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COMMON ASSESSMENT TASK

Level 2 Digital Technologies and Hangarau Matihiko, 2019

91898 Demonstrate understanding of a computer science concept

Credits: Three

Achievement Criteria		
Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of a computer science concept.	Demonstrate in-depth understanding of a computer science concept.	Demonstrate comprehensive understanding of a computer science concept.

Type your School Code and 9-digit National Student Number (NSN) into the header at the top of this page. (If your NSN has 10 digits, omit the leading zero.)

Answer all parts of the assessment task in this document.

Your answer should be presented in 12pt Arial font, within the expanding text boxes, and may only include information you produce during this examination session.

You should aim to write between **800–1500 words** in total.

Save your finished work as a PDF file with the file name used in the header at the top of this page ("SchoolCode-YourNSN-91898.pdf").

By saving your work at the end of the examination, you are declaring that this work is your own. NZQA may sample your work to ensure that this is the case.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

**Merit
06**



INSTRUCTIONS

Read all parts of the assessment task before you begin.

Select ONE of the following computer science concepts:

- computer security
- encryption
- error control
- complexity and tractability
- artificial intelligence.

Type your chosen computer science concept in the space below:

Artificial Intelligence

Begin your answers on page 3.



ASSESSMENT TASK

- (a) Briefly explain your chosen computer science concept.

Artificial Intelligence, or AI, is the simulation of human intelligence by a machine. It is made up of algorithms that mimic human-level intelligence after going through an extensive learning process, and it is far more efficient than humans because it can analyse massive amounts of data in a short space of time, and it thinks in the most optimal way.



(b) Choose ONE of the following three options to answer.

EITHER: OPTION ONE

Give details of how your chosen computer science concept is used in current digital technologies.

At the moment, AI is most commonly used to replace humans in repetitive, menial jobs, which frees up human resources to complete more complex tasks that are better suited to humans. For example, AI could be used to replace online company representatives, or people who are answering questions on the behalf of businesses, which means that people no longer need to wait for people to talk to because they can have their questions answered by robots. AI improves efficiency because it can go through massive amounts of data very quickly in the way that humans cannot, and it can make workplaces safer because human's lives would no longer be at risk because AI would be doing the jobs. AI can also be used to go through complaints by customers, to find patterns and come up with a way to quickly improve, and this is a far quicker process with AI carrying this out than having humans do so. AI can sort through data about patients in hospitals, freeing up doctors and also more quickly giving a diagnosis, which is important for obvious reasons. It can sift through legal documents and narrow down the important information to free up the time of lawyers for more important work than going through data.

AI obviously doesn't need to be paid, so while it may result is a larger start-up cost for businesses, it will reduce the overall cost because they will not need to pay employees to work for them.

OR: OPTION TWO

Give details of how your chosen computer science concept is implemented in current digital technologies.

OR: OPTION THREE

Give details of how your chosen computer science concept occurs in current digital technologies.



(c) **Opportunities** include providing a solution, improving functionality and solving a known issue / risk.

Answer ONE of the following two options:

EITHER: OPTION ONE

How **is** your chosen computer science concept **currently** applied to address an opportunity?

Self-driving cars use AI to analyse data provided by radars, sensors and cameras to build a virtual image of its surroundings and uses machine learning to use this data to decide how to act accordingly to the circumstances. There are six levels of autonomy in self-driving cars, from level 0, which is a car completely driven by a human, through various stages of autonomy like parking assist and alerts if the driver is drifting into the wrong lane, up to level 5, which is a car completely driven by the machine, and the humans are merely passengers.

Self-driving cars are in the early stages of being implemented into society. Self In level 5 autonomous cars, the everyday commute to work would be very different: the humans could use this time to study notes or check emails because their attention is not required to operate the car, they would be designed very differently because the need for a steering wheel or pedals or a joy stick would be gone, and there would be no need for a driver's license because no one would need to drive the car. It would mean that even children would be able to get themselves places.

Self-driving cars are being implemented into the taxi driving and truck driving industries, which puts people out of jobs because AI can now drive people where they need to go. For the truck driving industry, this includes around 1 million Americans who would be without a job if self-driving technology took over. But it does also free people from menial jobs and allow them to explore other options in more complex work.

Road safety is a huge issue in the world, with virtually every fatal and non-fatal crash being caused by human error. Human error would be eliminated by the use of autonomous cars, which would mean that things like drugs, alcohol and a complete lack of attention would no longer be a factor that would cause crashes.

