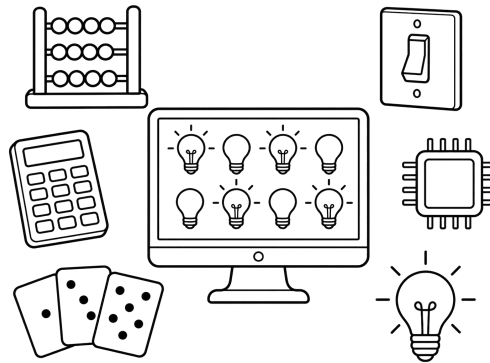


ICT

INFORMATION AND COMMUNICATION TECHNOLOGY

GRADE 8



UNIT 1

Number Systems

Student Workbook



"The King of ICT"

CHAMEEN RATHNASENA

Senior Lecturer in IT

Motivational Speaker

BSc (Sp) Computer Science - University of Peradeniya

PGDE - Open University of Sri Lanka

MIT (Reading) - University of Sabaragamuwa

STUDENT DETAILS

Name:

School:

Institution:

Contact:

BEFORE WE START

What This Unit Is About

Read this page with your teacher

i AT THE END OF THIS UNIT YOU WILL BE ABLE TO

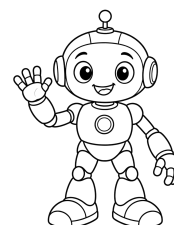
- ☐ Say why a computer needs numbers to understand data.
- ☐ Name four number systems and write their symbols and bases.
- ☐ Show the base of a number as a subscript, like 101_2 and 47_{10} .
- ☐ Explain the place values of decimal numbers and binary numbers.
- ☐ Convert a decimal number to a binary number by dividing by 2.
- ☐ Convert a binary number to a decimal number using place values.
- ☐ Explain how a computer uses ON (1) and OFF (0) for text, images and sound.

! THREE RULES FOR THE COMPUTER ROOM

- **Always** ask your teacher before you open a program.
- **Never** open, change or delete another student's file.
- **Never** eat or drink near the computer.

i HOW TO USE THIS BOOK

Each chapter has three parts. First you **read** the chapter with your teacher. Then you **do** the activity with cards, beads or a computer. Last you **write** the exercises.
Colour the small pictures when you finish your work early.



Colour me!

THE WORDS YOU WILL LEARN

Number system	Symbol	Base	Subscript
Binary	Octal	Decimal	Hexadecimal
Place value	Expanded form	Counting frame	Bit
Binary digit	Power of 2	Convert	Quotient
Remainder	Bit pattern	ON / OFF	Input
Processing	Output	Main memory	Microprocessor

"Two little symbols, 0 and 1, run every computer in the world. Let us learn their language."

- THE KING OF ICT



CHAPTER 1

Number Systems and Their Bases

? TWO FRIENDS, ONE QUESTION

"I typed **Hello** and the computer showed it. So it can read English!" says Amali.

"No," says Kasun. "My brother says a computer only understands numbers."

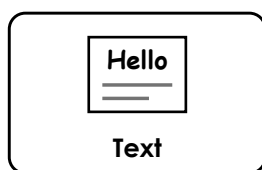
Who is right? **Let us find out.**



1.1 Use of number systems

Computers make our everyday work **easier**, **more accurate** and **efficient**. But a computer **cannot understand** data and instructions in human languages.

The computer understands **text**, **numbers**, **images** and **sound** as **numbers**. In the computer memory they are all kept as 0s and 1s.



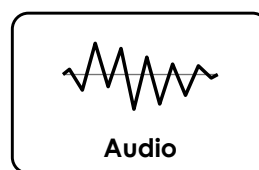
Text

↓ 1011...01010



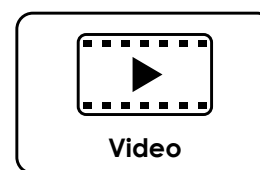
Image

↓ 1111...00101



Audio

↓ 0110...10101



Video

↓ 0110...01011

COMPUTER MEMORY

10010100...1010010 101010...01011010 10010011...010010
1010101...1010001 0110101...000101 11110101...000101

1.2 Types of number systems

? WHAT IS A NUMBER SYSTEM?

A **number system** is a method that can be used to **represent numbers**. There are several different number systems. Each number system has a **fixed number of different symbols**.

We will learn about **four** number systems. The number of different symbols in a number system is called its **base**.

Number system	Symbols	Base
Binary	0, 1	2
Octal	0, 1, 2, 3, 4, 5, 6, 7	8
Decimal	0, 1, 2, 3, 4, 5, 6, 7, 8, 9	10
Hexadecimal (Hex)	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F	16



NOTE: Only the **binary** and **decimal** number systems are studied in Grade 8.

1.3 The base of a number system

The **base** shows to which number system a number belongs. It is written at the **right end** of the number as a small **subscript**.

the number
1011₂ ← the base
(a subscript)

Number system	Examples
Binary	101 ₂ , 111011 ₂
Octal	101 ₈ , 573 ₈
Decimal	101 ₁₀ , 47 ₁₀
Hexadecimal	101 ₁₆ , 7B ₁₆

101₂, 101₈, 101₁₀ and 101₁₆ look alike. The bases show that they belong to **four different** number systems.

> DO IT - PRACTICAL 1 (WORKBOOK ACTIVITY 1.1)

Use the Calculator. **Ask your teacher first.**

1	Click Start , type Calculator and open it.
2	Click the menu (three lines). Choose Programmer .
3	Find HEX , DEC , OCT and BIN . Click DEC .
4	Which keys can you click? Write them below.
5	Click BIN . Now only 0 and 1 work!
6	Click OCT , then HEX . Which keys work now?
7	Count the keys that work. That is the base .

