Tutorial 3 M150

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I have put this tutorial on the web. This tutorial can be viewed and downloaded from http://www.users.totalise.co.uk/~rifat then selecting M150 Tutorials then Tutorial 3.

1) Define what is meant by analogue system and give examples of measurements of analogue system?

2) Define what is meant by digital system and give examples of measurements of digital system? What fundamental mathematical equation is used to convert signals from analogue to digital?

3) Which items in the following list are fundamentally analogue and which fundamentally discrete?

   a) The price of petrol
   b) The amount of heat from a fire
   c) The speed of a car
   d) The energy of a star
   e) The size of the audience at a play
   f) The pressure of the atmosphere

4) In your head do the following arithmetic and time yourself :

   a) 100 + 200
   b) 350 + 120
   c) 68 + 53
   d) 239 + 84
   e) 21345 + 87234

   Which of these too you less time to do and hazard a guess as to why that is?

5) What is decimal system of numbering and which is the most important digit in this system? Write 385 in decimal representation?

6) What is octal system of numbering? Write 85 in octal representation?

7) What is binary system of numbering and why can current computers only communicate using binary system? Write 7 in binary representation?

8) What is hexadecimal system of numbering? Write 24 in hexadecimal representation?

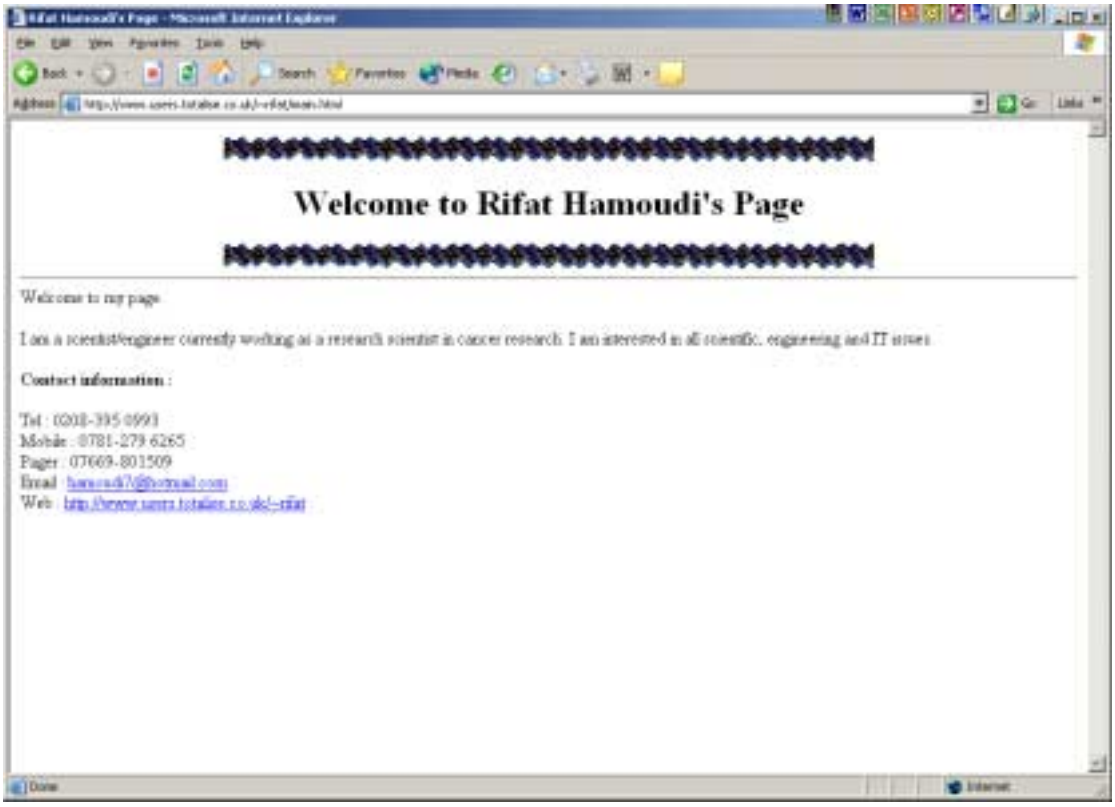
9) Define the followings : (1) Bit (2) Byte (3) Word (4) RAM (5) ROM (6) Hard disk (7) Megabyte (8) Gigabyte. Why is 1 kilobyte = 1024 and not 1000 bytes?

10) What is ASCII and why is it important for computers? Why has ASCII supported 128 numbers exactly?

    Using the definition of ASCII and providing that you know that the ASCII value for “A” is 65 and “a” is 97; “Z” is 90 and “z” is 122. Write a short program in pseudo English that takes a string of characters and converts all lower case letters to upper case. If you are familiar with any programming language you can write it in that language if you prefer.

