



4.8 Consequences of Uses of Computing

- 1) Between 2008 and 2010, a company that was gathering data for an online mapping system, using cars fitted with cameras and WiFi equipment, collected some information that was being transmitted on personal WiFi networks. The company apologised for doing this and an investigation found that a small number of software developers had been responsible for adding this functionality to the mapping system data collection software.

In the context of this example, discuss:

- how it was possible for this data to be collected.
- what steps the owners of the networks could have taken to prevent the data from being collected.
- what legal and ethical issues might have arisen as a result of collecting this data.
- what lessons the company might have learnt from the incident and how their practices might have changed as a result of it.

In your answer you will be assessed on your ability to follow a line of reasoning to produce a coherent, relevant and structured response

[12 marks]

Guidance – Indicative Response

1. How it was possible for data to be collected

- WiFi signals can travel outside of property // over wide area // limited control over range
- Any WiFi receiver in range can read the data packets **NE**. The receiver in the car can read the packets
- No need to physically “tap” into a WiFi connection, unlike a cabled connection
- A protocol that does not encrypt the transmissions may have been used // unencrypted data sent. **NE**. Network not secure

2. Steps to prevent

- Use a protocol that encrypts data transmissions **A**. Encrypt the transmission **R**. Password protection
- Example of secure protocol eg WPA, WPA2
- Disable broadcast of SSID to make network harder to identify (Note: Accept this point even though the SSID would be in other data packets)
- Limit power of transmitter so data does not travel outside premises (although in practice this might be hard to achieve)
- Use cabled network instead of WiFi. **R**. MAC address filtering (as cars were not connecting to networks just intercepting transmissions)





3. Legal and ethical issues

- If the data is being transmitted through the air, who does it belong to, if anyone? // Should data transmitted by WiFi be treated like a broadcast (eg TV) or a private communication (eg telephone call)?
- Is it wrong to intercept data if people freely choose to transmit it wirelessly? **A.** Is it ethical to collect data from people without their permission?
- Is it legal to intercept data if people freely choose to transmit it wirelessly? What laws apply in this scenario? Is this really hacking?
- Are the ethics or laws different for intercepting data transmitted wirelessly than by cable?
- Is there a difference between collecting statistical data eg channel number, signal strength, SSID and collecting the payload data?
- Was the data just collected or was there an intention to process it as well?
- What should the company have done when it realised that the data had been collected? // Should the data have been immediately deleted, or kept so that the company could contact and apologise to people it had collected data from? // What should be done with the data now?
- What should the company have done if it inadvertently discovered evidence of illegal activity in the collected data?
- Legality/ethicality may depend on the nature of the data gathered // (In the UK) would some of the collected data count as “personal data” (under the Data Protection Act) // could some of the data have been sensitive (accept example eg bank account details, details of minors) NE. Data may be private
- To what extent is the company financially liable for collecting the data? Or any consequences of its use?
- Could the legal situation be different in different countries where the company operated?
- Was the collection of data intentional or just an accidental side-effect of a reasonable process?
- What was done to ensure (existing) policies are followed?
- Should there have been more oversight of code development?
- Could intellectual property have been inadvertently stolen?
- Is it ethical to collect/store information secretly from people // without them knowing?
- Is it ethical to collect data if there is no (legitimate) purpose for doing so?
- Were the developers in breach of their contracts with the company / company guidelines?

Relevant Legislation Students may name specific pieces of legislation that could have been breached as part of their response. Determining whether or not a breach has actually occurred would probably require more information than is provided in the question and detailed knowledge of the legislation, which is not required by the specification. Therefore, up to two points can be given for students naming relevant pieces of legislation that could have been breached, regardless of whether or not this can be ascertained with certainty. Relevant pieces of legislation include:

- The Data Protection Act
- The Computer Misuse Act
- The Regulation of Investigatory Powers Act
- The Communications Act





Points should be given for assertions that legislation has definitely been breached, even if this is only a possibility in the context rather than a certainty.

Responses that reference other legislation should be referred to Team Leaders.

