

1 * Amit is studying Computer Science at university. He has been asked to write an assignment on Artificial Intelligence (AI).

Discuss the extent to which you think computer systems will inherit the biases and discrimination of their programmers as the use of AI increases.

You should include the following in your answer:

- the meaning of AI
- examples of when AI may be affected by bias
- the measures that can be taken to prevent people being affected by bias in AI.

[illegible]

[9]

2 * Many technologists predict that in the future, shops on the high street will use facial recognition to identify customers before they walk into a shop.

Discuss the possible benefits and drawbacks of technology being used in this way.

You should refer to the following in your answer:

- The benefits and drawbacks to both the customers and businesses
- Moral and ethical issues
- Legal issues

Blank lined paper for writing.

3 *OCR Car Park would like to calculate the parking charges when a car leaves their car park.

They will need to record the time that a car enters and leaves their car park in order to calculate the parking charge.

Discuss the different methods that could be used to collect this data.

In your answer you should include:

- The benefits and drawbacks of each method
- Ethical implications
- Legal implications

[illegible]

[9]

- 4 * Discuss the positive and negative impacts computers are having on the environment.

[9]

5 *“It’s like the Wild West, the Internet. There are no rules.” – Steven Wright.*

The quote above suggests that the Internet is a lawless place.

Discuss the extent to which you agree with this statement and how important you feel that the regulation of the internet is.

[9]

Give **one** advantage and one disadvantage to the customers of the taxi using self-driving cars rather than drivers.

[2]



This image shows a blank sheet of white paper with horizontal dashed lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no other markings or text on the page.

[9]

END OF QUESTION PAPER

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
1	Mark Band 3–High Level (7-9 marks) The candidate demonstrates a thorough knowledge and understanding of artificial intelligence, machine learning and how biases can be inherited. The material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate provides a thorough discussion which is well balanced. Evaluative comments are consistently relevant and well-considered. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. Mark Band 2-Mid Level (4-6 marks) The candidate demonstrates reasonable knowledge and understanding of artificial intelligence, machine learning and/or how biases can be inherited; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate provides a sound discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed. There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge of some aspects of artificial intelligence or machine learning; the material is basic and contains some inaccuracies. The candidate makes a	9 (AO1.1) (2), (AO1.2) (2), (AO2.1) (2), (AO3.3). (3)	AO1 Artificial intelligence is used for computer systems that are required to perform tasks that normally require human intelligence. AI is generally programmed. Machine learning is where a machine improves its performance/output through experience/access to data. Machine learning is a subset of AI. AO2 AI follows programming so if a program contains biases then so will the AI outcomes. Programmers must be aware of this and tackle it during design/implementation/testing. Machine learning bias depends on data given. Larger data sets are generally more inclusive/less biased but must be aware of data that is itself biased. Candidates may give examples that meet this. AO3 Thorough testing, multiple programmers and scrutiny of data sets are essential to ensure that unconscious biases are not inherited. If not thoroughly considered then biases will certainly be inherited. Datasets for machine learning need to be large enough to be representative but not so large that data is not able to be checked. <u>Examiner's Comments</u> There were a wide range of responses to this question and a wide range of marks given. The most successful responses were able to address all parts of the question and could give the meaning of AI as well as some relevant examples of AI bias. They were also able to give at least one measure that could be taken. Many candidates used self-driving cars as their only example and should be encouraged to explore the use of AI in different fields. Some confused the AI being biased with people being biased against AI. Many candidates were unable to give relevant measures for preventing bias. Candidates should be encouraged to make sure they include all points the question asked for, in their answer.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. 0 marks No attempt to answer the question or response is not worthy of credit.		
			Total	9	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
2	Mark Band 3–High Level (7-9 marks) The candidate has weighed up benefits and drawbacks of the technology and has applied the moral, legal and ethical issues to both the customer and the business; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate will have come to a fully justified conclusion. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Mark Band 2-Mid Level (4-6 marks) The candidate has weighed up benefits and drawbacks of the technology. They will have explored some of the moral, legal and ethical issues but they may not be equally spread across both the customer and the business; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate will have come to a conclusion although they may not fully justify it. <i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i> Mark Band 1-Low Level (1-3 marks) The candidate identifies some of the benefits and drawbacks, though they have probably shown little consideration of the legal, ethical and moral issues; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and	9 (AO1.1) (2) (AO1.2) (2) (AO2.1) (2) (AO3.3) (3)	Knowledge: Benefits Customer: • Personalised offers Business: • Targeted adverts • Able to track movement habits of customers • Provide more personalised shopping experiences. Drawbacks Customer: • Personal intrusion • Invasion of privacy • Pressured selling Business: • Cost of infra structure • Viewed as invading personal privacy Moral and Ethical issues • Violation of civil liberties • Recording people on the street who are not going into the shop Legal issues: • under data protection laws the shop would need to ◦ Keep any data recorded secure ◦ Personal data should be accurate and up to date Application: Benefits Customer: • Personalised experience will lead to more convenient shopping trips • Staff will give personalised service Business: • Tracking movement of customers means able to identify best opening times • Tracking customers around shop allows better analysis of popular products

