

1. An autonomous vehicle is controlled by a computer system, senses its environment and requires no input from a human driver.

Discuss the legal and ethical impacts that need to be considered when replacing manual, human-driven vehicles with autonomous vehicles.

(Total 6 marks)

2. Several companies produce microchips that can be implanted in humans. Thousands of people around the world have voluntarily had these microchips implanted in their hands. These tiny microchips are the size of a grain of rice. They can be a form of identification and can store a range of personal data.

Describe how human microchip implants might be used when travelling or visiting places away from home.

In your answer you should include:

- potential uses
- advantages to the person who has the implant
- legal and ethical considerations of human chip implants.

(Total 6 marks)

3. Explain **one** data privacy concern an organisation would need to consider when setting up a wireless network.

(Total 2 marks)

4. A healthcare publication contains the following article.

VeriChip, a company that makes microchips which can be implanted in humans, has sold 7000 chips, approximately 2000 of which have been placed in people. The company's present focus is tagging "high-risk" patients, such as those with diabetes, heart conditions or Alzheimer's.

"People who wear identification tags and bracelets often remove them because they do not like the way they look or feel," said Allison Tomek, Vice President, Investor Relations and Corporate Communications at Applied Digital. "The VeriChip is the only medical device that is guaranteed to always be with you to provide your identification and medical records information in an emergency situation."

VeriChip has offered hospitals free RFID scanners to encourage use of the chips, but acceptance has been limited, and the potential risks associated with RFID may be to blame.'

Explain **two** potential legal **and/or** ethical impacts of using implanted microchips in healthcare.

(Total 4 marks)

5. Explain **two** reasons why software companies usually do **not** make their source code publicly available. Source code is the code they wrote to create the software.

(Total 4 marks)

**6.** Most schools have a computer network.

Some schools allow teachers to access the school network from their home computers.

Give **one** reason why some schools allow this and **one** reason why some schools do not allow this.

(Total 2 marks)

**7.** Many organisations provide free public access to a wireless network.

Explain **three** ethical, legal or data privacy issues that an organisation should be aware of when allowing this access.

(Total 6 marks)

**8.** Many people use smartphones. Smartphones often include a range of sensors and have the ability to run software known as apps. Smartphones are an example of a mobile technology.

Discuss some of the ethical, legal and environmental issues that surround the use of smartphones and apps on them.

(Total 9 marks)

**9.** Cloud storage is being increasingly used by individuals and businesses to store their data.

Discuss some of the ethical, legal and environmental issues that surround the use of cloud storage.

(Total 9 marks)

**10.** In recent years, there has been a large growth in the use of cloud storage.

Discuss the advantages and disadvantages of using cloud storage.

In your answer you should include an explanation of the reasons for the large growth in recent years and consider any legal, ethical and environmental issues related to the use of cloud storage.

(Total 9 marks)

**11.** Chess is a two-player board game. Every year there is a competition to find the best chess-playing computer program. In 2011 the chess program Rybka was accused of having copied program code from other chess-playing computer programs and was disqualified from the World Computer Chess Championship. Prize money won in previous years had to be returned.

- (a) To date, it has never been proven or disproven that Rybka contained copied program code. State **two** reasons why it could be difficult to prove if program code in Rybka had been copied from another program.

(2)

- (b) The program code that Rybka was accused of copying was open-source, this means that it was publically available so that anyone could look at it. The programmers of Rybka could have tried to prove they were innocent by publishing all their program code. This would allow people to compare it to the code they were accused of copying and see that it was different.

Assuming that there was not any copied program code in Rybka, state **one** reason why the programmers might not want to do this.

(1)

(Total 3 marks)

12.

Some people believe that copying program code without permission should **not** be a crime. State **one** reason why they might believe this and state **one** reason why some people would disagree with them.

(Total 2 marks)

## Mark schemes

1.

6 marks for AO2 (apply)

Level	Description	Marks range
3	There is a logically structured discussion of <b>both</b> the legal and ethical impacts of the increased use of autonomous vehicles.	5-6
2	There is an explanation of the legal <b>and/or</b> ethical impacts of the increased use of autonomous vehicles. Answers may focus on <b>only one</b> aspect (legal or ethical) but clear and relevant points are made.	3-4
1	There is some reference to the legal <b>and/or</b> ethical impacts of the increased use of autonomous vehicles but the points made may not always be clear or well-explained.	1-2
No creditworthy material		0

### Guidance:

#### Ethical impacts

- Trust. The driver is trusting the algorithms in the car to make the correct decisions whilst driving eg slowing down when pedestrians are in the road.
- Decision making. The car must make human-like decisions when confronted with unusual circumstances eg the 'trolley problem'.
- Safer driving. Autonomous vehicles could be safer drivers than human drivers eg by keeping a safe distance from the car in front at all times.
- Data collection. Autonomous vehicles may collect private data about their passengers such as locations visited. Passengers may want to keep their journeys private.
- Job opportunities. Fewer roles needed for some professions such as taxi drivers but other opportunities could be created.
- Accessibility. Disabled passengers will not have to operate traditional car controls.