A. As an alternative to naming the Data Protection Act, a response could instead question whether privacy laws have been breached, or if a breach of privacy has occurred.

4. Lessons

- Improved training for developers in what is legal / ethical (accept company needs to improve understanding of legal/ethical issues)
- Need to review guidelines that developers are expected to follow
- Need for scrutiny of code / supervision by people outside of development team
- Developers could be required to check each other's code
- Developers could be required to log changes made to code and reason
- Should only collect data that is absolutely necessary // that has a clear purpose // need to review collected data to see why it is being collected and stored // need to fully consider the purpose of any data collection before doing it
- Could/should remove equipment for Wi-Fi data capture used in cars to collect mapping data.
- **NE.** Further testing should be carried out unless there is a clear explanation of the mechanism by which testing will check that the software has no additional functionality is described eg inspection of collected data files to verify purpose of contents





- 2) A company provides a social media service through which members can share information about themselves and view information and news from their friends. The service also displays current affairs news stories to its members.

The service does not have journalists who write the stories but instead it uses algorithms to select news stories written by other organisations and individuals and shows these. Different news stories may be shown to different members.

Discuss:

- how algorithms might determine which current affairs news stories to display to an individual member
- the moral, ethical and legal considerations that the developers of the system and its operators should consider in relation to how the algorithms work and which news stories are displayed.

[6 marks]

Area 1: How it could work:

- members could specify their interests / views and stories could be matched to these;
- consider basic facts about member eg age, gender, location;
- consider what stories have been read by friends of the member;
- analyse the type of stories that the user has read before;
- analyse the information that a member shares about themselves to identify characteristics/interests etc;
- track how popular a story is to display the most popular ones;
- look at member's search history;
- look at member's reaction to other similar stories eg likes;
- show stories viewed by others with a similar profile to this user;
- display articles that have been more popular // had more hits // received more positive feedback;
- compare keywords in articles with keywords in articles previously viewed by the member;
- how can the algorithm avoid displaying click-bait?;

Area 2: Legal

- who owns the copyright in the story?;
- is it legal for the company to reproduce a news story that someone else has written?;
- is the company legally responsible for the content/accuracy of stories?;
- do contracts need to be signed between the company and the organisations/ individuals that stories will be displayed from?;





- do laws in some countries prevent some types of stories being displayed? // need to ensure laws in different countries are followed;
- need to ensure that stores are age-appropriate;
- need to notify members about how their information is being used to select stories;

Area 3: Ethical / Moral

- by choosing what news stories to display, will the service influence the views of members?;
- how should the company deal with governments/organisations who might want to influence/control which stories are displayed?;
- should the company accept payments to promote stories?;
- how should the company deal with complaints / issues raised by members (in a timely fashion)?;
- will the reproduction of news stories adversely (or positively) affect the number of people who go to read the original stories from their authors?;
- how can / should reliability of stories be checked / shown (fake news)?;
- how can / should the company assess bias / prevent spread of propaganda;
- does the company have a duty to try to provide balance?;
- should a method be provided so members can request their data is not analysed for this purpose? // importance of consent;
- should the company let them know that the news they are seeing is being tailored to them / not everyone sees the same news?;

Area 2 or 3: Legal OR Ethical / Moral

- should the company have people who read/check each story?; Is it practical to do this?;
- how should the company select which organisations/individuals it will display stories from?;

Max 4 if all points are from one area





- 3) Supermarkets often gather information about their customers and the purchases that they make. This information can be analysed by the supermarket and other companies for a range of purposes.

By analysing the purchases that a shopper has made, it might be possible to identify such things as whether the shopper has children, is pregnant, or lives in a house with a garden. Other types of analysis might include the amount of money a customer spends, the times that they choose to shop at and the differences in shopping habits of different groups of shoppers.

Discuss some of the ethical and legal issues that might arise as a result of the capture and processing of this data.

