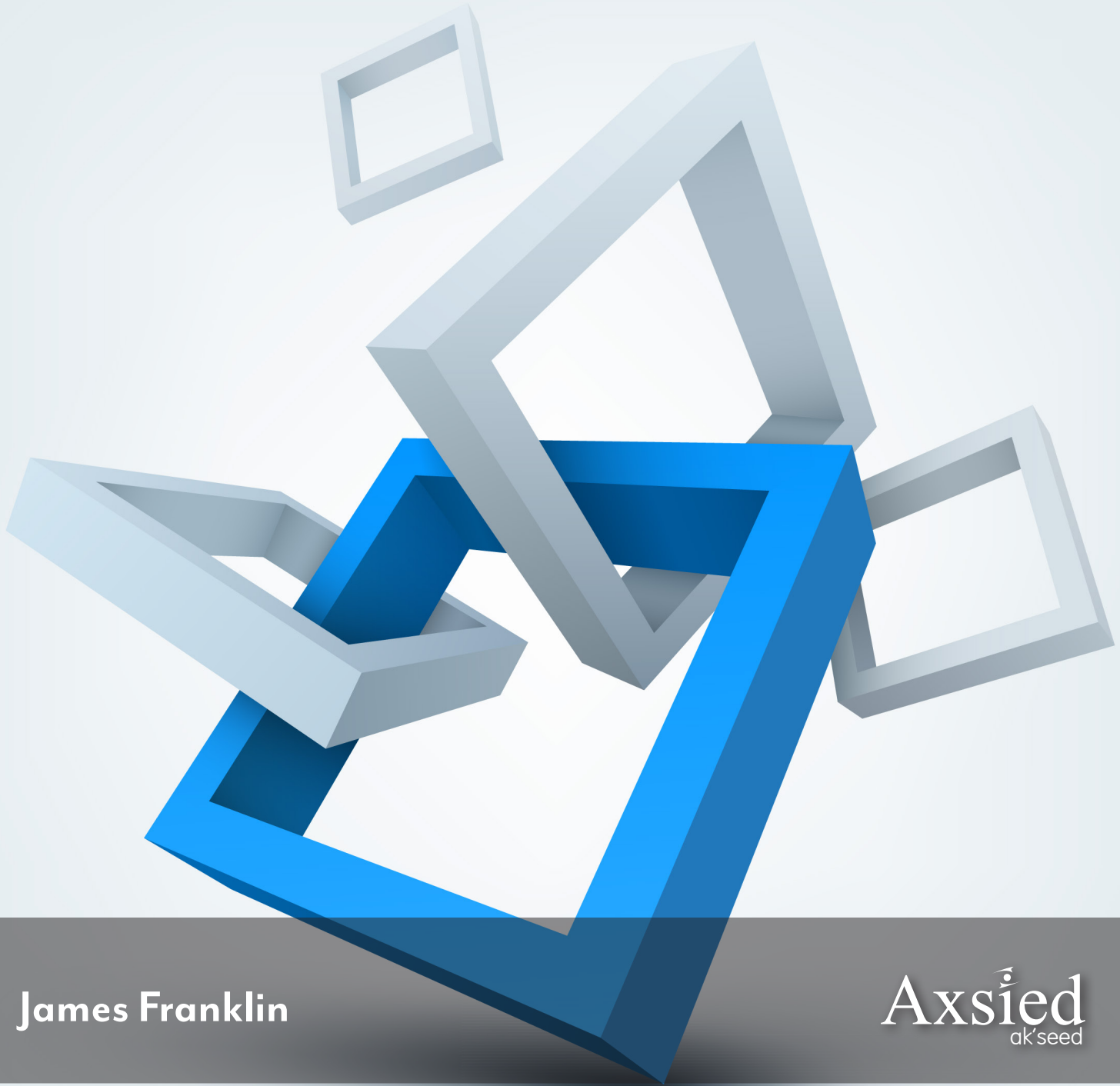
GCSE (9-1) Computer Science Teacher's Workbook

for OCR J276

Readings, questions and answers for both theory exams

4th Edition



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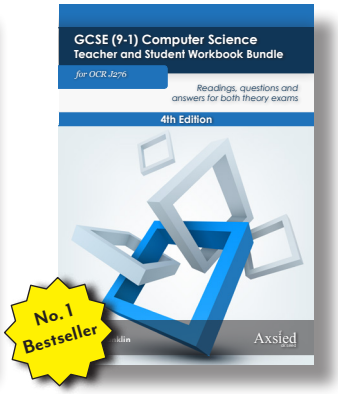

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Info

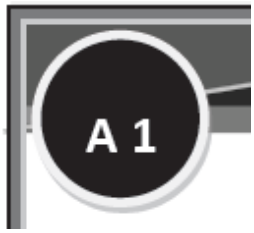
Useful Information 1

This workbook contains all readings, questions and answers for all the topics covered in OCR GCSE (9-1) Computer Science (J276) theory exams. This is the teacher's workbook which contains the answers to all questions. A companion student's workbook does not contain the answers and is suitable for sharing with students if you wish to set worksheets as a homework or test. You may share this version of the book with students if you wish them to independently study or revise the material. The books may be uploaded to a VLE – be very careful that this is behind a password so that only students or teachers from your institution can access the material.

Each of the readings is contained on one page and faces one page of questions. This allows them to be photocopied or printed easily either together or separately. All pages are in black and white to allow printing or photocopying where colour is not available.

Each question page contains easier questions on the left and harder questions on the right. There are 10 marks available on each side making a total of 20 marks for each sheet. Calculating percentages is therefore made easy. Learners who find the topic or subject difficult could be asked to complete just the left hand side making the sheets perfect for differentiation.

Each topic is numbered. The first section of the book is for readings and questions. The second section of the book is for answers. These are labelled with R, Q and A as in the following table.

Readings	Questions	Answers
		

Crosswords are also available to cover the programming topics of the course. These are labelled C and S for crosswords and solutions respectively.

When answering questions, boxes require a tick and circles need to be filled in. Any answer that has a circle to be filled in must only have **one** answer that is correct. An answer that has squares will have **two or more** answers that need to be ticked. This is to help prevent learners from making accidental mistakes by not realising how many boxes or circles should be ticked. You may wish to explain this when giving out worksheets.

Example	Note
2. Logic gates can only take what two values as inputs? Tick **two** boxes. ❑ 0 ❑ B ❑ 1 ❑ A ❑ X ❑ Nil	Boxes require two or more ticks as indicated in the question
1. Hard disks and CD drives are both examples of what type of storage? ❍ Magnetic storage ❍ Primary storage ❍ Optical storage ❍ Secondary storage	Circles require one circle to be filled in

Info

Useful Information 2

The second section of the book contains answers to all questions. All answers should be easy to mark as either correct or incorrect. There are no partial marks to make marking easier and suitable for peer marking. As longer written answers cannot be assessed this way, the questions should be supplemented with questions from previous exam papers or appropriate essay type questions.

A progress sheet is included in the following page. You may wish to give each of your students a copy of this so that they are able record their progress and results. You may wish to have them stick the sheet into the front of their books or folders if they are given any.

In general, if a student has understood the topic they should be expected to get at least 80% on each of the sheets.

Progress Sheet

Progress Sheet

This progress sheet allows you to record your mark out of 20, or a percentage, for each worksheet you complete.

1	2	3	4	5	6	7	8	9	10

11	12	13	14	15	16	17	18	19	20

21	22	23	24	25	26	27	28	29	30

31	32	33	34	35	36	37	38	39	40

41	42	43	44	45	46	47	48	49	50

51	52	53	54	55	56	57	58	59	60

61	62	63	64	65	66	67	68	69	70

71	72	73	74	75	76	77

Crosswords (marked out of 10)

1	2	3	4	5	6	7	8

Revision Sheet

This sheet can be used for revision. Once you have reviewed each topic either tick the box, or if you have worked on the questions write down your result. Make a note of any topics which you are uncertain of so that you can ask your teacher.

