ALevel CS C01 Information representation

Hexadecimal	Denary	Octonary	Binary
F	15	17	1111
E	14	16	1110
D	13	15	1101
C	12	14	1100
B	11	13	1011
A	10	12	1010
9	9	11	1001
8	8	10	1000
7	7	7	0111
6	6	6	0110
5	5	5	0101
4	4	4	0100
3	3	3	0011
2	2	2	0010
1	1	1	0001
0	0	0	0000

Binary to Denary

1	0	1	1	1
2^4	2^3	2^2	2^1	2^0

$1\times2^4+0\times2^3+1\times2^2+1\times2^1+1\times2^0 = 23$

Octonary to Denary

3	2	0	7
8^3	8^2	8^1	8^0

$3\times8^3+2\times8^2+0\times8^1+7\times8^0 = 1671$

Hexadecimal to Denary

3	A	F
16^2	16^1	16^0

$3\times16^2+10\times16^1+15\times16^0 = 943$

Denary to Binary

2 | 59 → 1
2 | 29 → 1
2 | 14 → 0
2 | 7 → 1
2 | 3 → 1
2 | 1 → 1
0

59 ~ 111011

Denary to Octonary

8 | 1671 → 7
8 | 208 → 0
8 | 26 → 2
8 | 3 → 3
0

1671 ~ 3207

Denary to Hexadecimal

16 | 943 → 15~F
16 | 58 → 10~A
16 | 3 → 3
0

943 ~ 3AF

Binary Add

```
  1 0 1 1 1 0 1 0  186
+ 1 1 1 0 1 1 0 1  237
  1 1 1 1 1 0 0 0
1 1 0 1 0 0 1 1 1  423
```

Overflow:
a condition when the result of a calculation is too large to fit into the number of bits defined for storage

Denaty to Octonary

1	0	1	1	1	1	0	1

binary: 10111101

2	7	5

octonary: 275

Denary to Hexadecimal

1	0	1	1	1	1	0	1

binary: 10111101

C	E

octonary: 275

HTML Color

#FFFFFF #333333 #FF00000 #00FF00 #0000FF #00FFFF #9324FC

color depth: the number of bits used to represent each color
black and white, **1bit** per pixel
4 color, **2 bits** per pixel
8 color, **3 bits** per pixel
Image resolution: the number of pixels that make up an image.
400*600 pixels
file size 400 * 600 image, RGB 3 * 16 * 16 color depth :
400 * 600 * 3 * ($\log_2256$) bits
= 240000 * 3 * 8 bits = 720000 byte
= 720000 / 1024 kB = 703 kB
= 703 / 1024 MB = 0.68MB

	R	G	B	range
hexadecimal	93	24	FC	00~FF
denary	147	35	252	0~255
binary	10010101	00100100	11111100	

Calculation of file size:
image file size:
image resolution(in pixels) * colour depth (in bits)
sound file size:
sample rate(in HZ) * sample resolution (in bits) * length of sample (in seconds)

Decimal prefix

Decimal prefix name	Symbol Used	Factor applied to the value
kilo	k	10^3
mega	M	10^6
giga	G	10^9
tera	T	10^{12}

Binary prefix

Binary prefix name	Symbol used	Factor value
bit	b	1 bit
nibble		4 bits
byte	B	8 bits
kibi byte	KiB	1024 B
mebi byte	MiB	1024 KiB
gibi byte	GiB	1024 MiB
tebi byte	TiB	1024 TiB

Denary: + 21
Binary: (signed)

0	0	0	1	0	1	0	1

One's complement: the binary number obtain by subtracting each digit in a binary number

0	1	1	0	1	0	1	0

Two's complement: the one's complement of a binary number, plus 1

0	1	1	0	1	0	1	1

BCD (Binary Code Decimal): use a nibble to represent a denary digit

0.26	0000 0000	0010 0110
0.85	0000 0000	+ 1000 0101
1.11	0000 0001	0001 0001

Usage:
1.on a screen of a calculator.
2. digital time display.

ASCII and Unicode

Standard ASCII code: character set consists of 7-bits codes
Extended ASCII: use 8 bit codes give another 128 codes to allow for non-English alphabets.
Unicode: represent any possible text in code form.
UTF-8: the most popular version of unicode.

Given:	Ask:	Answer:
Hex ~ 41	D	D Hex ~ 44 Denary ~ 64
A	G	G Hex ~ 47 Denary ~ 67

Image (Vector)

Vector graphic: a graphic consisting of drawing objects defined in a drawing list
Drawing list: contains one set of values for each drawing object
Drawing object: a component defined by geometric formulae and associated properties
Property: defines one aspect of the appearance of the drawing object

Vector and Bitmap Usage:

1. **vector** - part of an architectural, engineering or manufacturing design
2. **bitmap** - printer, digital camera. publication, web page

difference	
Vector	Bitmap
made of shapes	made of pixel
scalable without losing quality	loss quality when resized larger

Image (Bitmaps)

Picture element(Pixel): the **smallest identifiable component** of a bitmap image, defined by just two properties: its position in the bitmap matrix and its colour
Color depth: the number of bits used to represent one pixel
Bit depth: the number of bits used to represent each of the red, green and blue colours
Image resolution: the number of pixels in the bitmap file defined as the product of the width and the height values
Screen resolution: the product of width and height values for the number of pixel that the screen can display
File header: a set of bytes at the beginning of a bitmap file which identifies the file and contains information about the coding used
Bitmap file size is **larger than** the size of the graphic along because of the file header. The file header will define the **colour depth and the resolution**

Sound File

Analogue data: data obtained by measurement of a physical property which can have any value from a continuous range of values
Digital data: data that has been stored as a binary value which can have one of a discrete range of values
Sampling: taking measurements at regular intervals and storing the value
Sampling resolution: the number of bits used to store each sample
Sampling rate: the number of samples taken per second
An increased sampling rate and an increased sampling resolution will both cause an increase in file size and accurate representation.

aaaaaaaabbbbbbcc
↓ run-length encoding
a8b6c2

huffman coding

Code	Character
10	e
01	t
111	o
110	h
0001	l
0000	p
0011	w
0010	z

Compression

Lossless compression: coding techniques that allow subsequent decoding to recreate exactly the original file
Lossy compression: coding techniques that cause some information to be lost so that the exact original file cannot be recovered in subsequent decoding
Practice:
vector - text file - lossless
bitmap - bit file - lossy(reduce colour depth) or lossless
sound - bit file - lossy(lower sample resolutuib, time domain to frequency domain) or lossless