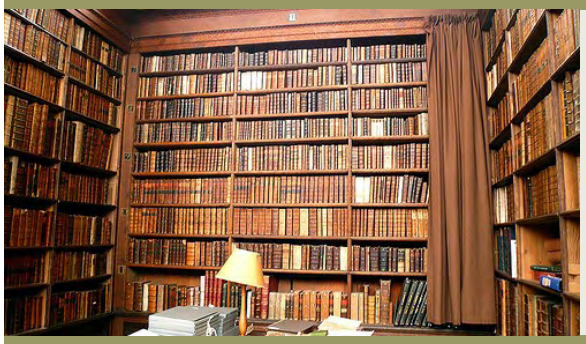
march 2015

monday	tuesday	wednesday	thursday	friday	saturday	sunday
23	24	25	26	27	28	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	1	2	3 Holiday	4	5

notes



april 2015

monday	tuesday	wednesday	thursday	friday	saturday	sunday
30	31	1	2	3 Holiday	4	5
6 Holiday	7	8	9	10	11	12
13 Holiday	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	1	2	3
4	5	6 Computing Science Exam 9am	7	8	9	10

notes

Computing Science – National 5
Course Summary

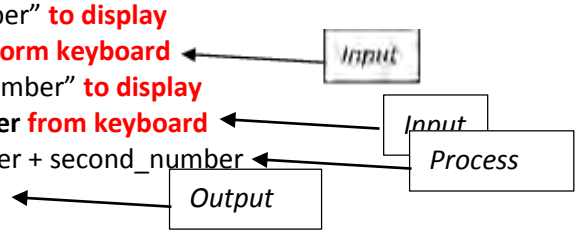
Name:

Software Design and Development		
		Done
Computational constructs	Expressions to assign values to variables	
	Expressions to return values using arithmetic operations (+, -, *, /, ^, mod)	
	Execution of lines of code in sequence demonstrating input – process- output	
	Expressions to concatenate strings and arrays using the & operator	
	Use of selection constructs including simple and complex conditional statements and logical operators.	
	Iteration and repetition using fixed and conditional loops	
	Pre-defined functions (with parameters)	
Data types and structures	String, character	
	Numeric (integer and real) variables	
	Graphical objects	
	Boolean variables	
	1D arrays	
Testing and documenting solutions	Normal, extreme and exceptional test data	
	Syntax, execution and logic errors	
	Readability of code (internal commentary, meaningful identifiers, indentation)	
Algorithm Specification	Input validation	
Design notations (also applies in ISDD)	Pseudocode to exemplify programming constructs	
	Graphical to illustrate selection and iteration	
	Other contemporary design notations:	
Low-level operations and computer architecture	Units of storage: bit, byte, Kilobyte, Megabyte, Gigabyte, Terabyte, Petabyte	
	Translation of high-level program code to binary (machine code): interpreters and compilers	
	Use of binary to represent and store: • Integers • Real numbers (mantissa & exponent) • Characters • Instructions (machine code) • Graphics (bit-mapped and vector)	
	Basic computer architecture: • Processor(registers, ALU, control unit) • Memory • Buses (data and address) • Interfaces	

Information Systems Design and Development		
The following concepts and vocabulary may apply to a range of information systems types and contexts including: Databases, websites, games, mobile applications, kiosk systems		**Done**
Structures and links (database)	Database structure: field, record, file	
	Database structure: flat file, linked tables, primary keys, foreign keys	
	Field types (text, numbers, date, time, graphic, object, calculated, link, boolean)	
	Validation (presence check, restricted choice, field length, range)	
	Database operations search, sort (on multiple fields)	
	Good design to avoid data duplication and modification errors (insert, delete, update)	
Structures and links (web based)	Website, page, URL	
	Hyperlink (internal, external) relative and absolute addressing	
	Navigation	
	Web browsers and search engines	
	Good design to aid navigation, usability and accessibility	
User interface (also applies to SDD)	User requirements (visual layout, navigation, selection, consistency, interactivity, readability)	
Media types	Standard file formats: • Text: txt, rtf • Audio: wav, mp3 • Graphics: jpeg, bmp, gif, png • Video: mp4, avi • Pdf	
	Factors affecting file size and quality, including resolution, colour depth, sampling rate	
	Calculation of file size for colour bitmap	
	Need for compression	
Coding	Scripting languages (including JavaScript)	
	Mark-up languages (including HTML)	
Testing	Links and navigation	
	Matches user interface design	
Purpose, features, functionality, users	Description of purpose, main features and functionality	
	Users: expert, novice, age-range	
Technical implementation (hardware requirements)	Input and output devices	
	Processor type and speed (Hz)	
	Memory (RAM, ROM)	
	Device type (including supercomputer, desktop. Portable devices including laptop, tablet, smartphone)	