#### Legal impacts

- Liability. There is a grey area about who is at fault (the manufacturer or the driver) in case of an accident.
- Insurance. The need for driving insurance will change as drivers are no longer responsible for the control of the car.
- Data protection. Car manufacturers must keep driving data secure in accordance with data protection laws.
- Security. Autonomous vehicles could be vulnerable to being hacked and hijacked for criminal purposes.
- Law updates. Driving laws will need to be amended to account for new types of vehicles on the roads.

[6]

**2.****6 marks for AO2 (apply)**

Level	Description	Mark Range
3	A range of uses, advantages legal and/or ethical considerations has been accurately described. The descriptions are in the context of travel.	5-6
2	Statements have been made about uses, advantages and legal and/or ethical considerations. There is a brief description of some which may contain inaccuracies. The statements are in the context of travel.	3-4
1	Some statements have been made about one or more of potential uses, advantages, legal and/or ethical considerations. These may not be accurate or correct. Some of the statements are in the context of travel.	1-2
0	No creditworthy material	0

**Indicative content****Uses:**

- near-field communication (NFC) payments for tickets can be made
- easy personal identification (without physical ID) when picking up pre-booked tickets
- enables secure access to systems / devices (eg a rental car)
- enables others access to your medical information if difficulties occur when you are travelling / if language is a barrier
- crossing borders without passport.

**Advantages:**

- you'll not need a wallet / cash
- don't have to carry multiple cards
- may contain health data for emergency use.

**Legal and ethical considerations:**

- may pose a risk of greater surveillance (by government / employers)
- may be exploited by criminals
- privacy of (and amount of) stored data and consent for use.

**[6]**

**3.****2 marks for AO1 (understanding)**

1 mark for any of the following concerns and 1 mark for relevant expansion:

- spoofing or session hijacking; where the attacker assumes the identity of an authorised user;
- eavesdropping; all network data is broadcast and can be intercepted by third party;
- encrypting data; making sure that data is not transmitted in plain text; by ensuring that routers have encryption turned on;
- malware infiltration; a Wi-Fi network is more exposed to attack because it's visible;
- malicious hotspots; unofficial access points that look like they are part of the network;

**[2]****4.****2 marks for AO1 (understanding) and 2 marks for AO2 (apply)**

A **maximum of 4 marks** can be awarded.

**One mark** for each point and **one mark** for an expansion.

Where creditworthy points are too similar to each other they must only be credited once.

Example responses include:

- if the microchip was going to be implanted in a person they would need to give consent; If they are suffering from an illness like Alzheimer's disease, they may not be able to give consent;
- a doctor/hospital might be able to apply to the courts; for permission to implant a microchip against the patient's will;
- guarantees might not exist that only the correct hospital/doctor; can read the information on the chip;
- if a hacker gains access; they could use the information for blackmail or identity theft;
- if the patient decides they want the implant removed; it may not be ethical to implant something that cannot be easily removed;

**[4]****5.****4 marks for AO2 (apply)**

1 mark for stating each reason to a maximum of 2.

Maximum 1 mark for justifying / explaining each reason to a maximum of 2.

- Algorithms cannot be copyrighted; and therefore need to be protected to preserve commercial advantage;
- Copyright of code; the company has paid for development of the code and therefore own the code. They may not want others to have access to what they have developed;
- Hacking / cyber security; hackers could identify vulnerabilities in the source code and use them to create targeted attacks;
- So third parties cannot insert / modify code and pass it off as original; as it affects profitability;

**R. Cracking.**

**[4]**

**6.**

**All marks AO1 (understanding)**

**Reasons for allowing:**

Teachers can access resources on the school network to allow them to plan lessons at home;

Teachers can teach lessons from home (using videoconferencing) if they are not able to get into work (eg travel difficulties);

Teachers can access electronic copies of student work so that they do not have to carry marking home;

**Reasons for not allowing:**

Data protection issues – schools may not want potentially sensitive student information to be accessed outside of school;

To try to help teachers have a work-life balance;