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
	understanding to the context provided. The candidate may not reach a recognisable conclusion. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i> 0 marks No attempt to answer the question or response is not worthy of credit.		• Use of modern technology will make the shop be seen as forward thinking. Drawbacks Customer: • Customers may not want to be “pressured” meaning they decide not to shop there anymore. • Tracking data could be hacked and used by criminals Business: • Extra hardware costs may lead to higher prices/competitors undercut them. • Customers who feel their privacy has been invaded may “vote with their feet” Moral and Ethical issues • Abuse of civil liberties could damage reputation of shop Legal issues: • Shop may need to add extra software to blur out faces of non-customers • Shop will need to spend more money on data protection compliance, leading to higher costs. <u>Evaluation:</u> Benefits • Increased revenue from directed sales offset extra costs from hardware/legal obligations • Improved reputation through use of modern technologies may attract more customers Drawbacks: • Loss of customer base due to customers unhappy with “pushy techniques” • Poor public opinion from invasive advertising puts new customers off. <u>Examiner’s Comments</u> Candidates were assessed on the quality of their extended response in this question.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
					Most candidates understood the basic concept of storing personal details being a violation of customers civil liberties. Few candidates had a balanced discussion and focused too heavily on the negative aspects of this system therefore being restricted to a mid-level mark.
			Total	9	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
3	Mark Band 3–High Level (7-9 marks) The candidate demonstrates a thorough knowledge and understanding of relevant data collection methods. They have covered a range of ethical issues and relevant legislation; the material is generally accurate and detailed across all three. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate has used a range of ethical implications and laws to justify their conclusion <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Mark Band 2-Mid Level (4-6 marks) The candidate demonstrates reasonable knowledge and understanding of relevant data collection methods. They have covered ethical issues and relevant legislation; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate has either good consideration of ethical issues or legal issues or a weaker consideration of both. These are used to come to some justification although it may not be completely justifiable. <i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i> Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge of relevant data collection methods. They have covered ethical issues or relevant legislation; the material	9 AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	AO1.1 • Automatic Number Plate Recognition (ANPR) could be used. This makes use of OCR to turn number plates on camera into digital characters. • Use of a token/ticket could be used when cars enter the car park which is time stamped. • Staff could be employed to manually record the time cars enter the car park and then again when cars leave. • Sensor could be used to detect cars entering / leaving the car park. • Photographs of vehicles can be taken when cars enter / leave the car park. These can be time stamped. AO2.1 • Data will be input into an algorithm that will work out the price based on amount of time car has spent in car park. • If the car park is considering storing videos / photographs of the cars then they will need to follow current data protection legislation as these may contain faces of people. • Car park users may see this as an invasion of privacy. Civil liberty issues as movements are being tracked / monitored. • Automated systems are likely to be more reliable and will produce statistical data that can be analysed better. Manual methods may be prone to human error. Automatic methods will allow for quicker processing than if a human was doing it. • Lower overheads as no human to employ. • They could connect to the other databases (e.g. police and DVLA) to check that cars are genuine (e.g. can check if cars have been stolen) • If connecting the cameras over the internet, then this would make them susceptible to hackers and therefore security methods would need to be put in place. AO3.3