1	2	3	4	5	6	7	8	9	10

11	12	13	14	15	16	17	18	19	20

21	22	23	24	25	26	27	28	29	30

31	32	33	34	35	36	37	38	39	40

41	42	43	44	45	46	47	48	49	50

51	52	53	54	55	56	57	58	59	60

61	62	63	64	65	66	67	68	69	70

71	72	73	74	75	76	77

Section 1
Readings & Questions

Computer Systems (J276/01)

Computational Thinking, Algorithms and Programming (J276/02)

Crosswords

Section 2 Answers

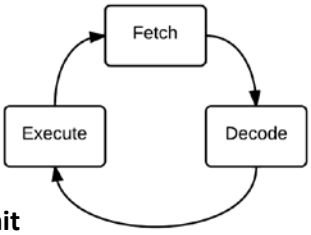
Computer Systems (J276/01)

Computational Thinking, Algorithms and Programming (J276/02)

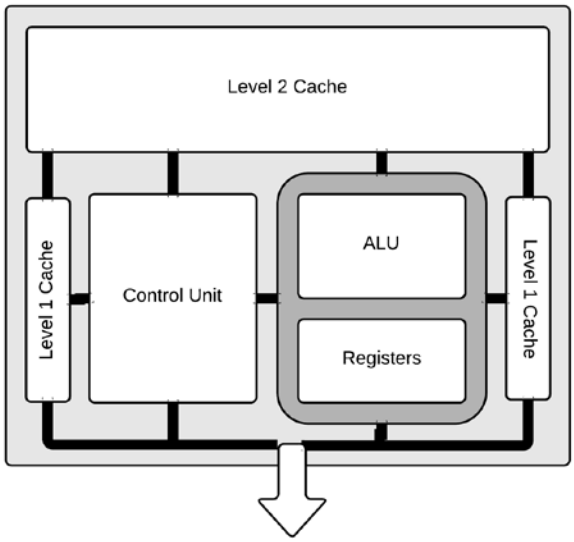
Crossword Solutions

The CPU - Reading

The **CPU** (**Central Processing Unit**) is responsible for the processing of data in the computer. Most computers today use a **Von Neumann architecture**.



The CPU **fetches the next instruction** to be processed from **memory** (RAM), **decodes the instruction** and then **executes** it. This is known as the **fetch-execute cycle**.

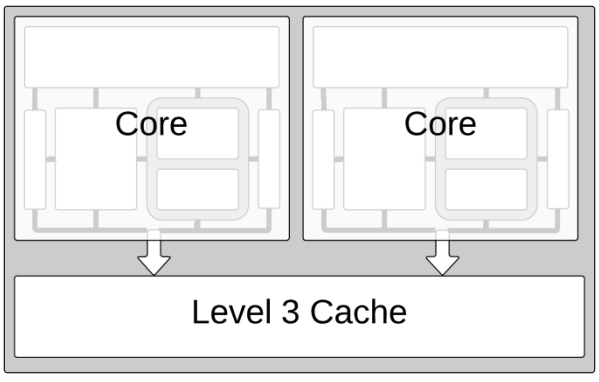


The CPU contains a **control unit** which coordinates the timing of the units and the flow of data in the CPU. It is responsible for fetching and decoding instructions and also managing their execution on the processor.

A CPU contains a very small amount of storage called **registers**. In a 64 bit processor, each register will store just 64 bits. **The Arithmetic Logic Unit** (**ALU**) is responsible for **arithmetic operations** like addition and subtraction. It is also responsible for **logical operations** such as the comparison of two numbers.

Cache is very similar to **RAM** (**Random Access Memory**). It is faster and more expensive to produce. A small amount of **level 1 cache** is placed next to the control unit for instructions and next to the ALU and registers for data. As the level 1 cache only stores a very small amount of data, if the CPU needs some data that isn't in level 1 cache then it will try the **level 2 cache**. This process continues through **level 3 cache** and finally to RAM. A computer may have 6 GB of RAM but only 6MB of level 3 cache.

A **dual core processor** has two **cores**. Each core can process data in **parallel** (at the same time). The cores normally have a shared area of **level 3 cache**. Processors can have four cores (**quad core** processors) or more. Processors that have more than one core are known as **multi-core** processors.



CPUs have a **clock speed**. This is the number of **fetch-execute cycles** that they can carry out per second. It is usually measured in **megahertz** (**MHz**) or **gigahertz** (**GHz**). A typical CPU today will have a speed of 4 GHz – 4 billion cycles per second.

Question: A quad core processor has a clock speed of 2.8 GHz. How many operations will it carry out per second?

Answer: 2.8 billion * 4 = **11.2 billion operations per second.**

Name: _____

The CPU - Questions

Q 3

1. What type of computer architecture do most computers use today?

_____ [1]

2. The main processing component in a computer is known as what?

_____ [1]

3. In the fetch-execute cycle, an instruction is fetched then executed. What happens between these two steps?

_____ [1]

4. Match the parts of a CPU on the left to what they do on the right.

ALU	Very small amounts of memory
Control Unit	Timing of the parts of the CPU
Registers	Arithmetic and logical operations

[3]

5. Match the units on the left to their meanings on the right

MHz	Thousand per second
kHz	Million per second
GHz	Billion per second

[3]

6. A processor states that it is dual core. How many cores does it have?

_____ cores [1]

___
10

7. For each description below, what part of the CPU do they describe?

Description	CPU part
A type of memory on the processor that stores only a few bytes of data for each one	
Responsible for arithmetic and logical operations	
Needed to coordinate timing and data flow in the processor	
An intermediate type of memory between registers and RAM	

[4]

8. A dual core processor has a clock speed of 1.7 GHz. How many operations will it carry out per second?

_____ operations per second [1]

9. Fill in the text below with the words beneath.

A CPU will make use of very small areas of memory called _____ which operate at the same speed as the processor. The CPU can also read from, and write to, RAM. This operates at a _____ speed. Processors can also contain _____. This operates at a speed that is faster than RAM. By increasing the amount of cache, a computer will work _____ as it will have to make fewer accesses to RAM. [4]

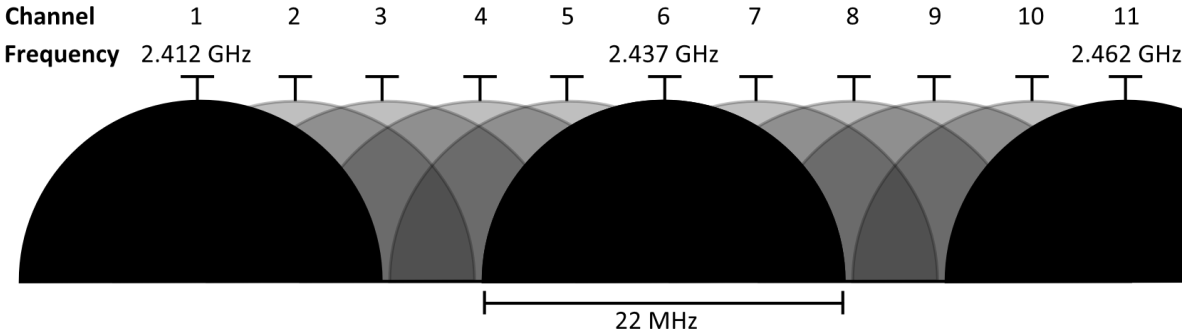
faster **cache** **slower** **registers**

10. A CPU that contains more than one core is known as what type of processor?

_____ processor [1]

___
10

Wi-Fi Channels and Frequency



Wi-Fi is a trademarked name for the IEEE 802.11 standard. Wi-Fi works at the microwave **frequencies** of 2.4 GHz and 5 GHz. The frequencies used for the 802.11g standard are shown above. Each Wi-Fi **Access Point** (**AP**) operates on a specific **channel** which uses 22 MHz of **bandwidth**. If your neighbour's access point uses the same channel then your network will slow down. Although the channels overlap, if you use channels far enough apart then they will not interfere – e.g. your neighbour uses channel 1 and you use channel 6. The newer 802.11ac standard uses the 5 GHz frequency. This is less crowded and therefore has less **interference**.

Wi-Fi Encryption

Encryption encodes communication so that only those who have the password to **decrypt** it can do so. As Wi-Fi communications go through the air, it is essential that they are **encrypted** so that other users cannot read them. Wi-Fi uses a number of methods to encrypt the data. **WEP** (**Wired Equivalent Privacy**) is an older standard of encryption which can be **cracked** in minutes. This has been replaced by **Wi-Fi Protected Access** (**WPA** and **WPA2**). WPA2 is the most secure of these. Home Wi-Fi uses a **Pre-Shared Key** (**PSK**) which users type into their device or computer. The device then uses this key to encrypt and decrypt information which it sends over Wi-Fi.

Network performance

The performance of a network is the service quality which the user experiences. There are a number of aspects which we measure the performance of:

- **Bandwidth** – the maximum rate of transfer of data
- **Throughput** – the actual rate of transfer of data through the network
- **Latency** – the delay taken from a packet being sent from the sender to being decoded by the receiver
- **Jitter** – the amount of change in the delay of packets
- **Packet loss** – the percentage of packets which are corrupted and don't correctly arrive with the receiver.