Increased security risks as teachers may not have fully-protected computers at home (eg if a teacher does not have anti-virus software on their home computer this may cause problems when they connect their computer to the school network);

**Max 1 mark:** if only described reasons for allowing access

**Max 1 mark:** if only described reasons for not allowing access

**[2]**

**7.****6 marks for AO2 (apply)**

Level	Description	Mark Range
3	<b>Explanation</b> of at least <b>three</b> issues that are clearly related to an organisation rather than the end user.  <b>or</b> <b>Explanation</b> of <b>two</b> issues that are clearly related to an organisation and <b>described</b> at least <b>one</b> other.	5-6
2	<b>Explanation</b> of <b>two</b> issues that are clearly related to an organisation rather than the end user.  <b>or</b> <b>Explanation</b> of <b>one</b> issue and <b>description</b> of <b>at least one other</b> issue clearly related to an organisation.  <b>or</b> <b>Description</b> of <b>three</b> issues that may not be related to an organisation.	3-4
1	<b>Explanation</b> of <b>one</b> issue which does clearly relate to an organisation.  <b>or</b> <b>Description</b> of <b>one</b> or <b>two</b> issues that may not be related to an organisation.	1-2
<b>No creditworthy material</b>		0

**Guidance:**

- Websites – any inappropriate websites ie pornography, drugs, guns, terrorism etc. e.g. is it acceptable for the organisation to allow access to this sort of material when you can't control who is accessing the service?
- Time – limit amount of time, they may not want to provide indefinite access or may want to charge for access after the time limit has expired.
- Preventing file sharing and illegal sharing \ use of copyrighted materials.
- Accountability – identification of users and actions on a network by preventing anonymous access.
- Prevention of illegal activities such as terrorism and fraud.
- The responsibility to keep children safe and protected.
- Responsibility to keep users (customers) data safe and secure.
- Spoofing of websites, phishing. Responsibility of organisation to put some kind of protection in place, eg filtering of known fraudulent sites.
- Recording of private messages or details if not encrypted.
- Recording of usernames and passwords that the user may also use to access other systems.
- Responsibility of organisation to secure their systems from possible attack.
- Sales and marketing – providing sales leads to market products.

**[6]**



**9 marks for AO1 (knowledge and understanding)**

Responses should be marked using the level descriptors. Suggested indicative content is given below the levels, but this is only indicative and any valid response should be considered.

**Level 3 (7–9 marks):**

Response covers at least two of the areas of legal, ethical and environmental issues. Overall, at least four individual points are considered and these points are well developed. If points are not well developed then a very broad range of individual points have been considered.

**Level 2 (4–6 marks):**

Response covers at least two of the areas of legal, ethical and environmental issues. Overall, at least two individual points are considered and these points are well developed. If points are not well developed then at least four individual points have been made.

**Level 1 (1–3 marks):**

A small number of points have been made that may only cover one of the three areas.

**0 marks:**

No creditworthy response made

**General**

Phones gather a lot of personal data about us

Phone uses GPS to identify where it is / where the person is

Phone has a microphone which can record sound around it

Phone has a camera which can record images around it

Apps mean that developers can run code to make the phone do what they want (subject to restrictions)

**Legal**

Laws govern what can be done with data stored on a smartphone (accept name of a relevant law)

Data from phone may be stored on servers in another country (with different laws)

Copyright law applies to apps installed on a phone

Mobile phones can be used by people who want to break the law as they can be hard to link to owners

**Ethical**

App designers need to consider what data they should gather

App designers need to consider what they should do with data they gather

App designers need to make users aware of what they will do with data

Phone users need to decide what use it is appropriate to make of their phone

Some organisations (eg schools, employers) may ask phone users to restrict their use in some way

**Environmental**

Phones use components which contain rare/irreplaceable metals (accept examples)

People upgrade phones regularly which creates a lot of waste

Phones can be used to gather environmental data eg about air pollution

Phones/apps can provide users with environmental data to help them plan (accept examples eg weather data, air pollution data)

**9 marks for AO1 (knowledge and understanding)**

Responses should be marked using the level descriptors. Suggested indicative content is given below the levels, but this is only indicative and any valid response should be considered.

**Level 3 (7–9 marks):**

Response covers at least two of the areas of legal, ethical and environmental issues. Overall, at least four individual points are considered and these points are well developed. If points are not well developed then a very broad range of individual points have been considered.

**Level 2 (4–6 marks):**

Response covers at least two of the areas of legal, ethical and environmental issues. Overall, at least two individual points are considered and these points are well developed. If points are not well developed then at least four individual points have been made.