11) Define the followings : (1) Bitmap (2) Pixel (3) VGA (4) Greyscale
    How do you represent the colour red in a computer?

12) This is my main web page which can be obtained from : http://www.users.totalise.co.uk/~rifat/main.html




```
<HTML>
<TITLE>Rifat Hamoudi's Page</TITLE>
<BODY BGCOLOR="#FFFFFF">
<A NAME="top"></A>
<CENTER><IMG SRC="dnastrpx.gif" BORDER=0 ></CENTER>

<CENTER>
<H1>Welcome to Rifat Hamoudi's Page</H1></CENTER>

<CENTER><IMG SRC="dnastrpx.gif" BORDER=0 ></CENTER>

<HR>Welcome to my page.

<P>
I am a scientist/engineer currently working as a research scientist
in cancer research. I am interested in all scientific, engineering and
IT issues.

<P><B>Contact information :</B>
<P>
Tel    : 0208-395 0993<BR>
Mobile : 0781-279 6265<BR>
Pager : 07669-801509<BR>Email : <A HREF="mailto:hamoudi7@hotmail.com">
hamoudi7@hotmail.com </A><BR>
Web    : <A HREF="http://www.users.totalise.co.uk/~rifat/main.html
                ">http://www.users.totalise.co.uk/~rifat</A>
<P>
</BODY>
</HTML>
```

Define HTML and describe the function of as many of the HTML tags in my webpage as you can.

Answer to question 1

Analogue system is a system that is constantly changing such as temperature, sound, wind, energy, brightness or light, pressure ..etc. Analogue signal measurements are infinite e.g. there are infinite measurements between 37.5°C and 37.6°C

Answer to question 2

Digital system is a discrete system whose data may only have a finite number of discrete values. Example is any communication or computing technology because they are binary and can only be represented as 1 (on) or 0 (off).

Fourier transform equations are used to convert signals from analogue to digital systems. This is sometimes referred to as **digitisation** or **quantisation**. Fourier transform is based on sine and cosine.

Answer to question 3

I would say that items b, c, d and f are definitely analogue, although we might choose to measure them with discrete instruments. Items a and e are discrete.

Answer to question 4

Most of you would find that (a) is the easiest to do in your head, this is because the human brain thinks in decimal so base 10 numbers are very easy to do, but you would find that (e) probably take the longest to do.

Answers should be :

(a) 300
(b) 470
(c) 121
(d) 323
(e) 108579

Answer to question 5

Decimal system of numbering is base 10 arithmetic, or a decimal system, from the Latin decima meaning ‘a tenth’.

Groups of 10000	Groups of 1000	Groups of 100	Groups of 10	Ones
10 × 10 × 10 × 10 × 1	10 × 10 × 10 × 1	10 × 10 × 1	10 × 1	1s

Or using the base system it can be represented as :

Groups of 10000	Groups of 1000	Groups of 100	Groups of 10	Ones
10^4	10^3	10^2	10^1	1s

Each group can have any number between 0 – 9
385 in decimal would be

5 x 1 = 5 put this on the far right column
8 x 10^1 = 8 x (10x1) = 8 x 10 = 80 put this in the middle column
3 x 10^2 = 3 x (10x10) = 3 x 100 = 300 put this in the far left column

When you add 5 + 80 + 300 you get 385 since this is base 10
therefore decimal 385 = 385
This is the same principal for any other numbering system but the main difference is the base number. So in decimal it is to the base 10. In octal its base 8 and so on.

Answer to question 6

Octal system is base 8 arithmetic system. Octa is Latin for eight. Therefore it can be represented as :

Groups of 4096	Groups of 512	Groups of 64	Groups of 8	Ones
8^4	8^3	8^2	8^1	1s

Each group can have any number between 0 – 7

Decimal 85 in octal would be

5 x 1 = 5 put this in the far right column
2 x 8^1 = 2 x (1 x 8) = 2 x 8 = 16 put this in the middle column
1 x 8^2 = 1 x (8 x 8) = 1 x 64 = 64 put this in the left column

Add 5 + 16 + 64 you get 85 but in octal it is 125.
Therefore octal 125 = decimal 85

Answer to question 7

Binary system is base 2. It comes from bi which means 2. Computers can only communicate in binary because they can represent analogue signals as binary data. This is because computers work based on voltage, so 5 volts means on or binary 1 and no voltage means binary 0 or off, anything in between does not activate the electronic circuitry. Optical computers in future can use quaternary logic or maybe even octal or later on perhaps decimal, then we will see a true "human" computer perhaps even defining the elusive quality of consciousness and the recognition of self that is fundamental to all humans.