A number of factors can cause a network to underperform. Many users trying to use the same **switch** or **hub** at the same time will cause the network to slow down. This is called **network congestion**. A physical break in a major wire on the Internet will also slow down the network as this will cause congestion on the other routes. **Power failures**, switch or server failures and **viruses** or **malware attacks** can all affect network performance.

The performance of Wi-Fi networks is negatively affected by many factors. **Physical obstructions** such as walls, **interference** from other devices on the same frequency, the channel being shared by many other devices, the **signal strength** not being strong enough and the size of the **antenna** will all reduce the performance of a Wi-Fi network.

Name: _____

Wi-Fi & Network Performance - Questions

Q 18

1. Match the acronyms on the left to their meanings on the right.

AP	Pre-Shared Key
WEP	Access Point
WPA	Wireless Protected Access
PSK	Wired Equivalent Privacy

[4]

2. Wi-Fi operates on different channels. What is a channel? Fill in **one** circle.

- ❍ It is the encryption method used
- ❍ It is the frequency which the devices will communicate at
- ❍ It is the power signal used when transmitting
- ❍ It is another name for the device

[1]

3. Which of the following will reduce the performance of a Wi-Fi network? Tick **four** boxes.

❑ A concrete wall	❑ Size of antenna	❑ The size of the AP
❑ The processor speed	❑ Interference	❑ Signal strength

[4]

4. To prevent other users reading our Wi-Fi communications we encode them so each device can only read them with a password. What is this process called?

_____ [1]

___
10

5. Which IEEE standard deals with Wi-Fi? _____ [1]

6. Your neighbours use channels 1 and 11 on their wireless networks (802.11g). What channel would be best for you to use? _____ [1]

7. Your wireless network has a low throughput. You are currently using the older 802.11n standard. Which standard would improve your network performance? Fill in **one** circle.

- ❍ 802.11g
- ❍ 802.11ac

[1]

8. You upgrade your Wi-Fi Access Point to a faster standard but experience no difference in throughput. Which of the following reasons is most likely? Fill in **one** circle.

- ❍ The standards all have the same throughput
- ❍ You haven't changed the angle of the antenna
- ❍ You need to upgrade all devices which connect to the AP

[1]

9. Complete the text below using the words beneath.

Networks have a number of performance issues. If you are unable to watch video on the network this is due to there not being enough _____. Sometimes you can watch video, but there is a delay of several seconds before a simple web page is received. This is due to the _____ between your computer and the server. On a poor quality connection a high _____ will occur and packets will need to be resent. If packets are delayed by different amounts when they go through the network then there is a high _____ on the network. [4]

jitter **packet loss** **bandwidth** **latency**

10. A Wi-Fi connection uses 802.11g on channel 6. What is the minimum and maximum frequency which it will be using?

From _____ to _____ [2]

___
10

R 38 Assignment, Variables, Constants & Sequences - Reading

Computer programs are normally written in **high level languages** that are close to how humans think rather than computers.

In computer programs we often want to store **values**. For instance, we may want to store a player's name or score in a game. The values that we store might need to change in the program so we store them in **variables** (as the values can *vary*).

A variable is an identifier (name) that points to a memory location in RAM which stores a value that can change when the program is run.

The rules as to how we write computer code are known as **syntax**. Here we will use syntax that is not for a specific language but is easy to understand no matter what language you decide to actually program in.

Putting a value into a variable is known as **assignment**. If we do this when the variable is first set up, it is known as **initialisation**.

Syntax for assignment

```
variableName = value
```

Example of assignment

```
score = 17
```

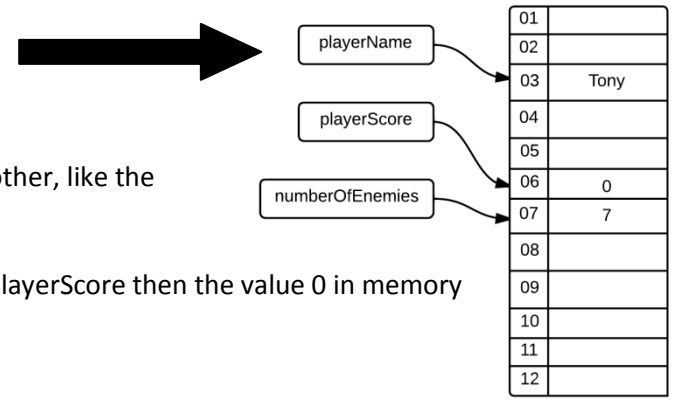
The **=** symbol is **NOT** an equals symbol. It is the **assignment operator** in this situation. For the above example we say that "the variable score is **assigned** the value 17".

In general, variables are written with no spaces and in lowercase. They can be written with an underscore separating words, which is known as **snake case**. Alternatively, words can be joined with each word starting with a capital letter, and this is known as **camel case**.

Example snake case variable names	Example camel case names
player_name	playerName
player_score	playerScore
number_of_enemies	numberOfEnemies

The following code will set up three variables. The variable names, pointers, memory locations and values in RAM are shown on the right as they would be at the end of the three lines of code running.

```
playerName = "Tony"
playerScore = 0
numberOfEnemies = 7
```



Lines of code which execute one after the other, like the above program, are known as a **sequence**.

If the following assignment were made to playerScore then the value 0 in memory would become replaced by 10.

```
playerScore = 10
```

If we want to store a value that doesn't change while the program is running then we store it in a **constant**. Constants are normally written with capital letters, e.g. MAX_NUMBER_OF_PLAYERS

```
const VAT_RATE = 20
```

Name: _____

Assignment, Variables, Constants & Sequences - Questions

Q 38

1. Match the words on the left to their meanings on the right.

variable	A number, string or character
value	An identifier that points to a value that doesn't change
constant	An identifier that points to a value that can change

[3]

2. For each of the following, tick whether they are likely to be a variable name, constant name or value. Tick **once** per row.

	Variable name	Constant name	Value
`playerName`			
`"smith"`			
`PI`			
`3.14`			

[4]

3. Variable names should be clear and indicate what they will be holding. Which of the following are the best choices for variable names? Tick **three** boxes.

❑ a	❑ p	❑ player	❑ playerName
❑ t	❑ time	❑ timeTaken	❑ tT
❑ s	❑ p_s	❑ playerScore	❑ player score

[3]

10

4. The rules of the language are known as what? Fill in **one** circle.

❍ Semantics ❍ Syntax
❍ Compilation ❍ Highlighting

[1]

5. Label each part of syntax in the line of code below.

```
playerScore = 10
```

_____ _____ _____

[3]

6. Look at the code on the right.

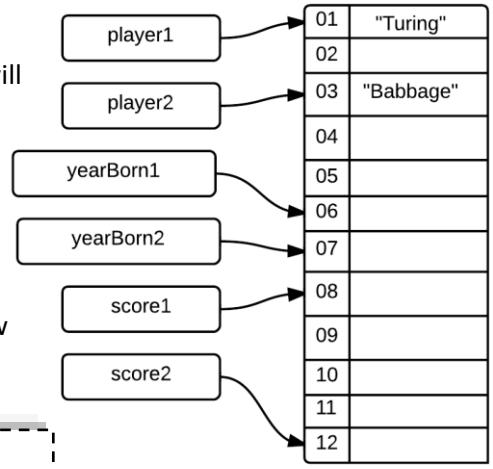
```
player1 = "Turing"
player2 = "Babbage"
yearBorn1 = 1912
yearBorn2 = 1791
score1 = 27
score2 = 31
score1 = score1 + 5
```

a) What type of programming structure is used? Fill in **one** circle.

❍ Constants ❍ Selection
❍ Sequence ❍ Equality

[1]

b) Complete the diagram on the right, showing the values that will be stored in memory when the program has finished running. The first two have already been completed.



[4]

c) Complete the line of code below so that score1 is increased by 1.

```
score1 = ________ + 1
```

[1]

10

Binary to Denary Conversions - Reading

In everyday Maths we use the denary system of counting which is also known as base 10. Look at how it works for the number 217:

100	10	1
2	1	7

The number 217 means:
2*100 +
1*10 +
7*1
217

Each column to the left has the value of 10 times the previous column.

