ICT Level 2 – Binary Key Terms and Practice

1 of 20 – Welcome

Welcome to this session on binary key terms and practice.

In this session we are going to look at some new terms and consider how they relate to binary notation:

* We will revisit a number of key terms from recent sessions
* We will consider their specific meanings
* We will learn how to use them in relation to binary notation
* We will practice binary conversions (to binary and back again)

We will also practice binary conversions.

2 of 20 – Introduction to binary key terms

**What are binary key terms?**

Binary is the number system that is used to convert natural data types into data that can be understood by a computer system.

There are a number of key terms that are related to binary and binary notation – such as bit, byte, and word – that explain how different things can be made by grouping binary numbers together in different ways.

The reason that binary is so important is that binary is what allows computers to understand analogue data (natural data) as digital data. Digital data is computer-friendly and can be understood and processed by a hardware system, in a way that analogue data cannot be.

3 of 20 – Analogue data and digital data

Analogue data and digital data are two terms that are often used in discussions about binary. This is because a binary conversion is the process that happens between these two data sets in order to turn analogue into digital.

Analogue data is natural data, i.e. it is something in the real world, and it is typically represented by an electrical signal of some description. Common examples of analogue data are the human voice (consider how that is represented by sound waves) and temperature.

Digital data is data that can be understood and processed by a technology system. It is typically made up of bits and bytes – which we will discuss later – and when digital data is introduced to a computer system, it is usually represented in a binary format (meaning it is data made up of 0s and 1s, as these are the only two digits used in binary).

4 of 20 – Encryption

Encryption is another key term to remember, not only when discussing binary but when discussing things like security risks and concerns, too.

Encrypting something involves protecting it somehow, usually by making it unreadable to anyone who finds it (that is, anyone who is not the person who originally wrote the information, or the person the information is being sent to or shared with).

Data can be encrypted using codes and passwords, alongside a number of other slightly more complicated methods as well.

Using binary conversions – turning data into a set of binary digits – can be thought of as a type of encryption but given that binary is understood by many computer users, it is not necessarily the safest way of storing very private or personal information.

5 of 20 – Binary format

Binary format uses two digits: 0s and 1s.

Data that is represented in a binary format will only ever use these two digits in a number of different combinations, as binary is a base 2 number system (meaning it only uses two digits).

Analogue data is re-shaped – or rather, converted – into binary format, which is what makes it digital data that can be read by a computer system.

6 of 20 – Bits and bytes

Bit is a key term used in binary notation; it is used to refer to an individual binary digit – meaning 0 or 1. Bits can be used to explain the processing power of a computer, too. They explain how much data can be handled by a processor at any given time through expressions such as: 32-bit and 64-bit.

When eight bits are grouped together (that is, a combination of eight 0s and 1s in any order) that can be thought of as a byte.

Byte is the term used when digital data – or pieces of binary – are grouped together in a string of eight bits.

Bytes are particularly useful for grouping together binary digits, because in this eight-digit format there are actually two-hundred and fifty-six different ways that those individual bits can be arranged and then processed by a computer.

7 of 20 – Words

A word, in binary talk, is the name given to a fixed-sized group of bits that are moved around the computer system as a group, and eventually handled as a group too, by the central processing unit and any other instruction components of the computer that might need to help with this data set.

Word length is a term that might also be used here too, as words can be either long or short in size.

If a word is long, this is usually a sign that a lot of data is being moved through the computer system in every clock cycle. This means that the processing power of the computer unit is particularly high, or strong, making for a longer word (or, to think of it in another way, making for more data movements and processes).

8 of 20 – ASCII

The ASCII – or the **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange – was developed in 1960 by the American National Standards Institute.

The code was developed for use in computer systems, meaning that a number of characters could be given (binary) values that would allow a computer to understand them properly.

The characters used in ASCII include both upper and lower case letters in the English alphabet, alongside a number of numerical values and a small selection of punctuation symbols, too.

However, ASCII was criticised for being too limited – there were not enough values available for unique symbols or characters from other languages, for example – and so a second extended version of ASCII was eventually released as well.

9 of 20 – Question 1

Indicate whether the following statements are true or false.

Analogue data is data that can be understood and processed by a computer system.

True

False

The correct answer is: False

Digital data is typically made up of bits and bytes.

True

False

The correct answer is: True

Encryption is a useful process to keep personal and private data safe from view.

True

False

The correct answer is: True

Binary is a base 10 number system because it uses the digits 1 and 0.

True

False

The correct answer is: False

10 of 20 – Question 2

Match these terms; **bit**, **byte** and **word**, to the descriptions below:

1. A group of eight binary digits
2. An individual binary digit, this will be either 0 or 1
3. This is a fixed-sized group of binary digits that can be moved or processed together

The correct answers are:

A group of eight binary digits is a description of a **byte**.

An individual binary digit, this will be either 0 or 1 is a description of a **bit**.

This is a fixed-sized group of binary digits that can be moved or processed together is a description of a **word**.