Click	Number system	Keys I can click	Base
HEX	Hexadecimal		
DEC	Decimal		
OCT	Octal		
BIN	Binary		

≡ Programmer

0

HEX
DEC
OCT

BIN

A	B	C
D	E	F
7	8	9
4	5	6
1	2	3
	0	

BIN: only 0 and 1 work

A Check the symbols

6 marks

Can each number be right? Look at its symbols and base. Write YES or NO.

1 1101 ₂	2 1201 ₂	3 75 ₈	4 78 ₈	5 9A ₁₀	6 9A ₁₆
-------------------------------	-------------------------------	-----------------------------	-----------------------------	------------------------------	------------------------------



B Fill in the blanks

6 marks

Use the words in the box.

WORD BANK

languages numbers method symbols base subscript

1. A computer cannot understand data and instructions in human
2. A computer understands text, images and sound as
3. A number system is a that can be used to represent numbers.
4. Each number system has a fixed number of different
5. The number of different symbols in a number system is its
6. The base is written at the right end of a number as a

C Complete the table

8 marks

Write the missing names, symbols and bases.

Number system	Symbols	Base
Binary		
	0, 1, 2, 3, 4, 5, 6, 7	
Decimal		
Hexadecimal	0 to 9 and	

D Which number system?

8 marks

Look at the base. Tick the number system.

The number	Binary	Octal	Decimal	Hexadecimal
1011 ₂	☐	☐	☐	☐
365 ₁₀	☐	☐	☐	☐
9C ₁₆	☐	☐	☐	☐
640 ₈	☐	☐	☐	☐
100 ₁₀	☐	☐	☐	☐
A5 ₁₆	☐	☐	☐	☐
17 ₈	☐	☐	☐	☐
100 ₂	☐	☐	☐	☐



E True or false

6 marks

Write T or F in the box.

1. ☐ A computer can understand data in human languages.
2. ☐ A computer understands text, images and sound as numbers.
3. ☐ The binary number system has only two symbols.
4. ☐ The base of the octal number system is 10.
5. ☐ A, B, C, D, E and F are symbols of the hexadecimal number system.
6. ☐ In the number 573_8 , the base is 573.

F Answer these

4 marks

Write full sentences.

1. What is a number system? (2 marks)

2. What does the base of a number show? Give one example. (2 marks)

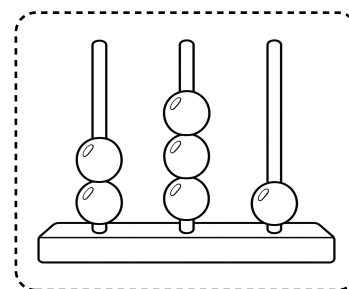
CHAPTER 2

Decimal and Binary Numbers

? A NUMBER ON A COUNTING FRAME

"My little brother put 2 beads, 3 beads and 1 bead on the counting frame. He says it shows two hundred and thirty-one. How can six beads make 231?"

Every **place** in a number has its own **value**. Let us learn the place values of decimal and binary numbers.



Colour me!

1.4 Decimal number system

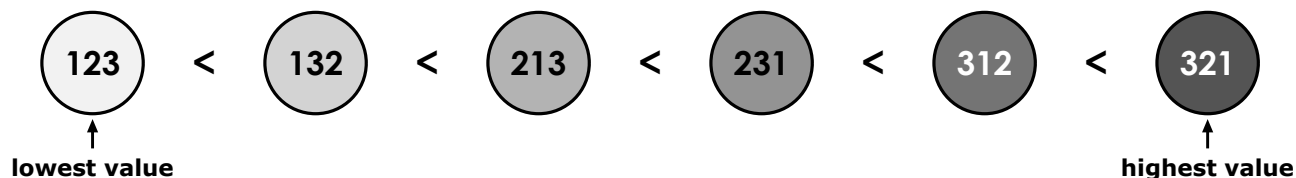
Humans are familiar with the **decimal** number system. We know its symbols as numbers, and we use it for all **arithmetic** operations.

Symbols of the decimal number system: **0, 1, 2, 3, 4, 5, 6, 7, 8, 9**

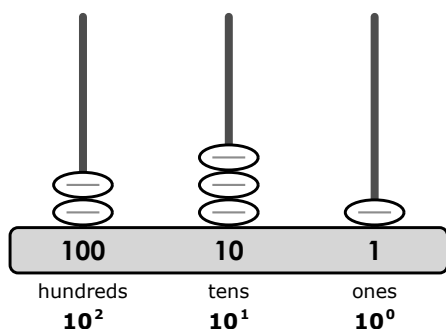
Each **position** in a number has a **place value**. So the same symbols can make numbers with different values.



Six numbers made with the symbols 1, 2 and 3



Showing 231 on a counting frame



231 in expanded form

$$\begin{aligned} 231_{10} &= 2 \times 10^2 + 3 \times 10^1 + 1 \times 10^0 \\ &= 2 \times 100 + 3 \times 10 + 1 \times 1 \\ &= 200 + 30 + 1 \\ &= 231 \end{aligned}$$

10^0 , 10^1 and 10^2 show the **place values** of the decimal symbols: ones, tens and hundreds.

> DO IT - PRACTICAL 2 (WORKBOOK ACTIVITY 1.2)

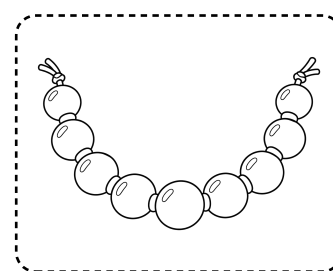
Make a counting frame. Work in pairs.

1	Draw three long lines on a sheet of paper. These are the rods .
2	Under the rods write 100 , 10 and 1 . This is your counting frame.
3	Use buttons, seeds or bottle caps as beads .
4	Show 231 : 2 beads on the 100 rod, 3 on the 10 rod and 1 on the 1 rod.
5	Now show 123 , 312 and 321 . Which one has the highest value?
6	Your friend shows a number with beads. Read it and write it in expanded form.

i WRITE WHAT YOU DID

The highest of 123, 312 and 321: _____

My friend's number in expanded form: _____



Colour me!

