

## Chapter 0 Methods of Answering

When compare A against B, the drawback for A is the advantage for B.

When no more points to write, try to connect/relate to other chapters/components.

Giving an example sometimes worth 1 mark.

Use as many technical terms as possible.

建议:

Chapter 2 Bit Streaming, 好几年没考了, 而且一考就是6分起步

Chapter 1 Vector Graphics, 一定要小心, 忘了就没分, 而且一般都有4分

Chapter 3 CSMA/CD 近几年的热点, 一般都是4分起步, 忘了也是没分

Chapter 5 Embedded system 一定要记住 build in microprocessor + solve a small and specific task (in a large system), 一般是1分题但是估计很多人会错

HDD 的机理要背, 6分题, 其他的storage机理没出过背不背应该无所谓 (???)

实在不行就瞎编吧, 围绕考试的syllabus编的合理一般都能拿很多分的

Recommend: <https://haoran-jie.github.io/Notes/> 友情推荐, 详细程度比这个高多了

## Chapter 1 Information Representation

### Run Length Encoding (an example of lossless)

Consecutive pixels with same value // Repeated characters

Is stored as a single data value and a count

### Vector Graphics vs. Bitmap Image

*(file header) = metadata Always answer this in any header like components (data dictionary)*

Bitmap is made up of pixels

**Bitmap files take up more memory space**

Enlarging a bitmap can mean the image is pixelated

**Vector graphic can be enlarged without the image becoming pixelated**

Bitmap images can be compressed

**Vector graphic images do not compress well**

Bitmaps are suitable for photographs

Vector graphics are suitable for more geometric shapes

Bitmap graphics use less processing power than vector graphics

A bitmap would be more difficult to edit because each pixel would need to be edited separately

### Vector Graphics

**(like CSS) Property** is the data about the shapes

*Black lines, white fill, font of letter*

**(like HTML) Drawing List** A list that stores each separate object, each shape has its own drawing list

*triangle, capital letter, rectangle, line, circle*

### Lossless vs. Lossy Compression

Data is loss and the decompressed file is not the /same as original/loss original details

Smaller file size, informational will not be noticed

Discard certain information

### ASCII

128 character for normal, 256 character for extended.

Each character has its own **unique** integer

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The characters are **replaced** by that integer  
The codes are stored in the **order** in the word  
Only English language

## Unicode

8/16/32 bits  
Many languages

## Sound

To get an approximation of the sound wave  
more accurate representation of analogue sound

## Compression Methods

Reduce sampling rate  
Reduce sampling resolution  
Reduce frame rate  
Crop the image  
Decrease bit depth  
Reduce image resolution

## Chapter 2 Communication

### Network

The employee's computers are the clients  
The server hosts the (shared) files  
An employee can request a file from the server from any of the client computers  
Several employee can access the same file at the same time.

### LAN

Device connected over a small geographical area  
Uses a dedicated infrastructure// company-owned infrastructure

### Public IP vs. Private IP

#### Public IP

Assigned by ISP  
Access by anyone using the internet  
Get internet service  
Unique

#### Private IP

Assigned by the router or gateway  
Address cannot be accessed by anyone  
only used within the local network  
Can be duplicated in other LAN

### IPv4 vs. IPv6

#### IPv4

4 groups of 8 bits  
Range from 0 to 255

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(.) separator

Eg 114.5.1.4

## IPv6

8 groups of 16 bits/4 hexadecimals

Range from 0000 to FFFF

Allow zero compression at most once

(:) separator

Eg 1145:1419:1981:00AA:AAAA::

## Router vs. Gateway

Connect two or more networks

Connect a local network to WAN

Receive packets and send to destination

Assigned private IP address

Router: used in similar network// same protocol + Store a routing table

Gateway: used in dissimilar network// different protocol

## Router Only

store/update/maintain a routing table

find destination of packets using the IP address

forward packets to the destination

Find the most efficient path to destination

Maintain a table of MAC and IP address

## (W)NIC (Wireless) Network Interface Card

Is needed to allow a device to connect to a network

Part of the device hardware and frequently contains the MAC address generated at the manufacturing stage

## Ethernet

Is a protocol for wired LANs

Node, medium, and frame

IP address conflict problem -> restarting the router

Collision (broadcast transmission) -> CSMA/CD

## CSMA/CD

//2021:

A node (wishing to transmit) listens to the communication channel

...data is only sent when the channel is free // ... if channel is free data is sent