Groups of 32	Groups of 16	Groups of 8	Groups of 4	Groups of 2	Ones
$2 \times 2 \times 2 \times 2 \times 2 \times 1$ (2^5)	$2 \times 2 \times 2 \times 2 \times 1$ (2^4)	$2 \times 2 \times 2 \times 1$ (2^3)	$2 \times 2 \times 1$ (2^2)	2×1 (2^1)	1s

Decimal 7 can be represented in binary as follows :

1 x 1 = 1 put that in right column
1 x 2^1 = 1 x (1 x 2) = 1 x 2 = 2 put this in middle column
1 x 2^2 = 1 x (2 x 2) = 1 x 4 = 4 put this in the left column

Add 1 + 2 + 4 = 7 but in binary this is represented as 111

Therefore decimal 7 = binary 111

So when you press the key on number 7 on your keyboard the computer translate that to ASCII and then to 111 which is transmitted to the CPU and then to graphic card, ultimately to the monitor and you see the number 7 appearing.

Answer to question 8

Following from previous answers hexadecimal system is base 16 (hexa is latin for 6 and deci is 10).

24 in hexadecimal can be represented as follows :

8 x 1 = 8 put this in right column
1 x 16^1 = 1 x (16 x 1) = 1 x 16 = 16 put this in left

Add 8 + 16 = 24 but in hexadecimal this is represented as 18

So decimal 24 = hexadecimal 18

Answer to question 9

Bit : **Bi**nary **d**igit it is the smallest size that can store information and can have any of the two values only : 1 or 0.

Byte : this is 8 bits

Word : group of 4 bytes or 32 bits

RAM : Random Access Memory, this is read and write memory where the data is stored in whilst the computer is on, when the computer is turned off the data in RAM is lost.

ROM : Read Only Memory, this is the memory that usually have essential piece of software hard coded into them e.g. in computers the ROM has BIOS (Basic Input Output Software) written into it and it comes on when the user turns on the computer. But when the computer is off the data remains in ROM. ROM cannot be written to.

Hard Disk : this is where user data such as files, images, mpegs ..etc is stored. When the computer is off the data remains on the hard disk.

Megabyte : 1 million bytes

Gigabyte : 1000 million bytes (terabyte is million million bytes)

1 kilobyte = 1024 instead of 1000 sound strange but this is to do with the use of binary terms to approximate decimal number 1000. The binary number 10000000000 (2^{10} or decimal 1024) is close to a thousand.

If our salaries are thought the same way then we will get something extra at the end of the month, unfortunately we live in analogue world that uses decimal and not digital world that uses binary, hmmm but do we really live in analogue world when we are surrounded by computers, what is real and what is fiction is becoming difficult to distinguish and the matrix is all around us. Next question is what is the Matrix!!! ☺

Answer to question 10

ASCII stand of American Standard Code for Information Interchange. It is agreed upon in 1977 and it is a system that allow the representation of alphanumerical characters non-white characters in the computer.

ASCII supported 128 numbers because the binary numbers 0000000 to 1111111 (0 - 127) can be stored in 7 bits. Unicode support 65,536 because this can be stored in 16 bits.

Function to convert string from lowercase to uppercase can be written as follows :

```
String UpperCase(String Line)
{
        int Index;
        for (Index = 1; Index <= Length(Line); Index = Index + 1)
                if ((Line[Index] >= ‘a’) AND (Line[Index] <= ‘z’))
                        Line[Index] = Line[Index] – 32;
        Return(Line);
}
```

The key is the Line[Index] = Line[Index] – 32;

Answer to question 11

Bitmap : representation image sketch by substituting edge with 1s and the rest as 0s

Pixel : stand for Picture Element and it is the smallest part of an image. It can have any value between 0 to 255 (in greyscale) 0 representing black and 255 representing white and any value in between representing grey level

VGA : Video Graphics Array, this is composed of 640x480 pixels and has better resolution than EGA and CGA. Recent graphic monitors can have as high as 1700x1500. The human eye can see in 2000x2000 so technology is approaching the human eye resolution.

Greyscale : represenation of colour variation in shades of grey

Computers can represent colours using the RGB model RGB means Red Green Blue and 255 or 1111 1111 for any of those colours indicates pure colour. So pure blue would be 0, 0, 255. Therefore pure red would be 255, 0, 0. Black 0, 0, 0 and white 255, 255, 255 and so on. You can mix and match colours just as artists do using computer.

Answer to question 12

HTML : HyperText Markup Language

Look the tags up in your note. The main ones to note are:

1) #FFFFFF is hexadecimal colour of the background
2) <H1> increase the size of the font
3) <IMG SRC=”dnastrpx.gif” BORDER=0 > including image on webpage
4) <HR> display hard return line
5) <P> Paragraph space
6) <B> Bold
7) <A HREF=”mailto: …etc “> references the user to the link
8) </B>, </A> </H1>. “/” indicate the end of the effect of the tag. If you don’t put this the page will keep remembering the tag and will look messy