1.5 Binary number system

The binary number system uses only **two** different symbols: **0** and **1**.

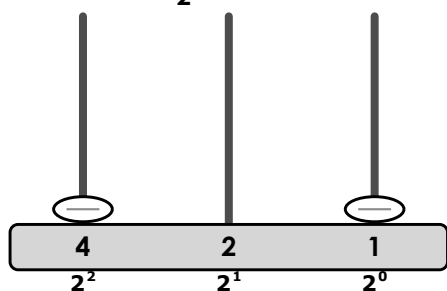
Symbols of the binary number system: **0, 1**

The binary symbols 0 or 1 are called **bits**.

Bit = (B)inary dig(it) → 0 or 1



Showing 101_2 on a counting frame



101_2 in expanded form

$$\begin{aligned} 101_2 &= 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 \\ &= 1 \times 4 + 0 \times 2 + 1 \times 1 \\ &= 4 + 0 + 1 \\ &= 5_{10} \end{aligned}$$

2^0 , 2^1 and 2^2 show the **positions** of the binary symbols. Their place values are 1, 2 and 4.

A Lowest to highest

6 marks

Use 5, 8 and 2 to make six numbers. Write them from the lowest to the highest.

B Counting frames

4 marks

1 and 2: write the number and its base. 3 and 4: draw the beads.

1

2

3 Show 205_{10}

4 Show 111_2

C Value of the underlined digit

6 marks

Example: in $23\underline{1}_{10}$ the underlined digit is worth $3 \times 10 = 30$. In $11\underline{0}_2$ it is worth $1 \times 2 = 2$.

1 $4\underline{7}2_{10} = \dots\dots\dots$

2 $3\underline{1}8_{10} = \dots\dots\dots$

3 $90\underline{6}_{10} = \dots\dots\dots$

4 $1\underline{0}1_2 = \dots\dots\dots$

5 $1\underline{1}1_2 = \dots\dots\dots$

6 $100\underline{2}_2 = \dots\dots\dots$

"Put every digit in its place. Every place has its value - and so do you."

- THE KING OF ICT



D Write in expanded form

8 marks

Fill in the dotted lines, as in the examples.

1. $352_{10} = \dots \times 10^2 + \dots \times 10^1 + \dots \times 10^0$
 $= \dots + \dots + \dots$
2. $608_{10} = \dots \times 10^2 + \dots \times 10^1 + \dots \times 10^0$
 $= \dots + \dots + \dots$
3. $110_2 = \dots \times 2^2 + \dots \times 2^1 + \dots \times 2^0$
 $= \dots + \dots + \dots = \dots_{10}$
4. $100_2 = \dots \times 2^2 + \dots \times 2^1 + \dots \times 2^0$
 $= \dots + \dots + \dots = \dots_{10}$

E Fill in the blanks

6 marks

Use the words in the box.

WORD BANK

decimal arithmetic place value two bits digit

1. Humans are familiar with the number system.
2. We use the decimal number system for all operations.
3. Each position in a number has a
4. The binary number system uses different symbols.
5. The binary symbols 0 and 1 are called
6. The word bit comes from binary

F True or false

6 marks

Write T or F in the box.

1. ☐ Humans are familiar with the decimal number system.
2. ☐ We use the binary number system for all arithmetic operations.
3. ☐ The binary symbols 0 and 1 are called bits.
4. ☐ 10^0 is equal to 0.
5. ☐ To show 231 on a counting frame, we put 3 beads on the hundreds rod.
6. ☐ 101_2 is equal to 5_{10} .

"You do not learn ICT by reading. You learn it by doing."

- THE KING OF ICT



G Answer these

4 marks

Write full sentences.

1. What is a bit? (2 marks)

2. What do 10^0 , 10^1 and 10^2 show in a decimal number? (2 marks)

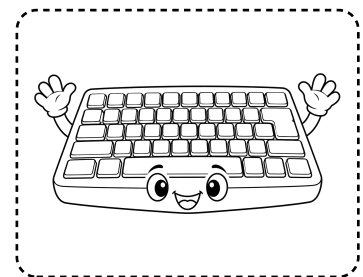
CHAPTER 3

Converting Decimal to Binary

? WHERE DID MY 9 GO?

"I pressed 9 on the keyboard and the screen shows 9. But the computer only knows 0 and 1. What happened inside?"

The computer keeps the 9 as a **binary** number. Let us learn how to **convert** a decimal number into a binary number.

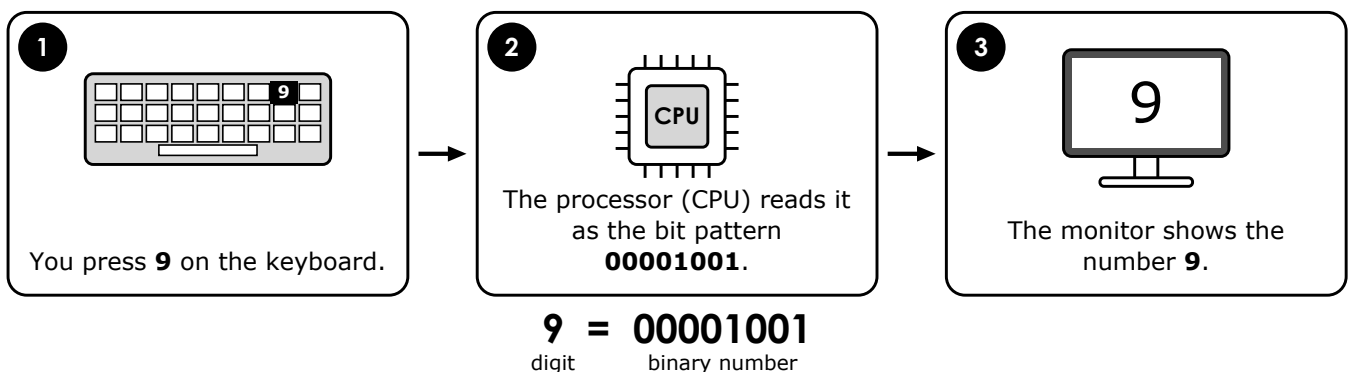


Colour me!