Because there is more than one computer connected to the same transmission medium

... two workstations can start to transmit at the same time, causing a collision

If a collision happens, the workstations send a signal / abort transmission

...and each waits a random amount of time before attempting to resend

//2022:

CSMA/CD is a protocol used to detect and prevent collisions in a bus topology

before transmitting, a device checks if the channel is busy

If the channel is busy the device waits // if the channel is free the data is sent

because there is more than one computer connected to the same transmission medium

... two workstations may start to transmit at the same time, causing a collision

If a collision is detected by the device, transmission is aborted / a jamming signal is transmitted

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both devices wait a (different) random time and then try again

## Client Side Model

Central security

Password and username to access network

Centralized backup

Centralized file/resources

The server holds the customer account data  
and performs the requested tasks / processes.

The computers used by the clients that send requests to the server

Which returns the result of the request

## Advantage

*Refer to drawback of p2p*

## Peer to Peer Model

All computers are of equal status

data is distributed across each computer

Computers can communicate and share resources

Each computer is responsible for its own security

*Each device both upload and download resources*

*Peers to participate as equal*

*Access data form other nodes*

*No authenticating*

*Suitable for small size*

## Drawbacks

Reduced security // no central management of security

... only as secure as the weakest computer on the network

... each computer is at risk from viruses from other computers

**(BACKUP)** No central management of backup

... if the data from one computer is not backed up it is lost to all of them

**(FILE)** No central management of files/software

... consistency may be difficult to maintain

... each computer may have different software from the others

Individual computers may respond slower

... because they are being accessed by other computers

In order to share files etc. all the computers involved need to be switched on

... so the files etc. may not be always available

## Thin Client vs. Thick Client

### Thick

✓ more robust, clients have more control

x less secure, each client needs to update data and software

Do not connect to a server

Relies heavily on local resources

More tolerant on slow network connection

### Thin

✓ Less expensive to expand

✓ All devices are linked to a server

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- ✓ Server can offer protection
- x high reliance on server
- x high start up cost

Always relies on a connection  
Requires few local resources  
Relies on fast network  
Data is stored on a remote server

## Network Models

Star, Mesh, Bus, Hybrid

## Wired vs. Wireless

### Wired Connection (Copper/fiber optics)

Faster connection  
More stable connection  
More Secure connection  
Signal does not degrade

### Wireless Connection (Wi-Fi/Bluetooth)

The device is free to move  
Easy to expand  
Easy to set up  
Multiple connections at the same time

## Satellites

Suitable for long distance  
Use a range of frequencies to prevent signal interference

## Copper wire

Cheaper  
Can travel in two directions  
Can bend

## Fibre Optics wire

Less interference  
Faster transmission speed  
More secure  
Greater bandwidth  
Less signal degrading

## WWW vs. Internet

WWW is a collection of interlinked, hypertext documents/webpages/multimedia resources (accessed via the Internet)  
WWW stores HTML pages  
Internet is the global infrastructure of interconnected computer networks  
The Internet uses TCP/IP protocol  
WWW uses HTTP protocols

## Cloud Computing

### Advantage

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Can be accessed anywhere with Internet access  
Do not need to install security // security might be better  
Do not need to perform backups  
Do not need to buy specific software/hardware  
Can easily share documents  
Can have multiple people working on the same document

## **Disadvantage**

You cannot access it if no internet access  
Reliant on someone else to backup  
Reliant on someone else for security // can have poorer security  
Cannot access if server goes down

## **Bit streaming (Personally I think its similar to cloud computing, the same answering method can be applied)**

sequence of digital signals / bits  
over a communication path / Internet  
transfer of data at high speed  
requires fast broadband connection  
requires some form of buffering  
bits arrive in the same order as sent

## **Advantage**

no need to wait for a whole file to be downloaded  
no need to store large files on user's computer  
allows on demand playback  
no specialist software is required for playback in browser

## **Disadvantage**

video stops / hangs if very slow Internet / broadband speed low  
video stops / hangs if inadequate buffering capacity  
loss of Internet means can't access films / files  
viruses can be downloaded from the websites

## **On demanding streaming vs. real time streaming (this is very unpopular topic, only once in 10 years)**

### **On Demand**

digital video tape is converted to bit streaming  
video files are then uploaded to a dedicated server  
a link for the encoded video is placed on a web site  
a user clicks on the link to download the encoded streaming video; the streamed video is then broadcast to the user as and when they require it  
can be paused / can go back and re-watch / fast-forward, etc

### **Real life**

an event is captured live with a video camera  
the video camera is connected to a computer  
the video signal is converted to streaming media files (encoded) on the computer  
the encoded file is then uploaded from the computer to a dedicated streaming server

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the server then sends the live images it to all users requesting it as real-time video streaming cannot be paused etc.

