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COMMON ASSESSMENT TASK

Level 2 Digital Technologies and Hangarau Matihiko 2020

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 not access the Internet or use any printed or other resources except for this assessment.

Excellence

07

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INSTRUCTIONS

Read all parts of the assessment task before you begin.

Select ONE of the following computer science concepts:

- error control
- encryption
- artificial intelligence.

Type your chosen computer science concept in the space below:

Artificial Intelligence

Begin your answers on page 3.

ASSESSMENT TASK

(a) Describe at least two examples in which your chosen computer science concept is either **used**, **implemented** or **occurs** in current digital technologies.

A prime example of where A.I. is used is in chatbots. These can range from simple things like tech support to complex algorithms that can hold a semi-decent conversation with someone. Chatbots however are rather weak A.I. as for the most part they compare keywords and phrases from their database to those they have received from a user and tie them together to attempt to produce a relevant answer.

Of course, chatbots aren't foolproof and there will be some phrases they don't understand in which different chatbots will have different responses. Where a Microsoft tech support chatbot, for example, might refer you to their help desk, a conversational chatbot would likely respond with a phrase like "uh huh" in order to try and coax you to mention a keyword. In the case of conversational chatbots this is a good solution as it makes them seem potentially more human however if used too much it can make them also feel quite limited. The applications of chatbots however are quite vast, from simple chat moderation in games and messaging apps to potentially even replacing GP appointments as you can just explain your symptoms to a chatbot and allow it to search for possible causes.

A second use of A.I. can be seen in the development of self-driving cars. In this context the A.I. are used for their split-second reactions as well as the ability to communicate amongst each other. Both would help, not only contribute towards safer roads, but also lead to greater efficiency in the routes taken.

This does have the disadvantages however that we would need pretty much every car to be artificially intelligent to ensure safer roads as well as to prevent the bullying of A.I. by other drivers as in order to prevent crashes A.I. would allow the other drivers to cut them off constantly as the only response they have to this is to stop to avoid hitting someone. A.I. would be unable to predict actions from other, human driven cars as these are not a part of their system and as such do not share information. This, alongside the unpredictability of humans on the road would only further the trouble the system would have if we didn't expand A.I. to all cars.

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

Select ONE of the following two options:

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

Copy and paste your chosen option in the space below:

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

Answer the question about your selected option in the space below:

Artificial Intelligence is currently being applied in some medical fields in order to assist with the accuracy of medical scans. As A.I have a large database to reference as well as a better eye for detail they can more easily spot the abnormalities that can lead to things like cancer and other dangerous developments in scans and it has actually been proven that they do so with a greater degree of success than some medical professionals. Alongside this, A.I. can also be used in the treatment process of things like cancer as they can narrow down almost the exact region affected to allow for safer treatment where only the affected area is treated to reduce risks for the patient. We can also see the application of A.I. to a similar effect in areas like agriculture where A.I. is used to find most efficient harvesting routes and to locate areas with weeds to avoid having to use chemicals like herbicides on the entire field. This ultimately means less chemicals in our food and so a much lower health risk as well as less herbicide use so it would likely end up being cheaper for the farmers as well.

(c) **Mechanisms**

(i) Explain the use of an **algorithm** or **technique** used in your chosen computer science concept.

For example, you could explain:

- how the Luhn algorithm works
- the purpose of private / public keys or password hashing
- why an artificial intelligence might be considered as intelligent.

Machine learning is a key algorithm in A.I. and is a lot of what makes them "intelligent". Machine learning is when an artificial intelligence is fed a stream of labeled data to use as a reference. Any data it receives from this point onwards is then tagged according to any criteria it picked up on by viewing the first data set.

A common way of testing this is through the use of the MNIST database. This database consists of 2 sets of data made up of thousands of images of handwritten numbers. The first set of data is pre-labeled and is given to the machine learning algorithm to allow it to develop it's criteria for telling the numbers apart. After this has been done the second set of data is given to the A.I. unlabeled and the A.I. is tasked with trying to correctly tag all the images it is given. How well it does this is used to determine the quality of the machine learning algorithm.

A real-life example of this was seen when engineer, Ben Hamm, got tired of his cat bringing dead rats into the house. He set up a camera to get as many photos as he could of the cat entering and exiting the house with and without a rat. He then set to work tagging these images and fed them to a machine learning algorithm tasked with locking the cat flap, should his cat try to bring a rat in. Surely enough it almost flawlessly performed its job and very few times was the cat able to sneak a rat into the house. This is but one simple use of machine learning but also shows how, even things like small quality of life improvements like these which seem inconsequential are still a possible use of A.I.