**Level 1 (1–3 marks):**

A small number of points have been made that may only cover one of the three areas.

**0 marks:**

No creditworthy response made

**General**

- Cloud storage companies might have more expertise to manage security of data than an individual would
- If data is stored in the cloud then a security breach might affect many users
- The data could be encrypted so that the cloud storage company itself cannot access it

**Legal**

- Laws govern what can be done with data uploaded to a cloud server (accept a named law)
- If the data is stored in another country then the laws might be different to those in the country of the service user
- A government could order the cloud storage company to give it access to a user's data without the user knowing (for security reasons)

**Ethical**

- Data privacy will need to be respected
- Once the data is stored in the cloud the owner of the data loses some control over what happens to it
- Complex issues can arise in relation to ownership of data, for example what happens to the data when the user dies?
- Cloud storage companies might analyse the data stored
- What should a storage company do if it finds illegal material stored (and does it have a duty to actively look for such material)?

**Environmental**

- Data centres which store the cloud data consume a lot of electricity (which can damage the environment)
- One data centre might have less environmental impact than many individual storage devices (as greater management of energy use, usage shared between many users)
- Manufacturing storage devices uses scarce resources (and so sharing these at a data centre might have less overall environmental impact)

**10.**

**All marks AO2 (apply)**

**Level 3 (7–9 marks):**

Answer demonstrates a **sustained line of reasoning** with a **substantiated** explanation for the recent large growth in the use of cloud storage that includes **both** technological and social reasons.

There is a **logically structured** consideration of the advantages and the disadvantages associated with the use of cloud storage – including **relevant** points covering **at least two** of legal, ethical and environmental issues.

**Level 2 (4–6 marks):**

Answer includes an explanation for the recent large growth in the use of cloud storage that includes **both** technological and social reasons.

There is a **logically structured** consideration of the advantages and the disadvantages associated with the use of cloud storage – including **one or two relevant** points related to legal, ethical and environmental issues.

**Level 1 (1–3 marks):**

The answer includes either a description of some of the reasons for the recent large growth in the use of cloud computing and / or brief consideration of the advantages and / or disadvantages associated with using cloud storage.

**0 marks:**

No creditworthy answer

**Guidance – Indicative Response (reasons for growth)**

Higher bandwidth mobile networks (eg 4G);  
Increased availability of mobile devices;  
Reduction in cost of large capacity storage devices;  
Improvements in network security;  
People have a higher level of trust in cloud storage;  
Improvements in web browser software;  
Increased availability of supercomputers (for cloud processing);  
Companies have managed to develop business models based on cloud computing that allow them to make a profit;

**Guidance – Indicative Response (advantages of cloud storage)**

Enables user to access their data from more places / devices;  
Enables user to more easily share data with others (can make parts of their cloud storage publically available);  
Increases the amount of storage available;  
Reduced cost of computing devices for users as no need for as much built-in secondary storage;

**Guidance – Indicative Response (disadvantages of cloud storage)**

Increased security risks;  
Relies on access to high-bandwidth network connection;  
Could potentially cost more due to ongoing costs;  
Reliance on company providing the cloud service;  
Increased chance of others accessing personal data (data privacy issues);

**11.****(a) All marks for AO2 (apply)**

The program source code is not available / published / made public;  
 (In large programs) it could be difficult to spot a small amount of copied program code;  
 The two programs were designed for the same purpose so it is likely that some of the code will be similar;  
 The two versions of the code could be based on the same idea / algorithm;  
 It is possible for (small sections of) code in two programs to be the same by coincidence;

**Max 2**

2

**(b) Mark is for AO2 (apply)**

Publishing their program code would mean that competitors could copy it;  
 Publishing their program code would mean that competitors could see how their program works and would find it easier to write chess-playing programs that could beat Rybka;  
 Publishing their code would help competitors to improve their chess-playing programs making it more likely people will buy alternative (improved) programs (meaning that the company that wrote Rybka would make less money);

**Max 1**

1

**[3]****12.****All marks for AO2 (apply)****Reasons for:**

Can lead to higher levels of innovation;  
 It is difficult to be sure that program code has been copied;  
 People could be discouraged from developing similar products to those already on the market, so reducing competition;  
 Makes it easier for other people to release bug fixes;  
**R.** some people might want people to be allowed to copy their code

**Reasons for disagreeing:**

Loss of income for developers;  
 Discourages software companies from developing new programs;  
 Copying code could result in multiple products having the same bugs;

**Maximum 1 mark for reasons for****Maximum 1 mark for reasons against****[2]**