1.6 Why do we convert numbers?

All input fed into the computer is kept in **binary** form. The computer processes the data in binary form. The output is information in the form of text, images, sound or video.

For example, when you type a **decimal** number on the keyboard, the computer keeps it in binary form. The screen shows it again as a decimal number.



So **converting** numbers from one number system to another is important.



1.6.1 Converting decimal numbers to binary

Divide the decimal number by **2** again and again, until the quotient is **0**. Write each **remainder** on the right side. Then write the remainders from the **bottom to the top**.

Example: converting 13_{10} to a binary number

$$\begin{array}{r}
 2 \overline{)13} \\
 \underline{2 \overline{)6}} \\
 2 \overline{)3} \\
 \underline{2 \overline{)1}} \\
 0
 \end{array}
 \begin{array}{l}
 - \text{ } \boxed{1} \\
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{1} \\
 - \text{ } \boxed{1}
 \end{array}
 \uparrow
 \boxed{13_{10} = 1101_2}$$

Division	Quotient	Remainder
$13 \div 2$	6	1
$6 \div 2$	3	0
$3 \div 2$	1	1
$1 \div 2$	0	1

Two more examples: 34_{10} and 49_{10}

$$\begin{array}{r}
 2 \overline{)34} \\
 \underline{2 \overline{)17}} \\
 2 \overline{)8} \\
 \underline{2 \overline{)4}} \\
 2 \overline{)2} \\
 \underline{2 \overline{)1}} \\
 0
 \end{array}
 \begin{array}{l}
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{1} \\
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{1}
 \end{array}
 \uparrow
 \boxed{34_{10} = 100010_2}$$

$$\begin{array}{r}
 2 \overline{)49} \\
 \underline{2 \overline{)24}} \\
 2 \overline{)12} \\
 \underline{2 \overline{)6}} \\
 2 \overline{)3} \\
 \underline{2 \overline{)1}} \\
 0
 \end{array}
 \begin{array}{l}
 - \text{ } \boxed{1} \\
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{0} \\
 - \text{ } \boxed{1} \\
 - \text{ } \boxed{1}
 \end{array}
 \uparrow
 \boxed{49_{10} = 110001_2}$$

> DO IT - PRACTICAL 3 (WORKBOOK ACTIVITY 1.3)

Convert on paper first. Then check your answers on a computer. **Ask your teacher first.**

1	Write your age in years. Convert it to binary on paper (divide by 2).
2	Do the same for the number of students in your class, and for 100 .
3	Open the Calculator . Click the menu (three lines). Choose Programmer .
4	Click DEC and type your age. Read the BIN line. Is it the same as yours?
5	Check your other two numbers in the same way.
6	If an answer is wrong, find the mistake in your division and correct it.

Decimal number	My answer on paper	The Calculator (BIN)	Right?
My age:			
My class:			
100			

The Calculator may show spaces or 0s at the left. 0s at the left do not change the value.

"Divide, write the remainder, repeat. Patience turns any number into binary."

- THE KING OF ICT



A Put the steps in order

7 marks

Number the steps of each list in the correct order.

A. When you press 9 on the keyboard

1. The monitor shows the number 9.
2. You press 9 on the keyboard.
3. The processor reads 9 as the bit pattern 00001001.

B. Converting a decimal number to binary

1. Write the remainders from the bottom to the top.
2. Divide the decimal number by 2.
3. Divide the quotient by 2 again. Stop when the quotient is 0.
4. Write the remainder (0 or 1) on the right side.

B Complete the table

6 marks

Convert 26 to binary. Fill in the table, then write the answer.

Division	Quotient	Remainder
$26 \div 2$		

Read the remainders from the **bottom** to the **top**.

$$26_{10} = \dots\dots\dots_2$$

C Convert to binary

12 marks

Use a division ladder. Write the binary number on the line.

1 6_{10}

= $\dots\dots\dots_2$

2 10_{10}

= $\dots\dots\dots_2$

3 19_{10}

= $\dots\dots\dots_2$

4 25_{10}

= $\dots\dots\dots_2$

5 40_{10}

= $\dots\dots\dots_2$

6 57_{10}

= $\dots\dots\dots_2$



D Complete the division ladders

6 marks

Fill in the empty boxes. Then write the binary number.

$2 \overline{) 22}$
 $2 \overline{) 11}$
 $2 \overline{) \quad}$
 $2 \overline{) 2}$
 $2 \overline{) 1}$
 0

- 0
 - 1
 -
 - 0
 - 1

$22_{10} = \dots\dots\dots_2$

$2 \overline{) 37}$
 $2 \overline{) 18}$
 $2 \overline{) 9}$
 $2 \overline{) \quad}$
 $2 \overline{) 2}$
 $2 \overline{) 1}$
 0

- 1
 -
 - 1
 - 0
 - 0
 - 1

$37_{10} = \dots\dots\dots_2$

E Answer these

6 marks

Write full sentences. Show your working.

1. Why is converting from one number system to another important? (2 marks)

2. Amali is 14 years old. Write her age as a binary number. Show your working. (2 marks)

3. Kasun converted 11_{10} to binary. His remainders from the top to the bottom were 1, 1, 0 and 1, so he wrote $11_{10} = 1101_2$. What was his mistake? Write the correct answer. (2 marks)

CHAPTER 4

Converting Binary to Decimal

? A SECRET CODE

"My friend wrote my house number in binary: **10111**. Can you find my house number?"

Yes! We use the **place values** of the bits to change a binary number into a decimal number.



1.6.2 Converting binary numbers to decimal

To find the decimal value of a binary number, **multiply each bit by its place value**. Then **add** the answers.