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides comes to a conclusion though there may be little considerations of legal or ethical issues to back it up. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i> 0 marks No attempt to answer the question or response is not worthy of credit.		• If automated systems are used then this can lead to improved customer satisfaction and lower costs due to streamlined system. However this could lead to less employment in the local area as computer systems taking over jobs. • Some people may be afraid of using carpark due to cameras. • Data protection laws should mean consumers are protected ◦ System secure ◦ Data only stored for a short time ◦ Only relevant data stored
			Total	9	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
4	Mark Band 3–High Level (7-9 marks) The candidate demonstrates a thorough knowledge and understanding of the effect of computers on the environment. The material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence / examples will be explicitly relevant to the explanation. The candidate provides a thorough discussion which is well balanced. Evaluative comments are consistently relevant and well-considered. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. Mark Band 2-Mid Level (4-6 marks) The candidate demonstrates reasonable knowledge and understanding of the effect of computers on the environment; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence / examples are for the most part implicitly relevant to the explanation. The candidate provides a sound discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed. There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge of the effect of computers on the environment; the material is basic and contains some inaccuracies. The	9 AO1.1(2) AO1.2(2) AO2.1(2) AO3.3(3)	The materials and fuel used in producing and transporting computers has an environmental impact. Digital devices have short life spans and are quickly disposed of... They often end up in landfill or are sent to less economically developed countries to be dismantled due to the value of some of the materials inside them. These devices are often made up of toxic materials (such as mercury) These can harm people disposing of the waste and damage / pollute the area in which they are buried / burned. People have many digital devices. These all need powering / charging. This means there is an increase in demand for electricity. Which means an increase in fossil fuel being burned. Computers are being used to automate the use of things like central heating. This can reduce electricity consumption Computers have encouraged a paperless approach... ..both in the workplace and in terms of companies sending bills to homes This has the potential to reduce the use of paper and as such destruction of trees. Developments in digital storage has reduced the need for physical media to be produced (e.g. CD, DVDs etc) This reduces the need for using plastics. Computers have allowed people to work from home / communicate from afar... This means they don't have to commute / travel, reducing traffic and pollution. Computers can analyse data which can be used in improve efficiency – data mining (appropriate example). <u>Examiner's Comments</u> Candidates were assessed on the quality of their extended response in this question. The negative impacts of computers on the environment were

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. 0 marks No attempt to answer the question or response is not worthy of credit.		generally well addressed by most candidates with fewer citing a balanced range of positive impacts. The level of discussion therefore varied with most candidate responses being given Level 2.
			Total	9	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
5	Mark Band 3–High Level (7-9 marks) The candidate demonstrates a thorough knowledge and understanding of the regulation of the Internet; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate provides a thorough discussion which is well-balanced. Evaluative comments are consistently relevant and well-considered. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. Candidate has used appropriate technical terminology throughout. There are few if any spelling errors or errors of grammar. Mark Band 2 –Mid Level (4-6 marks) The candidate demonstrates reasonable knowledge and understanding of the regulation of the Internet; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate provides a reasonable discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed. There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. There may be spelling errors or errors of grammar in the response but they are not obtrusive. Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge of the regulation of the Internet; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus.	9 AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	Anyone can put content onto the Internet. It can be hard to track down who put information up. People can make untrue claims or present biased information. There are certain crimes that have originated because of the internet (e.g. phishing and pharming) Other crimes have found new avenues through the internet (e.g. drugs, obscene materials etc.) Laws have been written to take into account the internet (e.g. RIPA in the UK). Traditional laws still apply to the Internet. Governments can apply laws in their jurisdictions... ..but may not be able to enforce them if content is from outside their country. It can be hard to track people down if they actively try to hide their identity. Regulation whilst difficult on the internet may be to some extent desirable. Education is important – teaching people about the risks of using the internet. Content is available to people of all ages and vulnerabilities. <u>Examiner's Comments</u> Candidates were assessed on the quality of their extended response in this question. Most candidates offered a reasonably well supported discussion citing appropriate legislation which can be applied to the internet. Many continued the discussion offering valid reasons why the application of such legislation may not be successful. Many candidates were given L2 or L3.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			Judgments if made are weak and unsubstantiated. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. There are likely to be spelling errors and/or errors of grammar, which will disrupt the flow of the response. 0 marks No attempt to answer the question or response is not worthy of credit.		
			Total	9	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
6			Advantages of an automated driver are it is potentially: - safer than a human driver (due to quicker reaction speeds etc.). - cheaper as no wage to cover. - less likely to make mistakes with route. Disadvantages of an automated driver are it is potentially: - May not be able to understand natural speech. - May be limited in terms of the roads on which it can operate. - Vulnerable to hacking. - Only as good as the program running it - a bug in the code could cause catastrophic accidents. - May prioritise safety of pedestrians over that of the passenger. (e.g. may take actions that may put the passenger at risk to save the lives of numerous people outside the car.) - No discussion possible with the driver / no "human presence" to reassure nervous customers. Max 1 advantage and max 1 disadvantage	2 (AO2.2)	<u>Examiner's Comments</u> There were a range of acceptable responses to this question. Some candidates did not gain credit because the advantage/disadvantage stated was not specific to the customer as the question asked. Candidates should be reminded to read the question carefully.
			Total	2	

Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
7	Mark Band 3–High Level (7–9 marks) The candidate demonstrates a thorough knowledge and understanding issues around computers and the workforce and Artificial Intelligence. The material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence / examples will be explicitly relevant to the explanation. The candidate provides a thorough discussion which is well balanced. Evaluative comments are consistently relevant and well-considered. There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. Mark Band 2–Mid Level (4–6 marks) The candidate demonstrates reasonable knowledge and understanding issues around computers and the workforce and Artificial Intelligence; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence / examples are for the most part implicitly relevant to the explanation. The candidate provides a sound discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed.	AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3) 9	Points may include but aren't limited to: AO1 Knowledge and Understanding Artificial Intelligence (AI) is the study of computers displaying intelligent behaviour (usually characterised by decision making). AI techniques include neural networks, evolutionary computation, Bayesian networks etc. Computers are well suited to certain jobs and as AI techniques improve the range of jobs they can do is likely to increase. AO2.1 Application For the argument: Many jobs have already been taken over by computers. Manual job such as work in the automotive industry has been replaced by robots. Computer based systems are attractive to employers, they don't require paying, don't get sick and can work 24/7 without making mistakes. Computer systems can be used for work that is considered dangerous for humans And for repetitive and menial tasks. Future developments may make computers better at highly skilled tasks making computers preferable And in the case of certain tasks (e.g. surgery) would make the use of human workers unethical. May cite recent developments in AI (e.g. beating world Go Champion) Against the argument: As technology develops people will be required to design these new systems.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence. Mark Band 1-Low Level (1–3 marks) The candidate demonstrates a basic knowledge around computers and the workforce and Artificial Intelligence.; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated. The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear. 0 marks No attempt to answer the question or response is not worthy of credit.		It is likely to assist but not take over all roles Producing a more skilled workforce Developments in AI have been forecast for many decades but never materialised. Forecasts as to the development of AI have always been wildly optimistic There is debate as to whether AI will ever be able to show human levels of intelligence. Tasks that humans find inherently ‘easy’ are still beyond the reach of computers. Crucially for many areas of work computers will have to pass the Turing Test – i.e. converse to such a level that will enable them to pass as human... ...Most believe this is still well beyond our current understanding. Laws would need changing as currently people have the right to have automated decisions checked over by humans (DPA) AO3.3 Evaluation Candidate should have come to a well reasoned conclusion for or against the argument. They could come down on either side, the important thing is they have considered both points of view and based their conclusion on the evidence they have discussed. Examiner’s Comments Candidates were assessed on the quality of their extended response in this question. Many candidates offered a balanced discussion although some of the examples used did not demonstrate that the candidate understood the difference between AI and robotic automation. Conclusions were often not fully justified / reasoned. Many candidates scored in the mid-level band on this question.
			Total	9	