## DNS

DNS = Domain name system // Domain name service // Domain name server

the true domain name (e.g. cie\_exams.co.uk) is resolved/turned into an IP address by DNS

DNS server stores a database/list of URLs with matching IP address

a DNS server may need to pass a request onto another DNS server

DNS server adds returned IP address and URL to its cache/database

DNS server may return an error message if requested domain name is invalid or does not exist

DNS server returns IP address to browser

## URL

Uniform resource locator

Reference address to a resource/website on the Internet

Includes protocol used /includes domain name

HTTP + domain name + file path

## Chapter 3 Hardware

### Buses

Control (two direction)

Address (one direction)

Data (two direction)

### RAM vs. ROM

RAM is volatile ROM is permanent

RAM can read and write ROM can only read

RAM = running data ROM = boot up instructions (BIOS)

### DRAM vs. SRAM

DRAM has to be refreshed SRAM do not has to be refreshed

DRAM use single transistor and capacitor SRAM use many transistor and capacitor

DRAM store bits with charge SRAM store bits with flip flop

DRAM more power < SRAM less power

DRAM cheap > SRAM expensive

DRAM slow access time < SRAM fast access time

DRAM high storage > SRAM low storage

aHard drive

### Alternative MS

#### Hard Drive

Large capacity...

to store videos / images / sound files with large file sizes

Reasonably fast access speed...

Users will not have to wait for videos to load

Inexpensive per unit storage...

If a large number of needed for different exhibits, the cost can be kept low

Does not need to be moved

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So moving parts unlikely to be damaged

Slower degradation of data

So will last longer / be more reliable under heavy use

## **Solid state**

Large capacity

To store videos/images/sound files with large file sizes

Fast access speed...

Users will not have to wait for videos to load

Reliable...

Can be dropped/damaged and will likely still work / no moving parts

Quiet...

No moving parts

## **Embedded System**

Built in system that includes a microprocessor that performs one specific task

**(Built in + microprocessor + one specific task)**

+ small in size easy to fit in device

+ Cheap

+ Dedicated to one task

+ Consume less power

- difficult to upgrade

- Wasteful

- Not secure

## **Hard Disk Drive**

Platter made of aluminum glass.

Platters rotate at high speed.

Electronic circuits control the movement of the **arm** and the **head**

The surface of the platter is divided into **concentric** tracks and sectors

One track in one sector is the basic unit of storage called **block**

Writing: variation in current (head) -> magnetic field (disk)

Reading: variation in magnetic field (disk) -> current (head)

Cheap per unit and large

## **Solid State Drive**

No moving parts

Robust

Low latency

Less power

Run much cooler

Lighter

## **Flash memory (NAND)**

## **EEPROM (NOR), EPROM, PROM**

PROM can be set once, EPROM and EEPROM can be overwritten multiple times.

EPROM needs to be removed from device EEPROM can be erased in situ.

EPROM and can be erased using UV light, EEPROM can be erased using voltage (without removing it from the device)



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EPROM must be entirely erased before rewriting, EEPROM does not have to be entirely erased before rewriting.

## USB

A devices automatically detected and configured when first attached/plug and play  
it is nearly impossible to wrongly connect a device

USB has become an industrial standard

supported by many operating systems

USB 3.0 allows full duplex data transfer

later versions are backwards compatible with earlier USB systems

allows power to be drawn to charge portable devices

## Microphone

The microphone has a **diaphragm**

The incoming sound wave cause vibration of the **diaphragm**

Causing a magnet to move past a coil

An electric signal is produced

## Speaker

The digital data pass trough a **digital to analogue converter**

This is them passed through an **amplifier** to create a large current

This electric current is converted to sound by the **loudspeaker**

*Takes an electrical signal and translates it into physical vibrations to create sound waves*

*An electric current in the coil creates an electro-magnetic field*

*Changes in the audio signal causes the direction of the electric current to change*

*The direction of the current determines the polarity of the electromagnet*

*The electro-magnet is repelled by or attracted to the permanent magnet*

*Causing the coil to vibrate*

*The movement of the coil causes the cone/diaphragm to vibrate*

*That vibration is transmitted to the air in front of the cone*

*The amount of movement will determine the frequency and amplitude of the sound wave produced*

## Screen Comments

Cost, Visibility, Muti-touch, durable, stylus

### Capacitive Screen

Made up of many layers of glass that act like capacitors creating a electric field

Microprocessor determines the coordinate of where the screen was touched

✓ cost, visibility, durability, multi touch

x stylus

### Resistive Screen

Upper layer polyester

Lower layer glass

Microprocessor determines the coordinate of where the screen was touched

✓ cost stylus

x visibility durability multi touch

## Sensors

Sensors sends to microprocessor...