	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Place value	128	64	32	16	8	4	2	1
Binary digit (bit)	1	0	1	0	1	0	0	0
Bit × place value	128	0	32	0	8	0	0	0

Decimal value = $128 + 0 + 32 + 0 + 8 + 0 + 0 + 0 = 168$, so $10101000_2 = 168_{10}$

Powers of 2 - the place values of binary numbers

Power of 2	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}
Value	1	2	4	8	16	32	64	128	256	512	1024

Example: converting 10111_2 to a decimal number

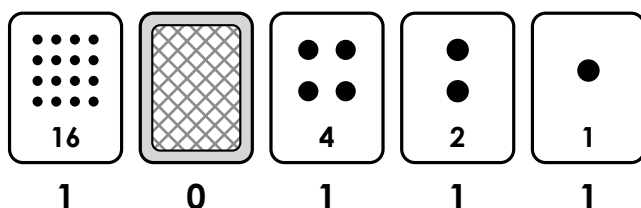
$$\begin{aligned}
 10111_2 &= 1 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 \\
 &= 1 \times 16 + 0 \times 8 + 1 \times 4 + 1 \times 2 + 1 \times 1 \\
 &= 16 + 0 + 4 + 2 + 1 \\
 &= 23_{10}
 \end{aligned}$$

Two more examples: $10010_2 = 16 + 2 = 18_{10}$ $11111_2 = 16 + 8 + 4 + 2 + 1 = 31_{10}$

> DO IT - PRACTICAL 4 (WORKBOOK ACTIVITY 1.4)

Make binary cards. Work in pairs.

1	Cut five small cards from old paper. Draw 16, 8, 4, 2 and 1 dots on them.
2	Write the number of dots at the bottom of each card.
3	Put the cards in a row: 16 8 4 2 1 (the biggest on the left).
4	A card face up is 1 . A card face down is 0 .
5	Show 10111 : turn the 8 card face down. Count the dots: $16 + 4 + 2 + 1 = 23$.
6	Now show 10010 and 11111 . Count the dots. Write the answers below.
7	Your friend makes a number with the cards. You find its decimal value. Then swap.



$$10010_2 = \dots\dots\dots_{10}$$

$$11111_2 = \dots\dots\dots_{10}$$

A Powers of 2

6 marks

Fill in the missing place values.

Power of 2	2^0	2^1	2^2	2^3	2^4	2^5	2^6	2^7	2^8	2^9	2^{10}
Value	1	2			16				256	512	

B Use the place value chart

8 marks

Put each bit under its place value, from the right. Find the decimal value.

Binary number	128	64	32	16	8	4	2	1	Decimal value
1001_2									
101010_2									
1100100_2									
11111111_2									

C Write in expanded form

6 marks

Show your working, like the example for 10111_2 .

Binary	Multiply each bit by its place value, then add	Decimal
1011_2		
10101_2		
11010_2		

D Which is bigger?

6 marks

Change each binary number to decimal. Then write $<$, $>$ or $=$ in the circle.

1 1010_2 ○ 12_{10}

2 111_2 ○ 7_{10}

3 10000_2 ○ 15_{10}

4 1100_2 ○ 1010_2

5 11001_2 ○ 25_{10}

6 1111_2 ○ 10001_2

"Add the place values of the 1s, and the secret code is solved."

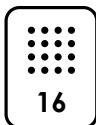
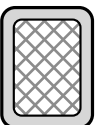
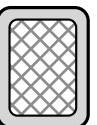
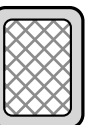
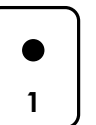
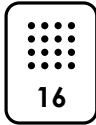
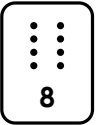
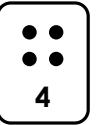
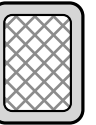
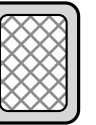
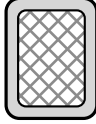
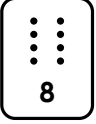
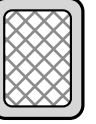
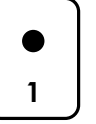
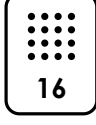
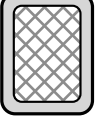
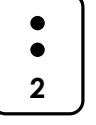
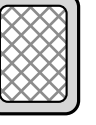
- THE KING OF ICT



E Read the binary cards

8 marks

Face up = 1, face down = 0. Write the binary number and its decimal value.

1.      Binary:
Decimal:
2.      Binary:
Decimal:
3.      Binary:
Decimal:
4.      Binary:
Decimal:

F Answer these

4 marks

Write full sentences.

1. Write the place values of the first five places of a binary number, from the right. (2 marks)
2. Nimal says that 100_2 is one hundred. Is he correct? Explain. (2 marks)

"A problem is only a puzzle that you have not solved yet."

- THE KING OF ICT

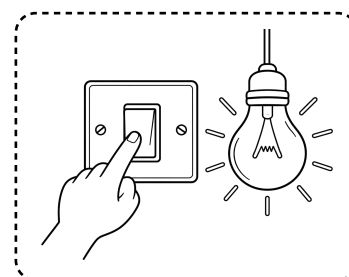
CHAPTER 5

How the Computer Uses Binary

? PHOTOS AND SONGS IN 0s AND 1s?

"My computer has photos, songs and stories. Are they all kept as 0s and 1s? How can that be?"

Yes! The computer uses **ON** and **OFF**. ON is **1** and OFF is **0**. Let us see how data move inside the computer.

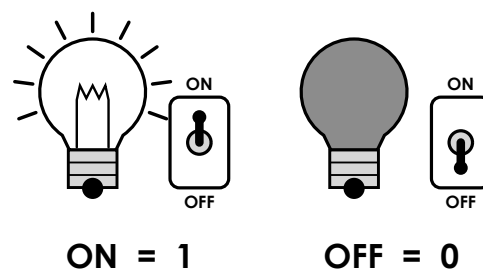


Colour me!