Technical implementation (software requirements)	Operating systems	
	Web browsers	
	Specific applications and/or utilities	
Technical implementation (storage)	Local, web/cloud	
	Capacity (in appropriate units)	
	Rewriteable, read-only	
	Interface type	
	Data transfer speed	
	Storage devices • Built-in, external, portable • Magnetic, optical • Solid state	
Technical implementation (networking / connectivity)	Stand-alone or networked	
	LAN/internet	
	Peer-to-peer , client/server	
	Wired, optical, wireless	
Security risks	Viruses, worms, Trojans, hacking	
	Spyware, phishing, keylogging	
	Online fraud, identity theft	
	DOS (Denial of Service attacks)	
Security precautions	Anti-virus software	
	Passwords/encryption	
	Biometrics	
	Security protocols and firewalls	
	Use of security suites	
Legal implications	Computer Misuse Act	
	Data Protection Act	
	Copyright, Designs and Patents Act (plagiarism)	
	Health and Safety regulations	
	Communications Act	
Environmental impact	Energy use	
	Disposal of IT equipment	
	Carbon footprint	

Computing Science – National 5
Course Summary

Software Design and Development	
	Expressions to assign values to variables 
	Expressions to return values using **arithmetic** operations + - * / ^ 
	Execution of lines of code in sequence demonstrating input – process- output The Algorithm below - 2 inputs - 1 process - 1 output 1. **Send** "Enter First Number" **to display** 2. **Receive first_number form keyboard** 3. **Send** "Enter Second Number" **to display** 4. **Receive second_number from keyboard** 5. **Set total to** first_number + second_number 6. **send total to display** 
	Expressions to **concatenate strings** and arrays using the & operator Bob Smith is an example of **concatenation**  

Use of selection constructs including **simple** and **complex conditional statements** and logical operators.

This is a simple statement as there is one conditions

1. If pupil_mark >=50 then
2. send pass message to display
3. Else
4. send fail message to display
5. End if

This is a complex statement as there are two conditions

1. If pupil_mark >=50
2. And assessments_mark = 100 then
3. send pass message to display
4. Else
5. send fail message to display
6. End if

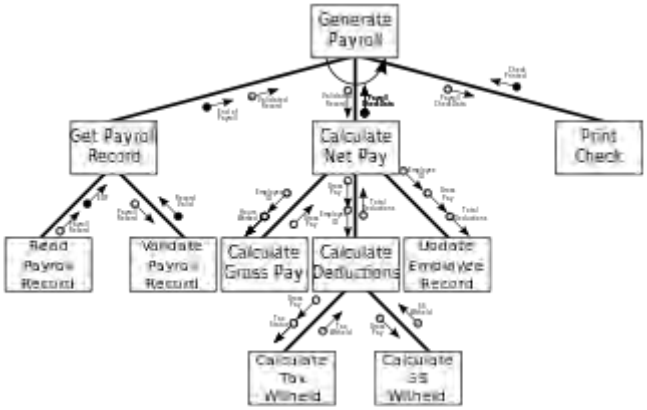
Iteration and **repetition** using fixed and conditional loops
Fixed loop below as it will loop a fixed number of times depending on the users answer

Below is a **Conditional Loop** as it depends whether the user has any money left.