Computers use binary which can contain only 0 or 1. This is also known as base 2. Each column to the left has 2 times the value of the previous column. To convert the number 11011001 from binary to denary do the following process:

1. Put the column titles in for each column:

128	64	32	16	8	4	2	1
1	1	0	1	1	0	0	1

2. Add each of the column titles with a 1 in it:

= 128 + 64 + 16 + 8 + 1 = 217

We can add a subscript to numbers to show which base we are using. We also put a space after every four digits of binary to make it easier to read. For example:

$217_{10} = 1101\ 1001_2$

This means 217 in base 10 equals 1101 1001 in base 2.

We can place as many leading zeros to a number as we like. So 0001 = 1. Because computers store numbers of a certain length, like 8 bits, we often use leading zeros. 32 stored as an 8 bit number would be:

128	64	32	16	8	4	2	1
0	0	1	0	0	0	0	0

32_{10} = 0010 0000 as an 8 bit number

Name: _____

Q 61

Binary to Denary Conversions - Questions

1. Match the binary numbers on the left to the denary numbers on the right.

10	3
0	1
11	0
1	2

[4]

2. Convert the following numbers from binary to denary.

a) 100 _____ [1]

b) 110 _____ [1]

c) 0000 0110 _____ [1]

d) 0001 0000 _____ [1]

e) 0010 0100 _____ [1]

f) 1111 1111 _____ [1]

___
10

3. What is the maximum number in denary that can be stored in a 4 bit number? _____ [1]

4. What is the maximum number in denary that can be stored in an 8 bit number? _____ [1]

5. What is the range of denary numbers that an 8 bit number can store?
_____ ~ _____ [1]

6. What does the 2 in the number $1011\ 0110_2$ mean? Fill in **one** circle

- ❍ It is in base 10
- ❍ It is in base 2
- ❍ It is a mistake
- ❍ Multiply the number by 2 [1]

7. Convert the following numbers from binary to denary.

a) 0101 0101 _____ [1]

b) 1010 1010 _____ [1]

c) 0000 1111 _____ [1]

d) 1111 0000 _____ [1]

e) 1101 0010 _____ [1]

f) 0010 1101 _____ [1]

___
10

Character Sets – ASCII - Reading

Computers only store 0s and 1s. Humans, though, want to read and write with letters of the alphabet. We therefore need a way of converting letters, known as **characters**, into binary.

To do this we use a **character set**. This is a set of characters along with the binary code that represents each one.

A common character set is **ASCII**, pronounced ASS-KEY. It stands for **American Standard Code for Information Interchange**. ASCII was developed in the late 1960s and so many of the characters are obsolete today. It uses 7 bits to encode up to 128 characters. **Extended ASCII uses 8 bits** (1 byte) to encode up to 256 characters (from 0~255).

The following table shows some of the ASCII and extended ASCII character set.

ASCII from 32~111

Binary	Char	Binary	Char	Binary	Char	Binary	Char	Binary	Char
0010 0000	Space	0011 0000	0	0100 0000	@	0101 0000	P	0110 0000	`
0010 0001	!	0011 0001	1	0100 0001	A	0101 0001	Q	0110 0001	a
0010 0010	"	0011 0010	2	0100 0010	B	0101 0010	R	0110 0010	b
0010 0011	#	0011 0011	3	0100 0011	C	0101 0011	S	0110 0011	c
0010 0100	$	0011 0100	4	0100 0100	D	0101 0100	T	0110 0100	d
0010 0101	%	0011 0101	5	0100 0101	E	0101 0101	U	0110 0101	e
0010 0110	&	0011 0110	6	0100 0110	F	0101 0110	V	0110 0110	f
0010 0111	'	0011 0111	7	0100 0111	G	0101 0111	W	0110 0111	g
0010 1000	(	0011 1000	8	0100 1000	H	0101 1000	X	0110 1000	h
0010 1001	)	0011 1001	9	0100 1001	I	0101 1001	Y	0110 1001	i
0010 1010	*	0011 1010	:	0100 1010	J	0101 1010	Z	0110 1010	j
0010 1011	+	0011 1011	;	0100 1011	K	0101 1011	[	0110 1011	k
0010 1100	,	0011 1100	<	0100 1100	L	0101 1100	\	0110 1100	l
0010 1101	-	0011 1101	=	0100 1101	M	0101 1101	]	0110 1101	m
0010 1110	.	0011 1110	>	0100 1110	N	0101 1110	^	0110 1110	n
0010 1111	/	0011 1111	?	0100 1111	O	0101 1111		0110 1111	o

ASCII from 112~127

Binary	Char
0111 0000	p
0111 0001	q
0111 0010	r
0111 0011	s
0111 0100	t
0111 0101	u
0111 0110	v
0111 0111	w
0111 1000	x
0111 1001	y
0111 1010	z
0111 1011	{
0111 1100	|
0111 1101	}
0111 1110	~
0111 1111	DEL

Extended ASCII from 232~247

Binary	Char
1110 1000	è
1110 1001	é
1110 1010	ê
1110 1011	ë
1110 1100	ì
1110 1101	í
1110 1110	î
1110 1111	ï
1111 0000	ð
1111 0001	ñ
1111 0010	ò
1111 0011	ó
1111 0100	ô
1111 0101	õ
1111 0110	ö
1111 0111	÷

Notice that uppercase letters have a lower binary number than lowercase letters. This means that in programming it is often true to say that A < a or c < d.

Question: What is the binary value of "K" in ASCII? Answer: **0100 1011**

Question: Convert "Happy Birthday!" into binary using ASCII.

Answer: **01001000 01100001 01110000 01110000 01111001 00100000 01000010 01101001 01110010 01110100 01101000 01100100 01100001 01111001 00100001**

(The spaces here would not be stored by the computer, it would just be one long sequence of 0s and 1s)

Name: _____

Character Sets – ASCII - Questions

Q 69

1. What does ASCII stand for?

_____ [1]

2. A letter, number or punctuation on a computer when used as text is called what? Fill in **one** circle.

❍ A symbol ❍ A character
❍ A text item ❍ An ASCII [1]

3. Computers store and use 1s and 0s in storage devices and RAM. They need to have a way of mapping a character to a binary number that represents it. What do they use? Fill in **one** circle.

❍ A text translator ❍ A character table
❍ A text set ❍ A character set [1]

4. Convert the following ASCII characters to the binary code that represents them:

a) A _____
b) d _____
c) < _____
d) Space _____ [4]

5. Convert the following binary into the ASCII characters which it represents:

a) 0101 0010 _____
b) 0111 0100 _____
c) 0011 1001 _____ [3]

___
10

6. How many bits does Extended ASCII use? _____ bits [1]

7. How many characters can Extended ASCII contain? _____ chars [1]

8. Convert the following ASCII characters to binary:

a) At _____
b) The _____
c) Cat _____
d) 5*1= _____
e) 2b|! _____ [5]

9. Convert the following binary in 8 bit ASCII to the characters that it represents:

01001001 01110100 01100000 01110011 00100000 01110011
01100101 01100011 01110010 01100101 01110100 00101110

_____ [1]

10. Which of the following will be false? Fill in **one** circle.

❍ A > a ❍ g < h
❍ F < f ❍ t > H [1]

11. You need to design a character set that includes all uppercase letters, all lowercase letters, numbers and the space character. What is the minimum number of bits that you could use for the character set?

_____ bits [1]

___
10

Character Sets – Unicode - Reading

The older character sets of ASCII and extended ASCII use 8 bits. **Unicode** is another character set that maps binary combinations to characters.

The problem with ASCII is that it has a maximum of 256 characters that it can store. Japanese people need to know over 2000 characters and the Chinese alphabet contains around 50 000 characters. Therefore the character sets need to have more bits to store them. Unicode is an international system of storing these characters.

Unicode currently stores over 100 000 characters. There is a **16 bit (2 byte) version** of Unicode which contains 65536 (2^{16}) characters. A **32 bit (4 byte) version** can store over 4 billion (2^{32}) characters, far more than required for every language in the world.

The following table shows a sample of characters available in Unicode. The black lines in the table show sections of the character set which have been left out.