1.7 Binary representation of data

The computer uses **ON** and **OFF** states to represent data and instructions as a **bit pattern** of 1s and 0s. Text, sounds and images are stored in the computer memory as binary bit patterns. So all data must be converted into binary form **before processing**.

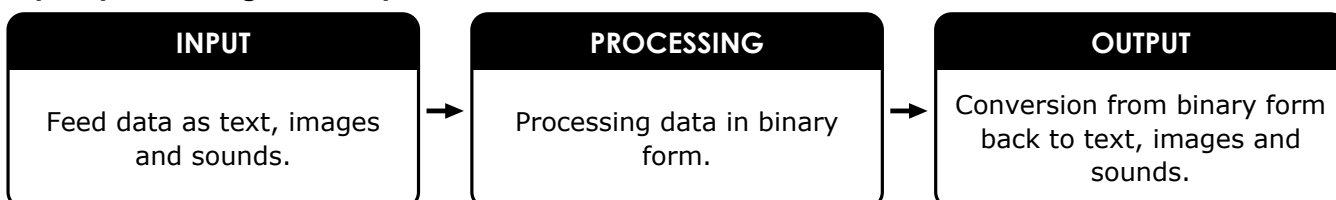


Data seen by humans and data seen by the computer

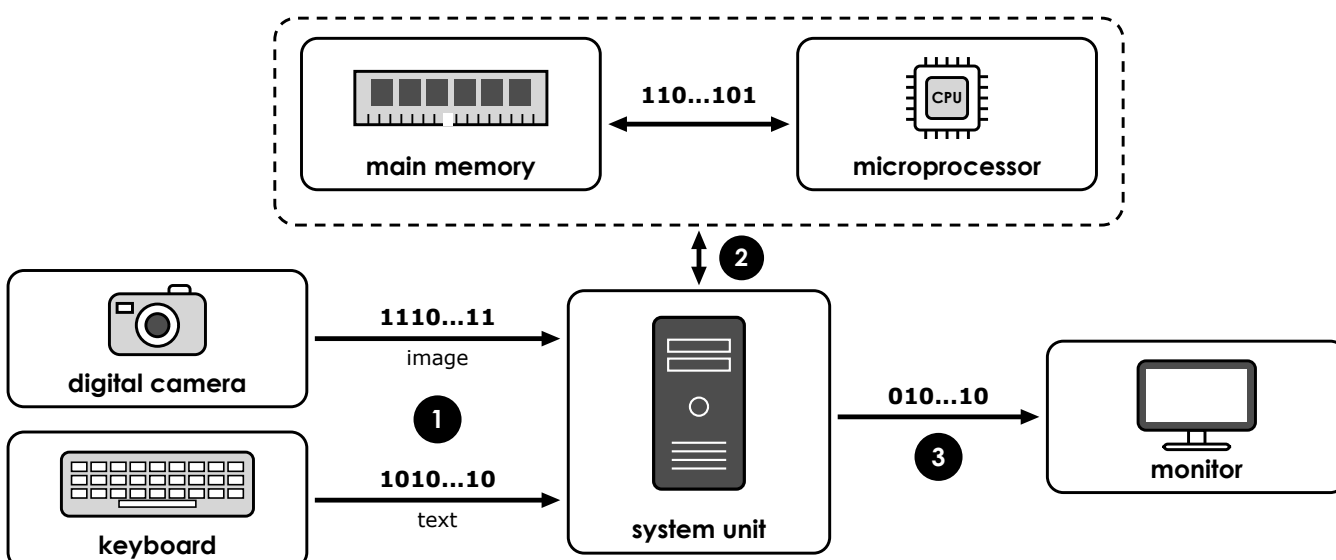
	Data seen by humans	Data seen by the computer
	converting an image to binary numbers →	1010...101010 11...11010101
	converting a sound to binary numbers →	11..1100101.0 010111...0101
	converting the letter A to binary numbers →	1000001
	converting the number 9 to binary numbers →	0001001

So the computer takes all inputs in binary form, processes them in binary form and gives them to the output devices as text, images and sounds.

Input, processing and output



The flow of binary data in a computer



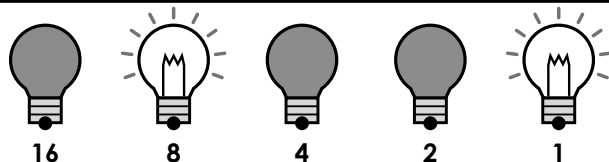
- 1 The **input devices** (digital camera, keyboard) send the data to the system unit in binary form.
- 2 The binary data go to the **main memory** and the **microprocessor**. After processing, they go back to the memory.
- 3 Then the data are sent to the **output devices**, like the monitor.

All activities in the computer are carried out using **0s and 1s**: data input, saving data **temporarily** in the main memory and **permanently** on the hard disk, processing, and sending information to the output devices.

> DO IT - PRACTICAL 5 (WORKBOOK ACTIVITY 1.5)

Human light bulbs! Five students stand in a row in front of the class.

1	Give the five students the cards 16, 8, 4, 2 and 1 (the biggest on the left).
2	Each student is a light bulb. Hands up = ON = 1 . Hands down = OFF = 0 .
3	The teacher says a binary number, like 01001 . The bulbs show it.
4	The class adds the cards of the ON bulbs: $8 + 1 = 9$.
5	The teacher says a decimal number, like 13 . The bulbs make it: 01101 .
6	Take turns, so that everyone is a light bulb once.
7	Bonus: seven bulbs can show the letter A as 1000001 . Try it!



$$01001 = 8 + 1 = 9$$

A Read the light bulbs

8 marks

ON = 1, OFF = 0. Write the binary number and its decimal value.

1. Binary:
Decimal:
2. Binary:
Decimal:
3. Binary:
Decimal:
4. Binary:
Decimal:



B Switch on the bulbs

4 marks

Draw rays around the bulbs that must be ON to show each number.