If every car on the road was to eventually become autonomous, then they would be able to 'talk' to each other, share data and make their routes more efficient. Because autonomous cars use machine learning to understand how to react in different circumstances, they get better over time as they gather more experiences and more data. This means that if cars were sharing data, they could improve more quickly, and they would also be able to, for example, know if there was a rock fall up ahead and change their route without even having to see the rock fall.

OR: OPTION TWO

How **could** your chosen computer science concept **be** applied to address an opportunity?

(d) **Mechanisms**

Select TWO of the following seven mechanisms:

- techniques
- algorithms
- principles
- protocols
- systems
- procedures
- processes.

(i) Type ONE of your two selected mechanisms in the space below:

Algorithms

Explain how this mechanism relates to your chosen computer science concept.

Machine Learning is the idea of getting machines to learn by themselves without the need for a programmer. It has three different sub types of machine learning: *Supervised learning* involves the machine being given labelled data and going through this data to find patterns and build up a database based on these patterns and labels. *Unsupervised learning* involves unlabeled data, which the machine goes through and groups data based on similarities. *Reinforcement learning* involves both labelled and unlabeled data, and the machine goes through the labelled data and uses it to label the unlabeled data, then the machine is given a score based on how accurate it was.

Deep learning is made up of layers of increasing complexity. It involves the machine going through massive amounts of data over and over again until it has reached an acceptable level of accuracy. For example, it might categorise something as a dog because it has four legs, but this doesn't differentiate it from a cat, so the next layer of complexity would involve two eyes and ears and a tail, but this still doesn't differentiate it from a cat. It would keep doing these iterations until it had reached a layer that had something that would categorise an object as definitely a dog, whether it be the paw shape of the jaw shape.

Neural networks are the supporting algorithms of deep learning. They are modelled on the way that humans learn and involves labelled data. It uses trial and error to start with, making educated guess about what the data contains, and then uses the labels to check if it was right. It will continue to do this over and over until It has reached a suitable level of accuracy.

(ii) Type your OTHER selected mechanism in the space below:



Techniques

Explain how this second mechanism relates to your chosen computer science concept.

Natural language processing is ability of machines to process and understand human language. At the moment, computers can easily understand the syntax of human language, which involves the sentence structure such as verbs and adjectives and nouns. It is much harder for the computer to understand the schematics though, and this involves the more nuanced components of language such as context (was the sentence said in anger or humour), slang, accents, emphasis and sarcasm, which are all things that can change the meaning of the sentence.

- (e) Explain in depth the impact that ONE or TWO of the following factors has on your chosen computer science concept.

Ethical issues:

Unemployment is the first issue that people think of when thinking about AI. It is true that as AI enters the workplace, people will be pushed out of jobs that require less skill, and then the question of where those who rely on unskilled labour to live will get their income arises. But this technological revolution where robots are taking over the unskilled labour will be much like the Industrial Revolution, where people lost their jobs, but new jobs were created, so it is less that jobs will be lost and more that the type of jobs will just change.

Distribution of wealth relates closely to the unemployment issue. When AI infiltrates the workplace, it means that because AI has no need to be paid, all the wealth will go to those that have shares in huge companies that produce and develop AI. This will open up the gap between the richest and poorest, so a way to redistribute wealth would need to be implemented.

Robot Stupidity talks about how, if AI comes across a situation that they have never come across, they would not know what to do. AI can be fooled in the way that a human could not, and in some cases such as autonomous cars, this can be fatal.

AI holds the same biases that the programmer does, and some facial recognition software has been found to contain racial biases. Facial recognition software, such as that in Google Photos, can easily identify white people, but has a much harder time differentiating between black people. Criminal prediction software has shown bias against black people, and if this was implemented in law enforcement, it could begin wrongly accusing black people of crimes.


Evil genies are often depicted in technological apocalypse movies. It is where AI promises to grant wishes, but a misunderstanding would result in terrible consequences. For example, it could promise to cure cancer, but do so by killing every human, thereby eradicating cancer but not in the way intended by humans.

Humans are at the top of the food chain because they are the most intelligent, not because they are the strongest or fastest. A time, referred to as 'The Singularity', where AI might have the same advantage over humans is a constant worry, because it would mean that AI might become the top of the food chain and would be able to defend against adversaries, even humans. At this point, humans would not be able to just turn the machines off, because AI would be able to defend against this with more intelligence than the humans trying turn them off.