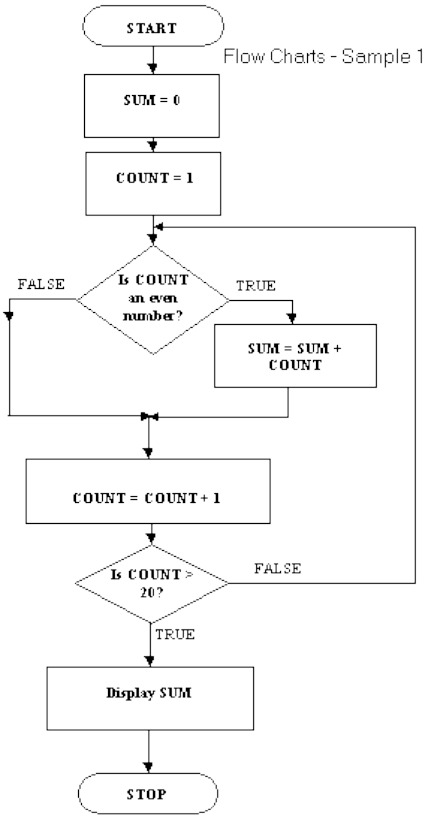
	Pre-defined functions (with parameters) - **RND** will round numbers 22.34 becomes 22 or **Root** 4 will become 2, or 9 will become 3.
Data types and structures	**String** - text variable like name
	integer - a round number used for number of people or items **real** - contains decimals used for distances or measurements
	Graphical objects - pictures
	Boolean variables - Yes or No
	1D arrays - used for a variable with many pieces of data all of the same data type. Pupilname (20)
Testing and documenting solutions	For an exam out of 100 **Normal** – 78, 45,67, 85, 44 **Extreme** – 0, 100 **Exceptional** - -89, bob
	Errors **Syntax** – The rules of the programming language have been broken. E.g. a typing mistake **Displya** rather than **Display** **Execution** – using **Average = total / 0** would give an execution error. **Logic** –will only show up when you run the program. Please see below Counter = 0 Repeat Counter = counter + 1 **Until counter = 0**
	Readability of code **internal commentary** - information about what the program does written by the programmer alongside the actual code. **Green in Livecode.** **meaningful identifiers** - Calling variable names that mean something length or height rather than L or H **indentation** starting parts of the code slightly into the middle of the page making it easier to read.
Algorithm Specification	**Input validation** - checking that what is entered by the user is acceptable e.g. that an age isn't a negative number. 1. **Repeat** 2. **Send "Please enter data" to display** 3. **Receive** data from keyboard 4. **If** data is outwith range then 5. **Send "re-enter data" to display** 6. **Until** data is within range

Design notations also applies in ISDD	**Pseudocode** example 1
	`SET total TO 0`
	`SET count TO 0`
	`WHILE count < 10 DO`
	`  RECEIVE nextInput FROM KEYBOARD`
	`  SET total TO total + nextInput`
	`  SET count TO count + 1`
	`END WHILE`
	`SEND total / 10 TO DISPLAY`
	Pseudocode example 2
	`RECEIVE age FROM KEYBOARD`
	`WHILE age < 0 OR age > 130 DO`
	`  SEND ''Enter an age between 0 and 130'' TO DISPLAY`
	`  RECEIVE age FROM KEYBOARD`
	`END WHILE`

Structure Diagram



Flow Chart



Low-level operations and computer

Units of storage:
8 bits = **1** byte
1024 bytes = **1** Kilobyte
1024 Kilobytes = **1** Megabyte
1024 Megabytes = **1** Gigabyte
1024 Gigabytes - **1** Terabyte
1024 Terabytes = **1** Petabyte

Translation of high-level program code to **binary** (**machine code**):

interpreters - translates it line by line, spots errors more easily but takes longer.
compilers - creates the machine code in one step, less likely to spot errors but more efficient. Creates a **run time version** that can't be edited.