1. 3_{10}	 16	 8	 4	 2	 1
2. 12_{10}	 16	 8	 4	 2	 1
3. 21_{10}	 16	 8	 4	 2	 1
4. 30_{10}	 16	 8	 4	 2	 1

C Input, processing or output?

6 marks

Tick the correct column.

What happens?	Input	Processing	Output
Feeding text, images and sounds into a computer	☐	☐	☐
Processing data in binary form	☐	☐	☐
Changing binary data back into text, images and sounds	☐	☐	☐
Typing your name on the keyboard	☐	☐	☐
The monitor showing a photo	☐	☐	☐
The microprocessor working on the binary data	☐	☐	☐

D Label the diagram

6 marks

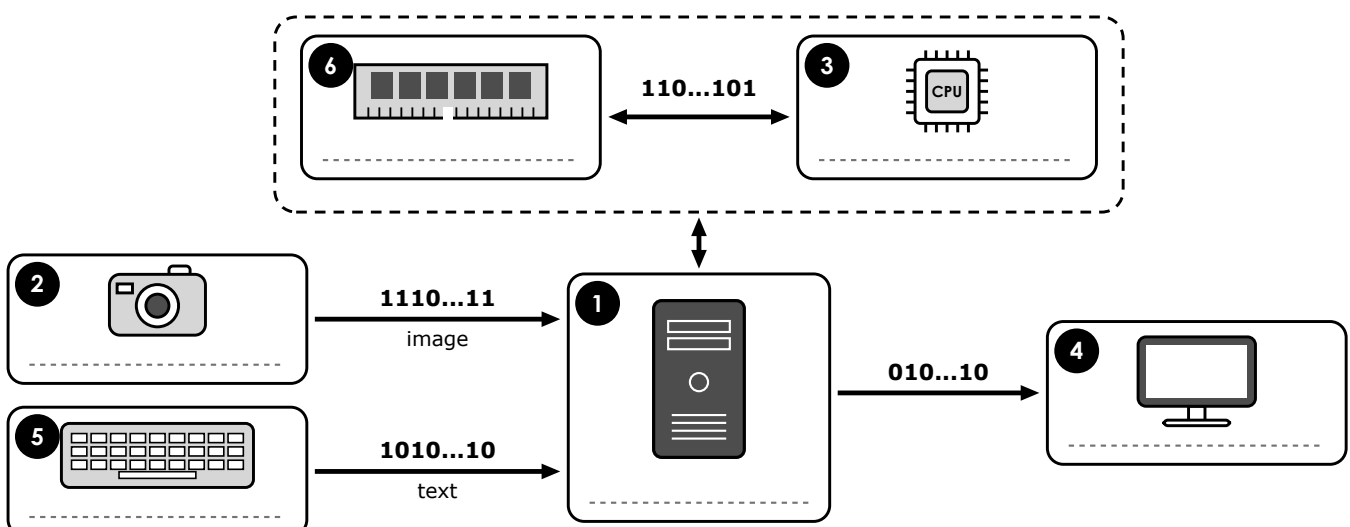
Write the name of each part on its dotted line.

WORD BANK

digital camera
microprocessor

keyboard
monitor

main memory
system unit



E True or false

6 marks

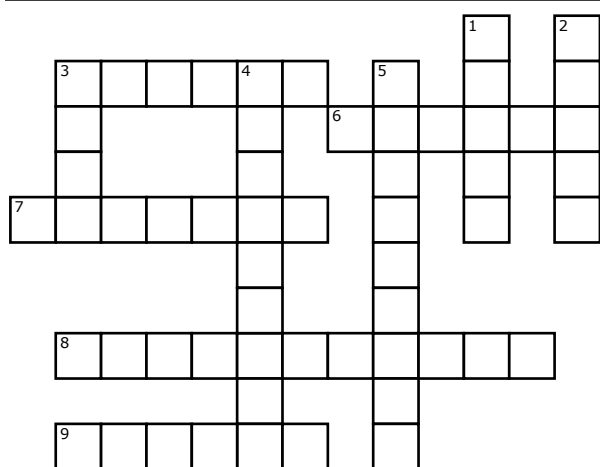
Write T or F in the box.

1. ☐ The computer uses ON and OFF states to represent data.
2. ☐ In binary, ON is 0 and OFF is 1.
3. ☐ Text, sounds and images are stored in the memory as binary bit patterns.
4. ☐ Data can be processed before they are converted into binary form.
5. ☐ The main memory saves data permanently.
6. ☐ After processing, the binary data are sent back to the memory.

F Crossword

10 marks

Read the clues. Write one letter in each square.



ACROSS

3. The number system with two symbols, 0 and 1. (6)
6. Changing binary back into text and images. (6)
7. The number system we use for arithmetic. (7)
8. The number system with base 16. (11)
9. The main saves data for a short time. (6)

DOWN

1. Feeding data into the computer. (5)
2. The number system with base 8. (5)
3. The number of different symbols in a system. (4)
4. What is left over after a division. (9)
5. The base is written as a small (9)

G Answer these

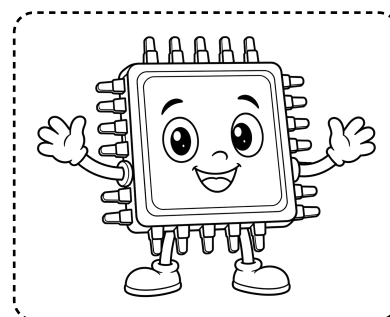
4 marks

Write full sentences.

1. How does a computer use ON and OFF states? (2 marks)
2. Write TWO activities in a computer that are carried out using 0s and 1s. (2 marks)

"ON or OFF, 1 or 0. Small choices, made many times, build big things."

- THE KING OF ICT



Colour me!