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Converted by ADC  
(analogue to digital converter) ...  
Compare with set value ....  
If inside of range then ...  
If out side of range then ...  
This process is continuous

## Laser Printer

Drum is given a positive charge  
Drum rotates  
**Laser** beam give negative charge on drum  
The negative charge position is the text/file  
Drum is coated with **toner** (positive)  
Paper (negative) roll over the **drum**  
Paper go through **fuser** to melt the ink  
**(Laser->toner->drum->fuser)**

## MS

The revolving drum is initially given an electrical charge  
A laser beam (bounces off moving mirrors) scans back and forth across the drum  
...discharging certain points (i.e. 'drawing' the letters and images to be printed as a pattern of electrical charges)  
The drum is coated with oppositely charged toner  
The drum rolls over electro-statically charged paper  
The 'pattern' on the drum is transferred to the paper  
The paper is passed through the fuser to seal the image  
The electrical charge is removed from the drum  
(经典的瞎编题) 直接写出 Laser Toner Drum Fuser 拿到四分然后剩下瞎编就行

## Inkjet Printer

Printer head moves from side to side across the paper printing the text/image  
The paper is advanced very slightly to print next line  
**Thermo bubble (heat)/Piezoelectric (electricity)**  
Different methods to expand the bubble and eject ink on paper

## Chapter 4 Processor Fundamentals

### Address bus, Data bus, memory bus

#### Register transfer notation

MAR <- [PC]  
MDR <- [[MAR]]  
CIR <- [MDR]  
PC <- [PC]+1

*Answering technique, What's before? What's after? What's transferred?  $1+1+(1) = 2+(1)$ pts*

## MAR

Stores the next addressed to be fetched  
Held in the PC, the data at this address is then retched  
(Before = PC, After = MDR, data = Address) = 2+1pts

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## MDR

Stores the data from the address pointed to by the MAR

The data in it is copied to the CIR

(Before = MAR, After = CIR, data = Data) = 2+1pts

## Control Unit

to synchronise the actions of other components in the CPU

to send / receive control signals along the control bus

to manage the execution of instructions (in sequence)

to control the communication between the components of the CPU

## Interrupts

At the end of each F-E cycle check interrupts

Processor check priority of interrupt

If the interrupt has high priority then

Save current content of registers in stacks

type of interrupt identified

call the appropriate Interrupt Service Routine

When ISR finished, restore registers from stacks

And check for further interrupts

Processor treat next F-E cycle

## PSTN Public Switched Telephone Network

Uses multiple telephone lines

Data is transmitted in both directions at the same time

The communication passes through different switching centers

## Assembler

Pass 1: Symbol table

Pass 2: Object code

## Assembly Language Instructions

Data Movement

Input and output instructions

Arithmetic operation instructions

Compare instructions

Conditional and Unconditional Jumps

## Addressing Methods

Absolute, **Direct**, **Indirect**, **Indexed**, **Immediate**, Relative, Symbolic

## System clock

Ensure synchronization

Each instruction is executed on a clock pulse // one F-E cycle is run on each clock pulse

so the clock speed dictates the number of instructions that can be run per second

## Clock Speed

Higher clock speed means more FE cycles per second

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Determines the number of cycles the CPU can execute per second

Increasing clock speed increases the number of operations/number of fetch-execute

Cycles that can be carried out per unit of time

...however, there is a limit on clock speed because the heat generated by higher clock speeds cannot be removed fast enough

## Cores

Each core processes one instruction per clock pulse

More/multiple cores mean that sequences of instructions can be split between them

## Bus width

allows the transfer of more data each time

the width of the data bus determines the number of bits that can be simultaneously transferred

increasing the width of the data bus increases the number of bits/amount of data that can be moved at one time (or equivalent)