Social impact:

AI is impacting relationships. We have all seen someone sitting on their phone, not paying attention to discussions or interactions. AI companions have crept into society to help the lonely because they are so good at mimicking human emotions and causing people to believe they are having real human connection. But AI can only act as though it is reacting to a situation, but in reality, it is just acting the way that the programmer has told it to. For example, if someone was to die, the machine could act sad, but unlike a human who feels genuine feelings, the machine would only be sad because it was told to be sad, not because it was genuinely sad.

People are constantly scared of the impact that AI might have on society, because they might lose their jobs and the majority of the older population will have no education that



would help them to get a new job in the technology-based new world. But AI will not be completely implemented overnight – it is just important that people understand the importance of being educated in technology to prepare for when they will need it in their jobs every day. It may take a generation to recover from this because the older population will have no helpful or relevant skills in technology to find new work, but as the younger population ages, they will have the education to get jobs in technology.

Sustainability:

Human factors:

Human error is a large issue in society, but AI doesn't have the same ability to make errors because of a lapse in judgement or sheer tiredness. AI thinks of the optimal way to do things e.g. you can never beat AI in a game of tic tac toe because it knows the most optimal method of playing, because it doesn't make errors like humans. This is abundantly helpful in many businesses where there is no room for human error. It helps analyse data, without making errors and not to mention far more quickly than a human could and come up with the most efficient plan to optimize businesses based on customer feedback.

On the road, where virtually every crash is caused by human error, autonomous cars would eradicate this and make the roads far safer.

Future proofing:



(f) Comprehensively explain the key problems or issues related to your chosen computer science concept.

This can include showing links between and expanding on your answers to parts (a)–(e).

Climate change is a huge problem right around the world at the moment. AI could analyse data to come up with the best plans for the world to reduce carbon emissions much more quickly than scientists can, and because climate change is a time sensitive issue, AI would help us to reduce carbon emissions more quickly. On a smaller level, it could also help individuals to reduce their carbon footprint by optimizing the way things are done, such as the shortest route for their car to take. AI could also analyse data about fuel usage and work out the best way to decrease fuel usage, or even come up with an idea for a new, renewable fuel source.

Overpopulation is another issue around the world, and people cannot keep up with the demand of the human race. If AI was implemented into more businesses, it could make menial jobs such as data analysis or just sifting through documents much more efficient and free people up to do jobs better suited to humans. For example, deliveries could be done via drone, which means that no human resources are wasted in deliveries. This already being done, where human aid charities send resources to remote parts of Africa via drone, but it doesn't require people to accompany the resources.

Road safety is another huge issue. With a high road toll around the world being caused by humans using drugs or alcohol or having a lack of attention on the road because of mobile phones, or even just a lack of understanding about the road laws, AI could eradicate human error and make the roads safer. It would also optimize time for humans, because they could use their daily commute for other things like checking emails or working or studying, and there would be no need for drivers' licenses. AI cars also do not have the same blind spots that humans do, because there would be multiple cameras looking for obstacles, so the car could have a better understanding of its surroundings than a human could ever have.

Cyber security, at a time where cybercrimes are at an all-time high, is grossly under resourced. AI could help cyber security officers and predict and even prevent cybercrimes. It can also be used to speed up processes in airport security, using mechanisms such as facial recognition or even just electronic check-in.

Merit Exemplar 2019

Subject	Digital Technologies		Standard	91898	Overall grade	06
Q	Grade	Annotation				
		<p>When briefly explaining Artificial Intelligence (AI), the candidate provided a short and clear explanation of what AI is. For current uses of AI, a number of short examples of uses for AI were given that showed the candidate had a good understanding of various uses of AI. Under the part of the assessment task dealing with Opportunities, the candidate focused on a single area of AI, namely self-driving cars. There was some confusion in the candidate's references to autonomy and intelligence. In part of their answer dealing with Mechanisms, the Algorithms question was done well with good explanations. The candidate also answered the Techniques section. Under the Impacts section, the candidate produced a number of detailed answers that showed they understood risks and benefits associated with aspects of AI. The candidate comprehensively explained the key problems or issues, and a number of good arguments were given, Overall, the assessment task warranted a Merit grade.</p>				