REVISION

Unit 1 in One Page

Read this the night before the test

Topic	The key facts
Number system	A method that can be used to represent numbers. Each one has a fixed number of different symbols.
Base	The number of different symbols. It is written as a subscript at the right end: 101_2 , 47_{10} .
Four systems	Binary (base 2) · Octal (base 8) · Decimal (base 10) · Hexadecimal (base 16).
Symbols	Binary: 0, 1. Octal: 0 to 7. Decimal: 0 to 9. Hexadecimal: 0 to 9 and A to F.
Grade 8	We study the binary and the decimal number systems.
Place value	Decimal: $10^0 = 1$, $10^1 = 10$, $10^2 = 100$. Binary: $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8$...
Bit	A binary digit: 0 or 1.
Decimal to binary	Divide by 2 again and again until the quotient is 0. Read the remainders from the bottom to the top: $13_{10} = 1101_2$.
Binary to decimal	Multiply each bit by its place value and add: $10111_2 = 16 + 0 + 4 + 2 + 1 = 23_{10}$.
ON and OFF	The computer uses ON (1) and OFF (0). All data are kept as bit patterns.
Input, processing, output	Data go in, are processed in binary form, and come out again as text, images and sounds.
Memory	The main memory saves data temporarily. The hard disk saves data permanently.

★ TICK WHEN YOU CAN DO IT

- ☐ I can name four number systems and their bases.
- ☐ I can write the base of a number as a subscript.
- ☐ I can show a number on a counting frame and write it in expanded form.
- ☐ I can convert a decimal number to binary by dividing by 2.
- ☐ I can convert a binary number to decimal using place values.
- ☐ I can show a binary number with cards or light bulbs.
- ☐ I can explain how a computer keeps data as 0s and 1s.

"Read every question twice. Then answer like a king."

- THE KING OF ICT



WORD POWER

Unit 1 Word List

Twenty-four words you must know

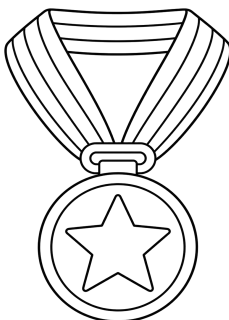
Word	What it means
Number system	A method that can be used to represent numbers.
Symbol	One of the different signs a number system uses, like 0, 1 or A.
Base	The number of different symbols in a number system.
Subscript	Small text at the bottom right, like the 2 in 101_2 . It shows the base.
Binary	The number system with base 2. Its symbols are 0 and 1.
Octal	The number system with base 8. Its symbols are 0 to 7.
Decimal	The number system with base 10. Its symbols are 0 to 9.
Hexadecimal (Hex)	The number system with base 16. Its symbols are 0 to 9 and A to F.
Place value	The value of a position in a number, like ones, tens and hundreds.
Expanded form	A number written with its place values: $231 = 200 + 30 + 1$.
Counting frame	A frame with rods and beads that shows a number.
Bit	A binary digit: 0 or 1.
Power of 2	A binary place value: $2^0 = 1$, $2^1 = 2$, $2^2 = 4$, $2^3 = 8 \dots$
Convert	Change a number from one number system to another.
Quotient	The answer of a division: $13 \div 2 = 6$, remainder 1.
Remainder	The number left over after a division.
Bit pattern	A row of 0s and 1s, like 00001001.
ON / OFF	The two states a computer uses. ON is 1 and OFF is 0.
Input	Feeding data into the computer as text, images and sounds.
Processing	Working on the data in binary form.
Output	Changing binary data back into text, images and sounds.
Main memory	Saves data temporarily while the computer works.
Hard disk	Saves data permanently.
Microprocessor	The processor (CPU). It processes the binary data.

"Learn the words first. Then the ideas will follow you everywhere."

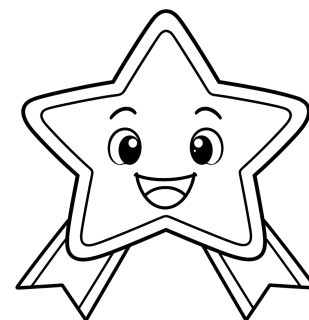
- THE KING OF ICT



Colour me!



Colour me!



Colour me!



END OF UNIT

Unit 1 Test

Time: 45 minutes

Total: 40 marks

Name _____

Class _____

Marks **1 Choose the correct answer****8 marks***Underline your answer.*

1. A method that can be used to represent numbers is called a
(a) number system (b) base (c) bit (d) symbol
2. How many different symbols does the binary number system have?
(a) 2 (b) 8 (c) 10 (d) 16
3. The base of the decimal number system is
(a) 2 (b) 8 (c) 10 (d) 16
4. Which one is a hexadecimal number?
(a) 101_2 (b) 573_8 (c) 47_{10} (d) $7B_{16}$
5. The word bit comes from
(a) binary digit (b) big item (c) basic unit (d) binary item
6. 1101_2 in decimal is
(a) 11 (b) 12 (c) 13 (d) 14
7. 20_{10} in binary is
(a) 10100 (b) 10010 (c) 11000 (d) 10101
8. In a computer, the OFF state is shown by
(a) 1 (b) 0 (c) 2 (d) 10

2 Fill in the blanks**8 marks***One word or number in each blank.*

1. The number of different symbols in a number system is its
2. The base is written as a at the right end of a number.
3. The symbols of the number system are 0, 1, 2, 3, 4, 5, 6 and 7.
4. Humans use the number system for arithmetic operations.
5. Each position in a number has a value.
6. To convert decimal to binary, we divide by again and again.
7. In a computer, the ON state is shown by
8. Data are saved for a short time in the main



3 Complete the chart

8 marks

Write the missing decimal or binary number in each column.

	1	2	3	4	5	6	7	8
Decimal	5	12			18		30	
Binary			111	1001		10101		100000

4 Answer these

16 marks

Write in the space given.

1. What is a number system? (2 marks)

2. Write the symbols and the base of the binary and the decimal number systems. (4 marks)

3. Convert 45_{10} to a binary number. Show your working. (3 marks)

4. Convert 110110_2 to a decimal number. Show your working. (3 marks)

5. A user presses 9 on the keyboard. Write what happens in input, processing and output. Use the words binary and decimal. (4 marks)