...hence improving processing speed as fewer transfers are needed

## Cache

cache is fast access memory (close to the CPU)

cache stores frequently used instructions / data

... more cache means more instructions / data can be transferred faster

... less swapping between RAM and cache

prevents the CPU idling while waiting for data

## Chapter 5 System Software

**Operation System** (记住首字母就很好背了)

**File management**

Storage space is divided into file allocation units

Space is allocated for particular files

Maintain directory structure

Provide file naming conventions (.txt .mp3 .jpeg)

Implement access rights

Read, Close, Delete files

**Process management** *Chapter 16 Not covered*

Multitasking

**Hardware management**

Communicating with all inputs and output devices

Using device drivers

Translating data from a file into a format that IO device can understand

Give priority to hardware resources

Handle interrupt and error messages

**Memory management**

Memory optimization, allocate **dynamically** memory for a number of running application.

Keep track of free memory and allocated memory.

Memory organization, determine how much memory is allocated.

Memory protection, ensures that two competing applications cannot use same memory.

Through FENCE which defines the boundary for applications.

**Security Management** *Chapter 6*

## Utility Software

Disk formatter - sets up a disk so it is ready to store files

Antivirus - put harmful programs into quarantine and remove them, make more space in RAM

Defragmentation - make memory location of files continuous, less time taken to access files

Disk repair - scan for errors in a disk, prevent bad sectors because it identifies

Compression - reduce file size

Back up - create a copy of data in regular routine in case the original is lost

## Dynamic Link Library (注意DDL和Library Routine的区别)

(main) memory requirements for program are reduced as dynamic link library is loaded only once / when required

the executable file size is smaller because the executable does not contain all the library routines

maintenance not needed to be done by the programmer because the DLL is separate from program

no need to recompile the main program when changes are made to DLL because changes / improvements/ error correction to the DLL file code are done independently of the main program

## Library Routines

Program libraries store pre-written functions and routines

The program library can be referenced/imported

The functions/routines can be called in her own program

## Benefits

Saves programming time as code does not have to be written/re-written from scratch

Code is already tested so it is more robust/likely to work

If there is an improvement in the library routine the program updates automatically

can perform complex calculations that the programmer may be unable to do

*Remember the difference between library routines and ddl*

## Compiler (这里要看情况瞎编，没有万能的写法)

Translate as a whole

Generate exceptionable file

When program is complete

repeatedly test the same section do not need to recompile

## Interpreter

Translate line by line

When writing the code

Aid debugging the partially completed program

Errors are identified one at a time

## IDE

Source code editor

Compiler, interpreter

Auto documenter

Run time environment with debugger

Color coding

Auto complete

Auto correct

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Context sensitive prompt

Expand and collapse code blocks

## IDE Debugging

Break point, Report window, Single stepping

*(3pts!) if you don't know you loss it*

## Chapter 6 Data Security Privacy Integrity

### Data Security Privacy Integrity

Security ensures that data is safe from loss

Privacy is prevent unauthorized access to data

Integrity ensures that data is accurate / consistent / up to date

*(Privacy belongs to Security if not mentioned **together**)*

### Uninterrupted Power Supply (UPS)

### CCTV

### User Accounts

Authentication

Access rights

### Passwords

### Firewall

Examine the traffic between the user's computer and a public network

Checking whether incoming or outgoing data meets a given set of criteria

Blocking the traffic if the data fails to meet the criteria

Give the network manager a warning

Preventing access to certain undesirable sites

Preventing viruses or hackers entering the user's computer

Warning the user if some software on their system is trying to access an external data source.

### Antivirus

Check software or files before they are run or loaded on a computer

Compare possible viruses

Heuristic checking

Quarantine files or grams which are infected

Delete viruses and alert the user

### Encryption / Digital Signature

(email) message put through hashing algorithm (? This does not make sense at all because hashing is irreversible but its from the fucking mark scheme so take it) to produce a digest

Digest encrypted with sender's private key (to create the digital signature)

the (digital) signature can only be decrypted with matching sender's public key

### Biometrics

Fingerprint scan

Retina scans

## Chapter 7 Ethics and Ownership

Legal, morality, ethics, and culture

Intellectual property rights

Privacy issues

### Ethics Company

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What employees can do

What employees cannot do

Responsibilities of employees

Identify company's values

To identify repercussions of employees performing activities they should not

## Ethnics Team

To make sure the team members feel valued

To get the best work out of team

To enable them to work together

To enable them to create the best product for the client

(Ethnic题核心价值观, 用这个编很好)

**Ethnics Action /IEEE** To the best interest of ....

PUBLIC / Software engineers shall act consistently with the public interest.