Use of binary to represent and store:
Real numbers uses **mantissa** & **exponent** - **2.56** X 10^{5}
Mantissa = 2.56 Exponent = 5
Characters - **ASCII** allocates a different **binary code** to each letter, **A = 00100001**
instructions, **machine code** - the only characters the processor can understand 10101011101
Graphics **bit-mapped** and **vector**
Bit-mapped, graphics are made up of **pixels**

Basic computer architecture:

Processor

- Registers - temporary storage locations holding data being processed
- ALU – deals with comparisons and arithmetic calculations
- control unit - controls all other parts of the processor, ensures instructions are carried out in the correct order

Memory

- Random Access Memory - temporary data storage only held as long as the computer is switched on.
- Read only memory - Permanent memory not lost when the computer is switched off. Data stored on a hard disk or a memory stick.

Buses

- data - carries data to and from the processor, memory and other devices. Bi-directional
- address - carries address info from processor to the memory.
- control - made up of a number of separate wires.

interfaces

allows a processor to send and receive data to and from peripherals like printers, scanners, keyboards and projectors.

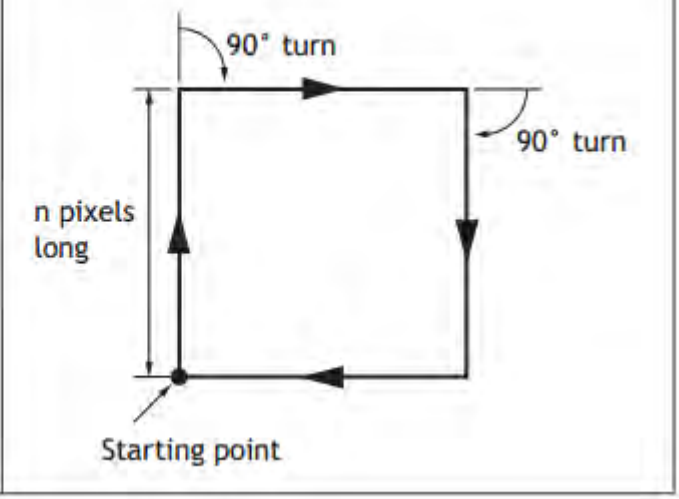
Binary Decimal

128	**64**	**32**	**16**	**8**	**4**	**2**	**1**	
1	1	1	1	1	1	1	1 =	**255**
0	1	1	0	1	0	0	1 =	**105**

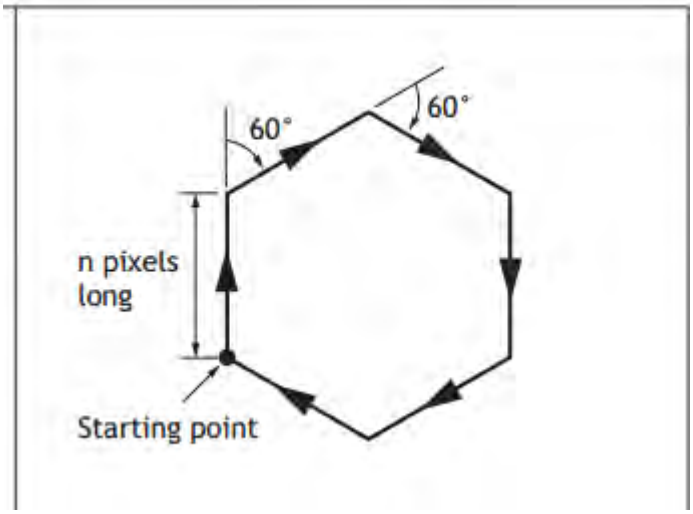
Computational Constructs

```
Square(n)

    REPEAT 4 TIMES
    move(n)
    rotate(90)
    END REPEAT
```