11 of 20 – Question 3

What characters does ASCII provide binary values for?

Choose all that apply:

1. Upper and lower case letters
2. Only lower case letters
3. Only upper case letters
4. A sample of punctuation marks
5. All punctuation marks
6. Numerical values

The correct answers are A, D and F, upper and lower case letters, a sample of punctuation marks and numerical values.

12 of 20 – Binary conversions

Binary can be used to convert denary numbers into something that is easier for a computer system to understand. Remember: denary is the name given to our everyday number system, which is base 10 rather than base 2.

When counting in binary, place values work a little differently. So instead of numbers running as 1, 2, 3, 4 as they do in denary, in binary, numbers (or rather, place values) instead run as 1, 2, 4, 8 with each number increasing to two times the size as the sequence continues.

These binary place values can be placed on a chart where they will run across the top, outlining the sequence of values like this (every left-hand number in the binary sequence will be double the number that is listed to its right):

|  |  |  |  |
| --- | --- | --- | --- |
| 8 | 4 | 2 | 1 |

13 of 20 – Binary conversions continued

After plotting the binary place values along the top of the chart, the denary values can then be added to the side of the chart.

Binary values for denary numbers can be found by working out which place values you need to make up a denary figure. 1 is placed in the column of any place value that has been used, 0 is placed in the column of place values not used.

The chart below shows binary conversions in practice:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Binary pattern | | | | | |
| Place value 32 | Place value 16 | Place value 8 | Place value 4 | Place value 2 | Place value 1 |
| Denary number | 0 |  |  |  |  |  | 0 |
| 1 |  |  |  |  |  | 1 |
| 2 |  |  |  |  | 1 | 0 |
| 3 |  |  |  |  | 1 | 1 |
| 4 |  |  |  | 1 | 0 | 0 |
| 5 |  |  |  | 1 | 0 | 1 |
| 6 |  |  |  | 1 | 1 | 0 |
| 7 |  |  |  | 1 | 1 | 1 |
| 8 |  |  | 1 | 0 | 0 | 0 |
| 9 |  |  | 1 | 0 | 0 | 1 |
| 10 |  |  | 1 | 0 | 1 | 0 |

So 10 denary is 1 0 1 0 binary, because to make 10 we can place a 1 in place value 8 and a 1 in place value 2, as these numbers combine to make 10, but a 0 in place value 4 and place value 1, giving 1 0 1 0 as the final binary value.

14 of 20 – Question 4

The chart below can be used to answer the following questions in this session:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Binary pattern | | | | | |
| Place value 32 | Place value 16 | Place value 8 | Place value 4 | Place value 2 | Place value 1 |
| Denary number | 0 |  |  |  |  |  | 0 |
| 1 |  |  |  |  |  | 1 |
| 2 |  |  |  |  | 1 | 0 |
| 3 |  |  |  |  | 1 | 1 |
| 4 |  |  |  | 1 | 0 | 0 |
| 5 |  |  |  | 1 | 0 | 1 |
| 6 |  |  |  | 1 | 1 | 0 |
| 7 |  |  |  | 1 | 1 | 1 |
| 8 |  |  | 1 | 0 | 0 | 0 |
| 9 |  |  | 1 | 0 | 0 | 1 |
| 10 |  |  | 1 | 0 | 1 | 0 |

Using the chart, can you work out what 5 denary is as a binary value?

**Tip:** binary place values must add up to their denary number.

Choose one answer:

1. 1 0 0
2. 1 0 1
3. 1 1 1

The correct answer is B, 1 0 1.

15 of 20 – Question 5

Using the formula introduced by the chart, what is 33 denary as a binary value?

1. 1 0 0 0 0 0
2. 1 0 1 1 1 1
3. 1 0 0 0 0 1

The correct answer is C, 1 0 0 0 0 1.

16 of 20 – Question 6

Using the formula introduced by the chart, what is 54 denary as a binary value?

1. 1 1 0 1 1 0
2. 1 1 1 1 1 1
3. 1 0 1 0 1 0

The correct answer is A, 1 1 0 1 1 0.

17 of 20 – Question 7

Converting between denary and binary works both ways. What is the binary value 1 0 0 0, as a denary number?

**Tip:** you can still use the chart to work this out.

Choose one answer:

1. 32
2. 16
3. 8
4. 4

The correct answer is C, 8.

18 of 20 – Question 8

Converting between denary and binary works both ways. What is the binary value 1 0 1 0 1 1, as a denary number?

**Remember:** you can put your 1s and 0s on the chart to see which place values have been used.

Choose one answer:

1. 41
2. 43
3. 46
4. 47

The correct answer is B, 43.

19 of 20 – End

Well done. You have completed this session on binary key terms and practice.

In this session we have covered:

* A number of key terms from recent sessions
* Their specific meanings
* How to use them in relation to binary notation
* Binary conversions in practice (to binary and back again)

If you have any questions about any of these topics, make a note and speak to your tutor for more help.