CLIENT AND EMPLOYER / Software engineers shall act in a manner that is in the best interests of their client and employer (consistent with the public interest.)

PRODUCT / Software engineers shall ensure that their products and related modifications meet the highest professional standards possible.

JUDGEMENT / Software engineers shall maintain integrity and independence in their professional judgment.

MANAGEMENT / Software engineering managers and leaders shall subscribe to and promote an ethical approach to the management of software development and maintenance.

PROFESSION / Software engineers shall advance the integrity and reputation of the profession (consistent with the public interest).

COLLEAGUES / Software engineers shall be fair to and supportive of their colleagues.

SELF / Software engineers shall participate in lifelong learning regarding the practice of their profession and shall promote an ethical approach to the practice of the profession.

## Ethnics Benefits [3]

Give guidelines to follow

So client know the standard being applied

So he(self) does not have to decide what is ethical, since its written down

Client know he is reputable

Recognition of his(self) skill and knowledge

Because there may be requirement for entry

They(colleagues) provide help and support

Such as legal service

They provide training courses

To keep skills up to date

## Licence

Free Software Foundation, Open Source Initiative

Commercial Software

Freeware

Shareware

*Cost, Modification, Redistribution, Copyright*

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## Risks to security

Hacking, Malware, Viruses, Worms, Logic bombs, Trojan horses, Bots, Spyware

## Phishing

Legitimate looking email

With links or attachments

Fake website

Appears to come from a trusted source

## Pharming

Malicious code installed on user's computer

Fake website

Leak to fraud or identity theft

## Data Integrity

### Validation

Check the data is reasonable

### Verification

Correctness

Prevent errors when entering or transmission

Validation checks data is reasonable/within bounds **it does not check that accurate data has been entered**

Verification checks if the data matches the data given (accurate) **it does not check if the original data is accurate**

### Visual Check

The user checks

### Double Entry

The computer/system checks

### Parity check

uses even or odd parity which is decided before data sent

each byte has a parity bit

parity bit is set to 0 or 1 to make parity for byte correct

after transmission, parity of each byte re-checked

if it is different, then an error is flagged

any reference to use of parity blocks/parity byte to (identify position of incorrect bit)

### checksum

a calculation is carried out on the data to be sent (checksum)

the result is sent, along with data to recipient

checksum is re-calculated at receiving end

if both sums are the same, no error has occurred

if the sums are different, the data has been corrupted during transmission

request is sent to re-send data

## Chapter 8 Database

### Relational database [6]

Allow data independence: changes to the data do not require programs to be re-written

Reduce data redundancy: because each item of data is only stored once

Improve data consistency: changes in one table will automatically update in another



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Improve data security: different views, composed of one or more tables

## Data Dictionary [6]

Metadata of the database

Field - column

Entity - a value

Tuple - a row = record

Foreign key - a primary key from another table that is **linked** to this key

Access rights

Password

Data type

Table name

## Security

Using usernames and passwords

Using access rights to manage actions

Encryption of the data stored

*Chapter 6*

## Data Modelling/Logical Schema

the overview of a database structure

models the problem / situation

... by using methods such as an ER diagram

independent of any particular DBMS

## SQL

SELECT <Field>

FROM <Table>

WHERE <Expression>

AND <Expression>

## Alternative

SELECT COUNT(STAFF.StaffID)

FROM STAFF

INNER JOIN DEVICE

**ON** STAFF.StaffID = DEVICE.StaffID

WHERE STAFF.FirstName = "Ali"

AND STAFF.LastName = "Khan";

UPDATE <Table>

SET <Expression>

WHERE <Expression>

ALTER TABLE <Table>

ADD <Field> <Type> ;

CREATE TABLE <Table> (  
    <Field> <Type> ,

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PRIMARY KEY (<Field>),  
FOREIGN KEY (<Field>) REFERENCE PRIMARY <Table>(<Field>)  
);

INSERT INTO <Table>  
VALUES(<Identifiers>);

## Normal Forms

1NF no repeating groups of attributes

2NF no partial dependency

3NF no non key dependency/fully depending on primary key

## Referential Integrity

Each foreign key value must have a matching value in the primary key of the linked table

No reference data not exist

Primary key cannot delete unless all dependent records delete

Foreign key value match corresponding primary key

Cascading update/delete