Binary	Hex	Denary	Char
Basic Latin			
0000 0000 0010 0000	0020	32	SPACE
0000 0000 0010 0001	0021	33	!
0000 0000 0010 0010	0022	34	"
Basic Latin			
0000 0000 0010 1100	002C	44	,
0000 0000 0010 1101	002D	45	-
0000 0000 0010 1110	002E	46	.
Basic Latin - Numeric			
0000 0000 0011 0000	0030	48	0
0000 0000 0011 0001	0031	49	1
0000 0000 0011 0010	0032	50	2
0000 0000 0011 0011	0033	51	3
0000 0000 0011 0100	0034	52	4
0000 0000 0011 0101	0035	53	5
0000 0000 0011 0110	0036	54	6
0000 0000 0011 0111	0037	55	7
0000 0000 0011 1000	0038	56	8
0000 0000 0011 1001	0039	57	9
Basic Latin - Uppercase			
0000 0000 0100 0001	0041	65	A
0000 0000 0100 0010	0042	66	B
0000 0000 0100 0011	0043	67	C
0000 0000 0100 0100	0044	68	D
0000 0000 0100 0101	0045	69	E
0000 0000 0100 0110	0046	70	F
0000 0000 0100 0111	0047	71	G
0000 0000 0100 1000	0048	72	H
Basic Latin - Lowercase			
0000 0000 0110 0001	0061	97	a
0000 0000 0110 0010	0062	98	b
0000 0000 0110 0011	0063	99	c
0000 0000 0110 0100	0064	100	d
Greek - Lowercase			
0000 0011 1011 0001	03B1	945	α
0000 0011 1011 0010	03B2	946	β
0000 0011 1011 0011	03B3	947	γ
Japanese – Hiragana			
0011 0000 0110 1001	3069	12393	ど
0011 0000 0110 1010	306A	12394	な
0011 0000 0110 1011	306B	12395	に
Arabic			
1111 1100 0010 1000	FC28	64552	ﰨ
1111 1100 0010 1001	FC29	64553	ﰩ
1111 1100 0010 1010	FC2A	64554	ﰪ

Question: What is the binary in Unicode that represents the letter D?
Answer: **0000 0000 0100 0100**

Question: What letter does the hexadecimal 3069 represent in Unicode?
Answer: ど

Name: _____

Character Sets – Unicode - Questions

Q 70

1. What is the benefit of using the Unicode character set over ASCII? Fill in **one** circle.

❍ It takes up less storage space ❍ It stores more characters
❍ There is no advantage ❍ It is a common character set

[1]

2. How many characters can be stored in 16 bit Unicode?

_____ characters [1]

3. 32 bit Unicode can store how many characters? Fill in **one** circle.

❍ Approximately 3 billion ❍ 2^{24}
❍ 1 677 7216 ❍ 2^{32}

[1]

4. Convert the following characters to the denary number in Unicode:

a) E _____
b) C _____
c) 3 _____
d) d _____

[4]

5. What characters are represented by the following binary in the Unicode character set?

a) 0000 0000 0011 0100 _____
b) 0000 0011 1011 0010 _____
c) 0000 0000 0010 0010 _____

[3]

___
10

6. What is the binary used in Unicode to represent the following characters?

a) な _____
b) ع _____
c) γ _____

[3]

7. What is the hexadecimal used in Unicode to represent the following characters?

a) G _____
b) ظ _____

[2]

8. What is the hexadecimal used in Unicode to represent the following sequences of characters?

a) AH _____
b) 67 _____
c) cab _____

[3]

9. What is the binary code used to represent the following characters?

a) e _____
b) M _____

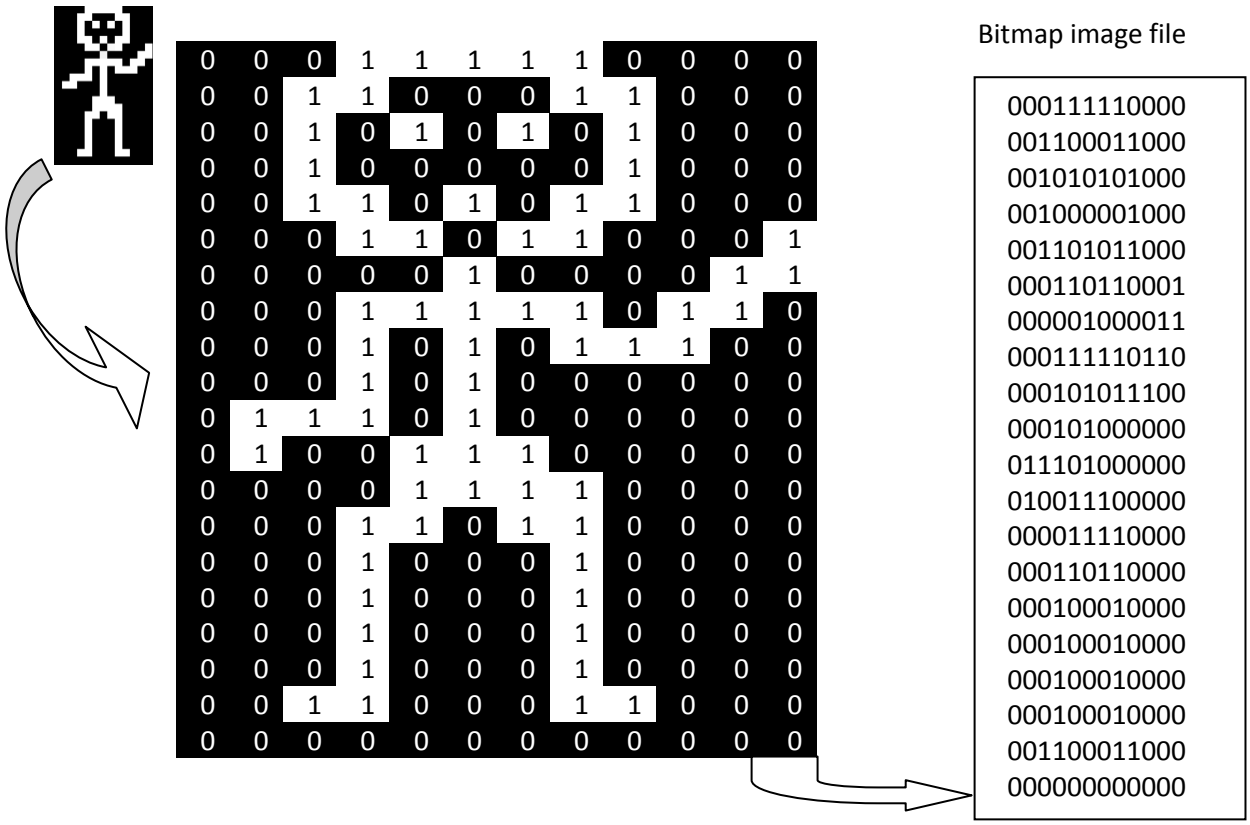
[2]

___
10

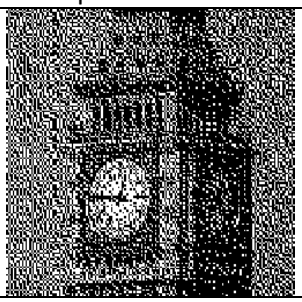
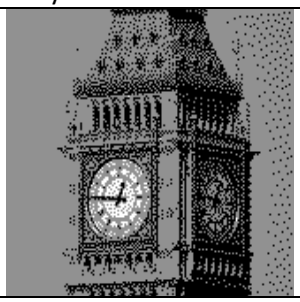
Images & Pixels - Reading

Images need to be stored and processed using binary. The simplest image format is for an image to be stored as a **bitmap image**. Bitmap images are made up of **picture elements** called **pixels**. These contain a mapping of the colour of each pixel to bits.

Black and white images have two colours (black and white) which can be stored with 1 bit per pixel.



Images that have different shades of gray are called **grayscale images**. We can use more bits to store the level of gray each pixel will have. The number of bits used for each pixel is called the **colour depth**.

Type of image	Bitmap	Grayscale	Grayscale
Example			
Colour depth	1 bit/pixel	2 bits/pixel	8 bits/pixel
Total number of colours	2	4	256

Full colour images store 8 bits for each of red, green and blue colours (**RGB**). These correspond to the sub-pixels on a computer display. This allows for 2^{24} (about 16.8 million) different colours. These can be written as 6 digits of hexadecimal. For example, FFFFFF is white and FF0000 is red.

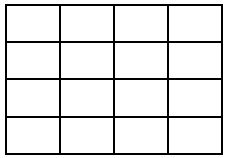
Name: _____

Images & Pixels - Questions

Q 71

1. A bitmap file contains the binary on the left below. 1 is white and 0 is black. Colour in each of the squares. What is the letter that is revealed?