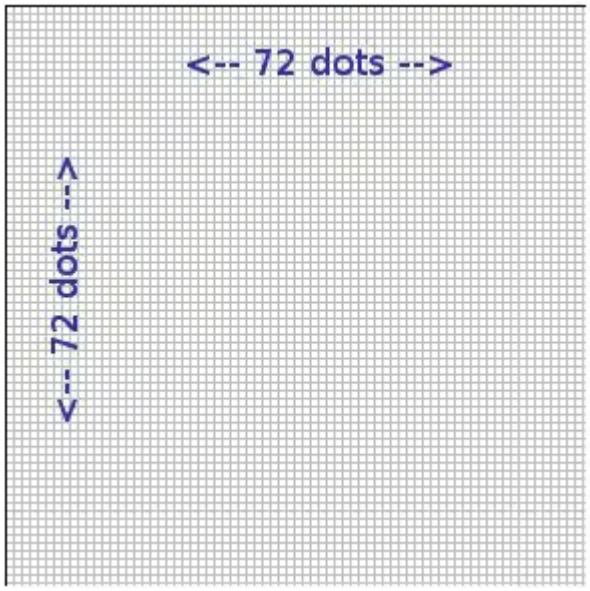
Hexagon(n)
Repeat 6 Times
Move (n)
Rotate (60)
End Repeat



Calculations

Formula
Number of pixels = image width x resolution x image height x resolution

Example 1



This is enlarged but is 1 inch by 1 inch.
In that case there are 72 x 1 x 72 x 1 = 5184 pixels

Example 2
Bitmap with a resolution of 600x600 pixels in 8 bit colour.
Storage requirements

600 x 600 x 1 bytes = 360000
It is 1 byte as it is 8 bits per pixel
360000/1024 = 351.6 kilobytes

Example 3
Calculate the number of pixels in 4 inch by 5 inch photograph scanned which has a resolution of 600 dots per inch.

Pixels = 4 x 600 x 5 x 600 = 7,200,000 bits
7,200,000 / 8 = 90000 bytes
90000 bytes / 1024 = 878.9 Kb

Vector Graphics

It is possible to edit **each object** separately, for example, change the shape, colour, size and position.

Even if an object in a vector graphic is quite large, it doesn't need a lot of computer memory. Therefore the file size of a vector graphic is often very **small**.

Vector graphics are **scalable** when you resize them, they **do not lose quality**.

Information Systems Design and Development

The following concepts and vocabulary may apply to a range of information systems types and contexts including: Databases, websites, games, mobile applications, kiosk systems.

Structures and links database

Database structure:

field - the fields below; Exhibitor, Company Name, Area, Stand Number, Product Reference, Item Name, Price (£)

record - A single row in a table, there are 8 records below

file - the entire database

Database structure:

flat file all the data is stored in one table

Exhibitor Code	Company Name	Area	Stand Number	Product Reference	Item Name	Price (£)
SG100	FutureTech	Tech Zone	22	GD101	3D Printer	1245
SG100	FutureTech	Tech Zone	22	GD102	3D Printer XL	1699
SG176	Digital80	Photo Zone	49	GD208	360 Camera	800
SG203	TechATive	Active Zone	123	GD187	GoJet	1300
SG203	TechATive	Active Zone	123	GD324	RollerJet	500
SG489	ABCMusic	Music Zone	234	GD387	Xkey	350
SG489	ABCMusic	Music Zone	234	GD367	Xkey Plus	500
SG512	HitechGaming	Games Zone	288	GD654	HowPower2	149

Drawbacks Data duplication Data inconsistency or update/ deletion/insertion anomalies Data integrity errors (due to data inconsistency) Inconsistent search results in multi-value fields

linked tables

Table would be split into

EXHIBITOR(Exhibitor Code, Company Name, Area)

PRODUCT(Product Ref, Item name, Price (£), Exhibitor Code*)

primary keys - these are unique identifiers for each row in a table

foreign keys – a primary key from a different table

Database operations

Simple search – a search on ABC Music would return the following

SG489	ABCMusic	Music Zone	234	GD387	Xkey	350
SG489	ABCMusic	Music Zone	234	GD367	Xkey Plus	500