[6 marks]

Ethical

- Customers may believe that data about what they buy/spend is personal // invasion of privacy
- Purchase of some items might be considered sensitive // some data might be considered to be sensitive (accept relevant examples)
- Will people fully understand what will be done with the data, even if they are told it is being collected Customers need to decide whether to allow the store to collect data about them (is it worth it for the return that they may get eg incentives / vouchers?) //do people feel forced to consent to benefit from offers
- Can company be sufficiently confident that any other companies they share the data with will process the data legally / fairly/for the purposes that they said they would?
- Risk of the supermarket carrying out actions that might reveal to other members of a shopper's household things that the supermarket has deduced that the householders don't know
- Should ethical consideration be given to the products promoted to people using the data collected about them or is it okay to promote a product to anyone? Are there some types of customers who should not be targeted with promotions at all // is it ethical to promote products to vulnerable customers?

Legal

- Naming a relevant law – GDPR, Data Protection Act
- Need to inform customers of what will be done with data // consent required to collect data R. customer has not consented
- Data must be kept securely
- Need to consider what purposes data should be used for
- Consideration of who should be able to access the data // there are rules about who the data can be shared with
- Possible negative impact if data stolen or leaked // information could be misused
- Limit on time-period that the data can be kept for
- Need to ensure that collected data is accurate





- Ensure data only transferred to countries it is legally allowed to go to // if transferred abroad, different laws may apply
 - The supermarket should let the customers see/edit data about them
 - Use of RFID might make data vulnerable to theft
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- 4) Algorithms and artificial intelligence are being increasingly used to assist with the diagnosis of medical conditions. For example, algorithms based on artificial intelligence can diagnose some medical conditions from X-ray images.

Discuss some of the moral, ethical and legal issues that might arise as a result of using computer systems to assist with diagnosing medical conditions.

In your answer you will be assessed on your ability to follow a line of reasoning to produce a coherent, relevant and structured response.

[6 marks]

- Risk of inaccurate diagnosis.
- Will patients trust a computer system to diagnose them?
- Who is responsible for the accuracy of a diagnosis // if a diagnosis is incorrect?
- Does responsibility lie with the people who programmed / designed it or the people operating it? // AI systems themselves cannot be held responsible.
- Should patients be informed if their diagnosis will be made by a computer system?
- Should patients have the option to ask for the diagnosis to be done by a person instead? // Will patients accept diagnosis or want it to be confirmed by human (thus removing some benefits of system)? // Should diagnoses be double-checked by a human?
- A human doctor may feel a moral responsibility that an AI system would not.
- Data may be of a confidential / private / personal nature // Data Protection Act / GDPR may apply (A. one example of provisions of these laws eg keeping data securely, patients having right to view data).
- Appropriate security would be required for the system as it would store personal data. Is it legal for an AI system to diagnose (without human assistance)?
- AI system will need training with data – how will this be obtained?
- Consent would be needed from patients to use their data for training.
- Choice of training data may affect reliability / effectiveness of system // algorithmic bias may develop (eg if one group of people not represented / underrepresented).
- Should system explain reasoning (if possible) to increase confidence in diagnosis?
- System could be used by GPs, reducing demand for more specialist doctors. A. may result in medical staff being made redundant
- How much evidence of the reliability of a system is needed before humans are no longer involved in the diagnosis?
- Could relying on computer systems risk missing diagnosis of very rare / new conditions?
- Could relying on computers de-skill medical staff?
- Would a doctor feel confident to over-rule a diagnosis by the computer system?
- If computer system could diagnose conditions that were not spotted by doctors, would this undermine faith in doctors? A. AI systems may be able to diagnose some conditions more reliably than humans





- Could be used to make diagnosis of some conditions possible in poorer countries (where there are fewer doctors).
 - If cost of system is high, benefits of it may not be available to all people // in poorer countries.
 - Are there some conditions that AI could be trusted to diagnose but others that it could not be?
 - Would it be acceptable to use AI if it missed some cases but detected many others?
 - System may detect issues / potential issues which would actually never turn into a condition that needed treating.
 - If more conditions diagnosed, may increase demand for treatments // may put pressure on hospital services.
 - System could go back through old cases and identify potential missed diagnoses.
 - Should patients be asked before old cases re-examined?
 - If data transferred between countries different laws may apply.
 - Should medical data be shared if it can help diagnose other patients?
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