0000
0111
0111
0000



Letter revealed: _____ [1]

2. Pixels are named after what? Fill in **one** circle.

❍ Picture Elements ❍ Part Elements
❍ Picture Cells ❍ Picture Hex Elements [1]

3. A black and white image will require how many bits per pixel?

Number of bits: _____ [1]

4. The number of bits per pixel is called what?

_____ [1]

5. A grayscale image is stored using the following colour depth. For each, state how many colours (shades of gray) will be available.

a) 1 bit _____
b) 2 bits _____
c) 4 bits _____
d) 8 bits _____
e) 16 bits _____ [5]

6. A grayscale image contains 1024 pixels. 4 colours (shades of gray) have been used. How much storage space will the data for this image require?

Space required: _____ bytes [1]

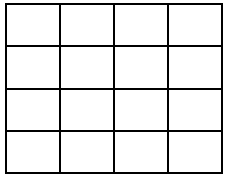
___
10

7. As you increase the colour depth what happens to the image quality? Fill in **one** circle.

❍ It makes no difference ❍ It improves
❍ It gets worse ❍ You cannot change it [1]

8. A bitmap file contains the binary on the left below. 11 is white, 10 is gray, 01 is light gray and 00 is black. Colour in each of the squares. What is the letter that is revealed?

11 11 11 11
11 10 10 11
11 11 11 11
11 00 00 00



Letter revealed: _____ [1]

9. An colour image has a 24 bit colour depth. Its dimensions are 1024x768. How much storage space will be taken up with the data for the image?

Space required: _____ megabytes [1]

10. A school logo requires 5 different colours. How many bits will be required for each pixel? Bits required: _____ [1]

11. Computer displays use 3 colours for each pixel. What are they?

Colour 1: _____ Colour 2: _____ Colour 3: _____ [1]

12. A web designer wishes to use 24 bit colour for their images. How many colours will be available for them to use?

_____ colours [1]

13. What do each of the following colours represent in hexadecimal?

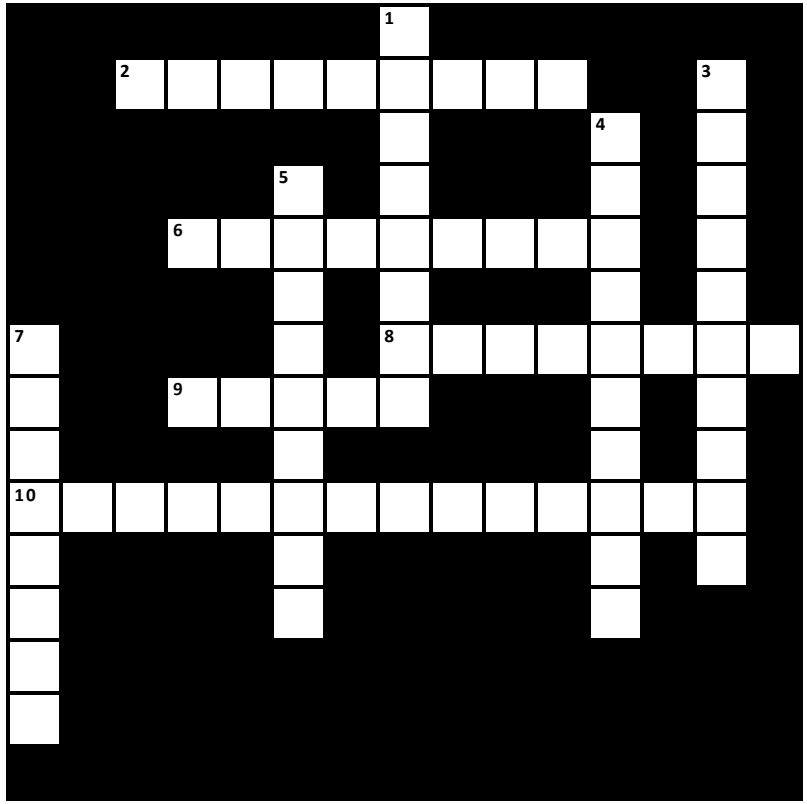
a) FFFFFF _____
b) 0000FF _____
c) 00FF00 _____
d) 555555 _____ [4]

___
10

Name: _____

Assignment, Variables, Constants & Sequences - Crossword

C 1



Across

2 Languages such as C, Java, Python; closer to how humans think (4,5)

6 A method of having each word in a variable name separated by an underscore. E.g. player_name (5,4)

8 A value that doesn't change when the program is run (8)

9 The actual data which is stored in a variable. E.g. 9 or 'g' (5)

10 What happens when you first put a value into a variable (14)

Down

1 Instructions executed one after the other (8)

3 The process where a value is placed into a variable. E.g. score = 7 (10)

4 A variable name or constant name is also known as this (10)

5 A way of writing variable names where each word starts with a capital. E.g. PlayerName (5,4)

7 An identifier which points to a location in memory which stores a value which can be changed when the program is run (8)

Covers keywords from reading 38 (R38)

___
10

The CPU - Answers

1. What type of computer architecture do most computers use today?

Von Neumann architecture [1]

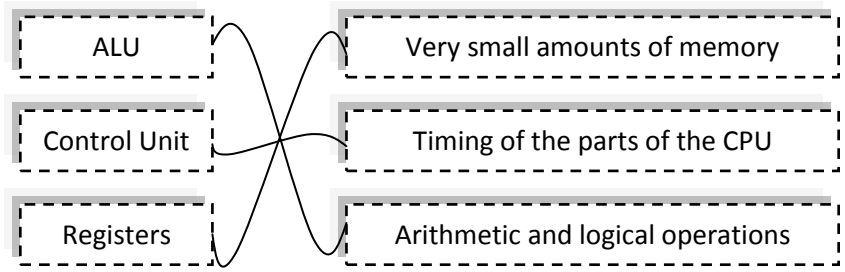
2. The main processing component in a computer is known as what?

CPU / Central Processing Unit [1]

3. In the fetch-execute cycle, an instruction is fetched then executed. What happens between these two steps?

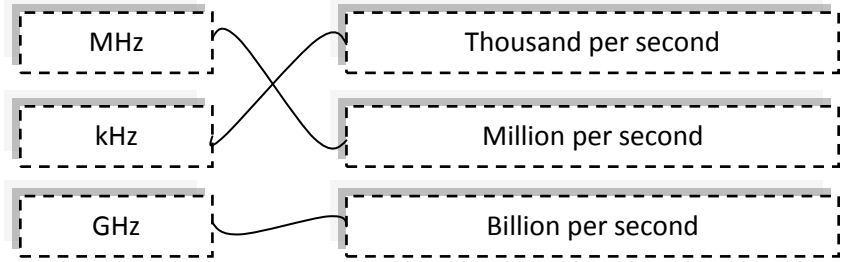
Decode [1]

4. Match the parts of a CPU on the left to what they do on the right.



[3]

5. Match the units on the left to their meanings on the right



[3]

6. A processor states that it is dual core. How many cores does it have?

2 cores [1]

10

7. For each description below, what part of the CPU do they describe?

Description	CPU part
A type of memory on the processor that stores only a few bytes of data for each one	**Registers**
Responsible for arithmetic and logical operations	**ALU**
Needed to coordinate timing and data flow in the processor	**Control unit**
An intermediate type of memory between registers and RAM	**Cache**

[4]

8. A dual core processor has a clock speed of 1.7 GHz. How many operations will it carry out per second?

1.7 * 2 = **3.4** operations per second [1]

9. Fill in the text below with the words beneath.

A CPU will make use of very small areas of memory called **registers** which operate at the same speed as the processor. The CPU can also read from, and write to, RAM. This operates at a **slower** speed. Processors can also contain **cache**. This operates at a speed that is faster than RAM. By increasing the amount of cache, a computer will work **faster** as it will have to make fewer accesses to RAM. [4]

faster **cache** **slower** **registers**

10. A CPU that contains more than one core is known as what type of processor?

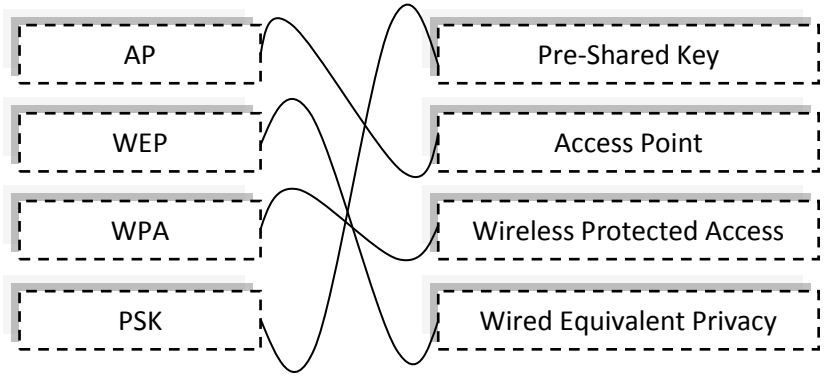
multi-core processor [1]

10

A 18

Wi-Fi & Network Performance - Answers

1. Match the acronyms on the left to their meanings on the right.



[4]

2. Wi-Fi operates on different channels. What is a channel? Fill in **one** circle.

- ❍ It is the encryption method used
- ◉ It is the frequency which the devices will communicate at
- ❍ It is the power signal used when transmitting
- ❍ It is another name for the device

[1]

3. Which of the following will reduce the performance of a Wi-Fi network? Tick **four** boxes.

☑ A concrete wall	☑ Size of antenna	❑ The size of the AP
❑ The processor speed	☑ Interference	☑ Signal strength

[4]

4. To prevent other users reading our Wi-Fi communications we encode them so each device can only read them with a password. What is this process called?