Complex search – Searching on two (or more) fields at once for example Company name = FutureTech and Price > 1500 would return the following

SG100	FutureTech	Tech Zone	22	GD102	3D Printer XL	1699

Simple sort – Sorting a table by one field, class registers are sorted by surname

Allan, Tom
Bennet, Gordon
Clark, Petula
Donaldson, Luke
Elliot, Paula

Complex sort – same as above but if two people have the same second name they are sorted by first name as well

Allan, Tom
Bennet, Gordon
Clark, Petula
Donaldson, Luke

Elliot, Paula
Ferguson, Alex
Ferguson, Sarah
This is in Alphabetical or Ascending order

Field types
text – A Roberts, ML1 3XF
numbers - 124
date – 29 April 2012
time – 08:30
object – Picture, video or sound file.
calculated – pay * 20%
link – www.bbc.co.uk
Boolean – either yes or no

Validation
presence check – data must be entered before the user can continue, usually has a star.
restricted choice - please see below, the user can only select one option.

Benefits

Reduces the chance of human error
Does not require the user to type a text response
Speeds up the ordering process as inputs are reduced to mouse clicks
Allows the use of a touchscreen

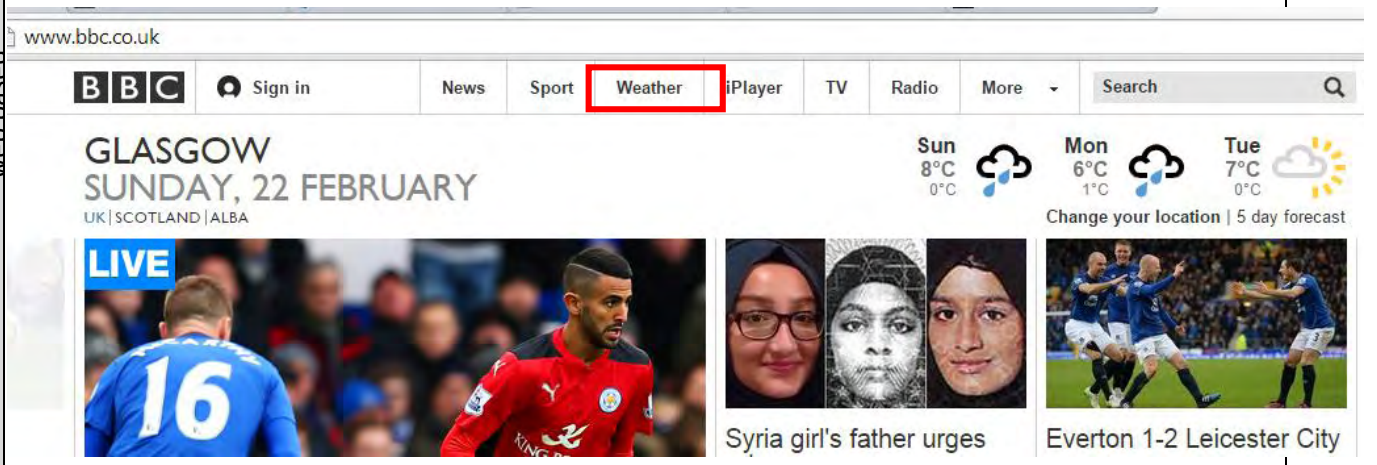
Good design to avoid data duplication and modification errors (insert, delete, update)

Flat file databases can lead to errors as shown below

DVD code	Title	Cost	Date out	Date in	Member number	Name	Telephone number
002	Finding Nemo	£2.50	03/09/04	04/09/04	1034	John Silver	142536
003	American Pie	£2.50	27/08/04	28/08/04	1056	Fred Flintstone	817263
003	American Pie	£2.50	01/09/04	02/09/04	1012	Isobel Ringer	293847
008	The Pianist	£2.50	04/09/04	06/09/04	1097	Annette Kirton	384756
011	Notting Hill	£2.50	27/08/04	28/08/04	1012	Isobel Ringer	293847
014	Prime Suspect	£2.00	27/08/04	28/08/04	1097	Annette Kirton	384756
015	Shrek	£1.50	10/09/04	11/09/04	1034	Joan Silver	142536

Is it a man John Silver or a woman Joan Silver?