Encryption [1]

___
10

5. Which IEEE standard deals with Wi-Fi? **802.11** [1]

6. Your neighbours use channels 1 and 11 on their wireless networks (802.11g). What would channel would be best for you to use? **6** [1]

7. Your wireless network has a low throughput. You are currently using the older 802.11n standard. Which standard would improve your network performance? Fill in **one** circle.

- ❍ 802.11g
- ◉ 802.11ac

[1]

8. You upgrade your Wi-Fi Access Point to a faster standard but experience no difference in throughput. Which of the following reasons is most likely? Fill in **one** circle.

- ❍ The standards all have the same throughput
- ❍ You haven't changed the angle of the antenna
- ◉ You need to upgrade all devices which connect to the AP

[1]

9. Complete the text below using the words beneath.

Networks have a number of performance issues. If you are unable to watch video on the network this is due to there not being enough **bandwidth**. Sometimes you can watch video, but there is a delay of several seconds before a simple web page is received. This is due to the **latency** between your computer and the server. On a poor quality connection a high **packet loss** will occur and packets will need to be resent. If packets are delayed by different amounts when they go through the network then there is a high **jitter** on the network. [4]

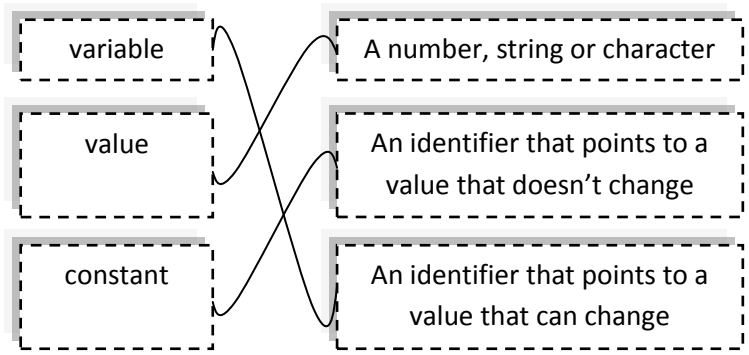
jitter **packet loss** **bandwidth** **latency**

10. A Wi-Fi connection uses 802.11g on channel 6. What is the minimum and maximum frequency which it will be using?

From **2.426 GHz** to **2.448 GHz** [2]

___
10

1. Match the words on the left to their meanings on the right.



[3]

2. For each of the following, tick whether they are likely to be a variable name, constant name or value. Tick **once** per row.

	Variable name	Constant name	Value
`playerName`	✓		
`"smith"`			✓
`PI`		✓	
`3.14`			✓

[4]

3. Variable names should be clear and indicate what they will be holding. Which of the following are the best choices for variable names? Tick **three** boxes.

❑ a	❑ p	❑ player	☑ playerName
❑ t	❑ time	☑ timeTaken	❑ tT
❑ s	❑ p_s	☑ playerScore	❑ player score

[3]

10

4. The rules of the language are known as what? Fill in **one** circle.

❍ Semantics	● Syntax
❍ Compilation	❍ Highlighting

[1]

5. Label each part of syntax in the line of code below.

```
playerScore = 10
```

Variable name / identifier — **Assignment (operator)** — **Value**

[3]

6. Look at the code on the right.

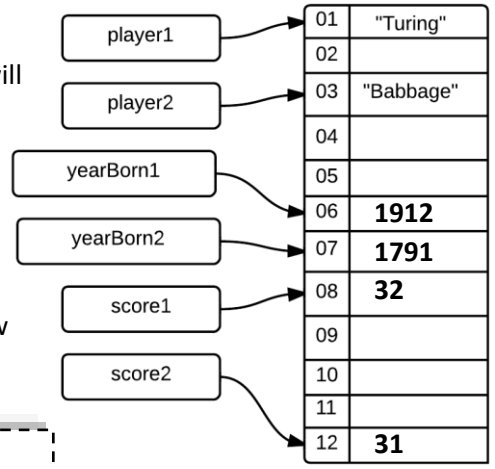
```
player1 = "Turing"
player2 = "Babbage"
yearBorn1 = 1912
yearBorn2 = 1791
score1 = 27
score2 = 31
score1 = score1 + 5
```

a) What type of programming structure is used? Fill in **one** circle.

❍ Constants	❍ Selection
● Sequence	❍ Equality

[1]

b) Complete the diagram on the right, showing the values that will be stored in memory when the program has finished running. The first two have already been completed.



[4]

c) Complete the line of code below so that score1 is increased by 1.

```
score1 = score1 + 1
```

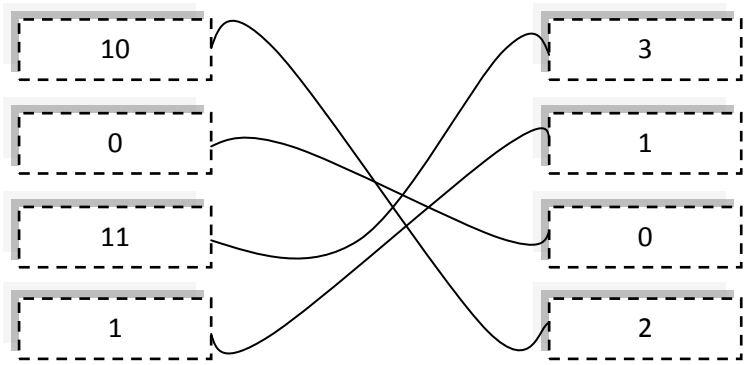
[1]

10

A 61

Binary to Denary Conversions - Answers

1. Match the binary numbers on the left to the denary numbers on the right.



[4]

2. Convert the following numbers from binary to denary.

a) 100 **4** [1]

b) 110 **6** [1]

c) 0000 0110 **6** [1]

d) 0001 0000 **16** [1]

e) 0010 0100 **36** [1]

f) 1111 1111 **255** [1]

___
10

3. What is the maximum number in denary that can be stored in a 4 bit number? **15** [1]

4. What is the maximum number in denary that can be stored in an 8 bit number? **255** [1]

5. What is the range of denary numbers that an 8 bit number can store?
0 ~ **255** [1]

6. What does the 2 in the number $1011\ 0110_2$ mean? Fill in **one** circle.

- ❍ It is in base 10
- ◉ It is in base 2
- ❍ It is a mistake
- ❍ Multiply the number by 2 [1]

7. Convert the following numbers from binary to denary.

a) 0101 0101 **85** [1]

b) 1010 1010 **170** [1]

c) 0000 1111 **15** [1]

d) 1111 0000 **240** [1]

e) 1101 0010 **210** [1]

f) 0010 1101 **45** [1]

___
10

A 69

Character Sets – ASCII - Answers

1. What does ASCII stand for?

American Standard Code for Information Interchange [1]

2. A letter, number or punctuation on a computer when used as text is called what? Fill in **one** circle.

❍ A symbol ● A character
❍ A text item ❍ An ASCII [1]

3. Computers store and use 1s and 0s in storage devices and RAM. They need to have a way of mapping a character to a binary number that represents it. What do they use? Fill in **one** circle.

❍ A text translator ❍ A character table
❍ A text set ● A character set [1]

4. Convert the following ASCII characters to the binary code that represents them:

a) A **0100 0001**
b) d **0110 0100**
c) < **0011 1100**
d) Space **0010 0000** [4]

5. Convert the following binary into the ASCII characters which it represents:

a) 0101 0010 **R**
b) 0111 0100 **t**
c) 0011 1001 **9** [3]

10

6. How many bits does Extended ASCII use? **8** bits [1]

7. How many characters can Extended ASCII contain? **256** chars [1]
(from 0 to 255 allows for 256 chars)

8. Convert the following ASCII characters to binary:

a) At **01000001 01110100**
b) The **01010100 01101000 01100101**
c) Cat **01000011 01100001 01110100**
d) 5*1= **00110101 00101010 00110001 00111101**
e) 2b|! **00110010 01100010 01111100 00100001** [5]

9. Convert the following binary in 8 bit ASCII to the characters that it represents:

01001001 01110100 01100000 01110011 00100000 01110011
01100101 01100011 01110010 01100101 01110100 00101110

It's secret [1]

10. Which of the following will be false? Fill in **one** circle.

● A > a ❍ g < h
❍ F < f ❍ t > H [1]

11. You need to design a character set that includes all uppercase letters, all lowercase letters, numbers and the space character. What is the minimum number of bits that you could use for the character set?

6 bits [1]
(26 lowercase+
26 uppercase+
10 digits+
1 space+
=63 characters
6 bits will allow from 0~63
i.e. 64 characters – one more than we need)

10

A 70

Character Sets – Unicode - Answers

1. What is the benefit of using the Unicode character set over ASCII? Fill in **one** circle.

❍ It takes up less storage space ● It stores more characters
❍ There is no advantage ❍ It is a common character set

[1]

2. How many characters can be stored in 16 bit Unicode?

65 536 characters [1]

3. 32 bit Unicode can store how many characters? Fill in **one** circle.

❍ Approximately 3 billion ❍ 2^{24}
❍ 1 677 7216 ● 2^{32} [1]

4. Convert the following characters to the denary number in Unicode:

a) E **69**
b) C **67**
c) 3 **51**
d) d **100** [4]

5. What characters are represented by the following binary in the Unicode character set?

a) 0000 0000 0011 0100 **4**
b) 0000 0011 1011 0010 **β**
c) 0000 0000 0010 0010 **“** [3]

___
10

6. What is the binary used in Unicode to represent the following characters?

a) ﻍ **0011 0000 0110 1010**
b) ﻉ **1111 1100 0010 1001**
c) γ **0000 0011 1011 0011** [3]

7. What is the hexadecimal used in Unicode to represent the following characters?

a) G **0047**
b) ﻅ **FC28** [2]

8. What is the hexadecimal used in Unicode to represent the following sequences of characters?

a) AH **0041 0048**
b) 67 **0036 0037**
c) cab **0063 0061 0062** [3]

9. What is the binary code used to represent the following characters?

a) e **0000 0000 0110 0101** **(next in sequence after ‘d’)**
b) M **0000 0000 0100 1101** **(5 after ‘H’)** [2]

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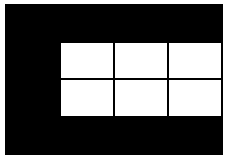
A 71

Images & Pixels - Answers

1. A bitmap file contains the binary on the left below. 1 is white and 0 is black. Colour in each of the squares. What is the letter that is revealed?

0000
0111
0111
0000



Letter revealed: **C** [1]

2. Pixels are named after what? Fill in **one** circle.

- ● Picture Elements
- ❍ Part Elements
- ❍ Picture Cells
- ❍ Picture Hex Elements

[1]

3. A black and white image will require how many bits per pixel?

Number of bits: **1** [1]

4. The number of bits per pixel is called what?

Colour depth [1]

5. A grayscale image is stored using the following colour depth. For each, state how many colours (shades of gray) will be available.

a) 1 bit **2**
b) 2 bits **4**
c) 4 bits **16**
d) 8 bits **256**
e) 16 bits **65 536** [5]

6. A grayscale image contains 1024 pixels. 4 colours (shades of gray) have been used. How much storage space will the data for this image require?

2 bits * 1024 pixels = 2048 bits / 8

Space required: = **256** bytes [1]

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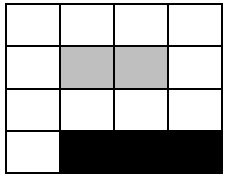
7. As you increase the colour depth what happens to the image quality? Fill in **one** circle.

- ❍ It makes no difference
- ● It improves
- ❍ It gets worse
- ❍ You cannot change it

[1]

8. A bitmap file contains the binary on the left below. 11 is white, 10 is gray, 01 is light gray and 00 is black. Colour in each of the squares. What is the letter that is revealed?

11 11 11 11
11 10 10 11
11 11 11 11
11 00 00 00



Letter revealed: **P** [1]

9. An colour image has a 24 bit colour depth. Its dimensions are 1024x768. How much storage space will be taken up with the data for the image?

Space required: **2.25** megabytes
1024*768*24/8 = 2359296 bytes/(1024*1024) = 2.25MB [1]

10. A school logo requires 5 different colours. How many bits will be required for each pixel? Bits required: **3**
(This allows for 8 colours) [1]

11. Computer displays use 3 colours for each pixel. What are they?

Colour 1: **Red** Colour 2: **Green** Colour 3: **Blue** [1]

12. A web designer wishes to use 24 bit colour for their images. How many colours will be available for them to use?

16 777 216 colours [1]

13. What do each of the following colours represent in hexadecimal?

a) FFFFFF **White**
b) 0000FF **Blue**
c) 00FF00 **Green**
d) 555555 **Gray / Dark gray**

[4]

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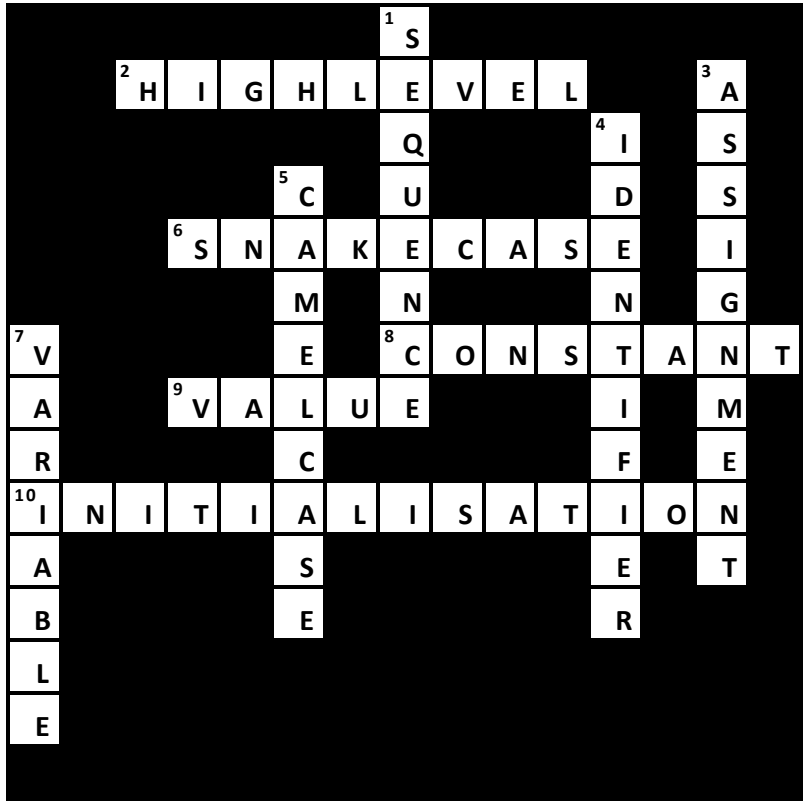
Assignment, Variables, Constants & Sequences - Solution



Across: 2 High Level, **6** Snake Case, **8** Constant, **9** Value, **10** Initialisation.

Down: 1 Sequence, **3** Assignment, **4** Identifier, **5** Camel Case, **7** Variable.

Covers keywords from reading 38 (R38)

Across

2 Languages such as C, Java, Python; closer to how humans think (4,5)

6 A method of having each word in a variable name separated by an underscore. E.g. player_name (5,4)

8 A value that doesn't change when the program is run (8)

9 The actual data which is stored in a variable. E.g. 9 or 'g' (5)

10 What happens when you first put a value into a variable (14)

Down

1 Instructions executed one after the other (8)

3 The process where a value is placed into a variable. E.g. score = 7 (10)

4 A variable name or constant name is also known as this (10)

5 A way of making variable names where each word starts with a capital. E.g. PlayerName (5,4)

7 An identifier which points to a location in memory which stores a value which can be changed when the program is run (8)

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