<table>
<tr><td rowspan="4">Structures and links
web based</td><td>Website – a series of web pages linked together, bbc.co.uk has thousands of linked pages
Page – A single page written in html on the internet, normally forms a website when linked with other pages
URL - Uniform Resource Locator - http://www1.skysports.com/football/</td></tr>
<tr><td>Hyperlinks
Internal – links to pages on the same site
External – links to a completely different website.

relative addressing – code to link to weather would be weather
Benefit – less coding, link will still work if the domain name changes
absolute addressing - code to link to weather would be
Weather
Benefit – easier to follow the code as it shows the whole address.</td></tr>
<tr><td> 
</td></tr>
<tr><td>Navigation - back, forward, home.
Web browsers - software allowing web pages to be viewed. Firefox, Chrome, IE
search engines - provide a list of links when a user types a search. Google, Yahoo, Bing
Good design to aid navigation - links clearly marked, consistent style
usability - Video clips, forums
accessibility - large text available, alt tags on pictures</td></tr>
<tr><td>Testing websites</td><td>Check navigation
Checks all hyperlinks/hotspots
Ensure graphics are not pixelated
Ensure audio clips run
Check JavaScript issues
Check compatibility with browsers</td></tr>
<tr><td>User interface also applies to SDD</td><td>User requirements
visual layout - eye-catching, simple to use and clear of cluttered buttons and text.
navigation - hierarchical, with links organised into sub categories, or linear, where pages are visited in one step-by-step order.
selection – options include clicking on a menu or radio buttons or filling in a form.
consistency – using the same font, colours styles & menus
interactivity – using video/audio, allowing users to post comments etc
readability – use white space and short pages to ensure it is easy to read.
Accessibility – Reading text aloud or having large fonts for users with eyesight issues.</td></tr>
<tr><td>Media types</td><td>Standard file formats:
Text: txt, rtf
Audio: wav, mp3
Graphics: jpeg, bmp, gif, png
Video: mp4, avi
Pdf: Portable Document Format</td></tr>
</table>

	Factors affecting file size and **quality** **resolution** - the number of pixels used to make up the picture. **colour depth** - the number of possible colours used to make up a pixel. The more possible colours the greater the file size. **sampling rate -** in sound files the number of recordings taken per second., the greater the sample rate the higher the quality and file size.
	Need for compression - reduces the file size so that the web page loads more quickly. Reducing bit depth has the same impact. Quality of the image is affected.
Coding	**Scripting languages** - JavaScript is used to make the webpages interactive, eg display date/time
	Mark-up languages - HTML used to code the webpages, styles can be used.
Purpos, features	Description of **purpose**, **main features** and **functionality**
	Users: expert **-** use keyboard short cuts **novice -** require extra help, clear menus age-range
hardware	**Input devices -** put data into the processor e.g scanner, keyboard, mouse **output devices** - display data from the processor e.g. monitor, printer, projector,
	Processor type - dual, triple and quad code **speed (Hz) -** 1.8GHz to 3.4Ghz (faster)
	Random Access Memory - used for current files, temporary storage of data which is lost if the device is switched off. **Read Only Memory -** ROM retains its memory even after the computer is turned off.
	Device types **Supercomputer** - large processing power and memory, used by large organisations. **Desktop -** processing power but not portable. **laptop -** portable but generally less powerful than a desk top **tablet -** portable but no physical keyboard. **smartphone -** use 3G or connect to wifi. same functions as a tablet.
software	**Operating systems -** controls and organises the general operation of the computer. Windows, iOS, Android
	Web browsers - allows web pages to be viewed e.g Chrome, Firefox, IE
	Utilities - software installed on the Operating System e.g defragment, anti virus, compression
storage	**Local -** storing data on your own device **web/cloud -** storing data to a remote server on the internet. **Benefits of the web/cloud** Can access data from any computer device remotely. No requirement for own servers, less need for own technical support on site. Automatic backup/recovery of data
	Capacity - Measured in GB & TB eg laptops have either 500GB or 1TB of storage. Servers in companies have far more.
	Rewriteable - Data can be removed and added any time e.g. USB stick **read-only -** as soon as data is saved onto the device it can't be edited. e.g FIFA15
	Interface - Allows data to be converted between the processor and devices like printers and keyboards .
	Data transfer speed - Thunderbolt is faster than usb 3.1 which in turn is faster than firewire
	Storage devices • Built-in - each device like a laptop or phone has storage space within it. • external - external hard drives allow users to do backups • portable - usb drives are very portable • Magnetic - like a an old style video tape. • optical - DVD and CD, can become scratched Solid state - robust as there are no moving parts
networking	**Stand-alone -** using a device but not connected to the internet, not common now. **networked -** a number of devices linked together to share data, internet, printers, communication.
	LAN - Local Area Network - A number of devices linked together in 1 location e.g. a school **WAN** - Wide Area Network - A network linking different locations used by banks & supermarkets

	internet - largest WAN, about 10 billion devices linked together
	Client Server Data can be stored/accessed centrally. Only accessible by registered users. Different access rights for users . Shared peripherals . Expensive as they have to purchase servers and additional hardware.
	Peer to Peer Resources stored on device available to other peers . No centralised stored .Not as secure as Client Server Risk from viruses
Security risks	**Viruses -** software written specifically to cause hard to a computer system **Worms -** malware that can copy itself from device to device **Trojans -** harmful software designed to look like something useful to the user e.g. a downloaded mp3 file. **Hacking -** unauthorised access to a computer system.
	Spyware - records actions carried out on a computer without the user knowing. Can find out websites visited and passwords. **Phishing -** Sending fake emails which link to a fraud site asking people to enter secure information like account numbers and passwords. **Keylogging -** Software which records every key stroke entered onto a computer. The fraudsters can then work out usersnames/passwords.
	Online fraud - paying for goods that don't arrive or being conned into sending bank details. **Identity theft -** criminals find out enough personal details about someone to obtain loans/credit cars/products in their name.
	DOS Denial of Service attacks - so many requests are sent to a computer in a short space of time that it crashes.
Security precautions	**Anti-virus software** - Software like Avast and Norton which scan for viruses and delete them.
	Passwords – guidelines to make a strong password, number of characters, mix of lower/uppercase, special characters.
	Encryption – Converting a message into code so that it can't be read by a hacker
	Biometrics – recognises parts of the body to allow or restrict access – fingerprints, iris, (eye) facial recognition.
	Security protocols - makes the website more secure when users are accessing online banking etc **Firewalls -** block unwanted data from arriving in a network
	Security suites - a package containing a number of different security tools to ensure the user is fully protected from all types of threats
Legal implications	**Computer Misuse Act -** illegal to hack into computer systems and create/send malware like viruses/trojans etc.
	Data Protection Act - data subjects have the right to see data held about them, any errors corrected, personal data should not be transferred outwith the EU.
	Copyright, Designs and Patents Act - illegal to copy software, music and movies.
	Health and Safety regulations - eyesite can become damaged and Repetitive Strain Injury can happen. The solutions are eye tests and regular breaks.
	Communications Act - makes it illegal to use a neighbours wifi without permission and trolling on social media deliberately upsetting other users.
Environmental impact	**Energy use** - Every electrical device, including computers, use energy, powersaving and standby mode limit the amount of energy used.
	Disposal of IT equipment - Computers contain "heavy metals" which cause pollution. Options for disposal include; give it to charity, sell it, part exchange for a new PC, have it recycled. Make sure all data is wiped first.
	Carbon footprint - amount of greenhouse gases produced, ways to reduce it are; videoconferencing rather than meetings, make electronic copies of documents rather than printing.