(ii) Explain the **protocol** or **procedure** used in your chosen computer science concept.

For example, you could explain:

- how an organisation ensures the protection of data by using encryption
- how barcodes are used, and errors identified
- how an artificial intelligence system is used to achieve a purpose.

The Turing test is a procedure used to determine the strength of an artificial intelligence. It was originally designed to have one person questioning both a computer and another human without knowing who was who. Both the human and the computer had to try and convince the person asking the questions that they were, in fact, human. If the person asking the questions failed to correctly guess which was the human more than half the time, then the A.I. was deemed to be a strong A.I.

The test however has started to lose it's value however as things like Siri, which don't try to hide the fact that they are A.I., still perform their job amazingly and as such, pretending to be human is a skill that a lot of A.I. do not require.

(d) **Impacts**

Select ONE of the following impacts:

- Ethical issues
- Human factors.

Copy and paste your chosen impact in the space below:

Ethical issues

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

One key ethical issue with artificial intelligence is algorithm bias. This is usually developed when there is a bias present in the samples the algorithm is fed in which case, said bias bleeds through into the A.I. itself. An example of this could be seen when a pair of LGBT+ youtubers, Bria Kam and Chrissy Chambers, tried to sue the company for wrongly filtering their content just based on the fact it was LGBT+ themed. This was likely caused as a result of past content from other creators on a similar theme containing not so family friendly content and as such the algorithm decided that LGBT+ content must be what they were filtering for.

Another example of algorithm bias was seen in amazon's recruiting algorithms where a study found that it heavily prioritized accepting CV's from male applicants even though there were female applicants who had the same, if not better qualifications. This is because the past accepted job applications it was shown were probably primarily male and so once again it developed a bias and decided that was an influential factor on what it decided was a good choice to employ. Algorithm bias is quite a difficult thing to deal with as even a subtle bias that we didn't even notice that we had in the test data can lead to quite an impact when the A.I. is tasked with carrying out it's job in a practical sense and there is no easy solution to this either. The development of such a solution is something that will likely take a lot of time and effort however it will also be a very important development and a key stepping stone in the future of artificial intelligence.

Another ethical issue is the potential misuse of A.I. by humans for things like harassment, bullying and even radicalization. An example of this was seen when a Microsoft chatbot was sent to twitter. Within 24 hours the community had the chatbot spouting racial slurs and inappropriate comment purely because of what they were saying to it. The chatbot, being artificially intelligent, would pick up on messages being sent to it and develop those as responses to certain questions or phrases and then effectively parrot them back to other twitter users. This lead to the chatbot being taken down quite quickly however, while being a rather large issue, it also helped us by letting us know what to watch out for with future developments of A.I. and by raising our standards in terms of what preventative measures we put in place to stop this in the future.

(e) 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)–(d).

The topic of self-driving cars which seems to be a large step in our future, could potentially have huge benefits from an ecological standpoint as well. The combination of A.I. driven cars alongside artificially intelligent traffic systems and dynamic routes for public transport could all help to reduce our carbon emissions that come from roadbased traffic. In Pittsburg the concept of artificially intelligent traffic systems is already partially in place and has seen at least a 20% drop in travel time meaning less time spent driving and less carbon emissions. The main problem with this is getting it implemented as the technology for widespread use of this is still very much in development and the redesign of several road systems does come at quite a cost however the environmental benefits of this implementation are huge.

Another key issue with A.I. that I previously touched on a little is the misuse by humans however there are measures that can be put in place to help prevent this. A good example of this is the text generating A.I. GPT-3. GPT-3, when given a topic and a format will write a piece on the given topic whilst doing it's best to conform to the format. Obviously, there are many potential misuses for this, from writing racist texts to spam to harassment and so on. However, the A.I.'s developers foresaw this and as such released it as an API to a limited audience. As an API they can better monitor what the A.I. is being used for and lock users out for misuse. They have also stated that they have released it to a team who would intentionally put it through these sorts of tests in order to help them develop future proofing through preventative measures and limitations so that the A.I. is safe for general use. These sorts of measures are expected to be put into place for pretty much all fields of A.I. as you can't predict exactly what someone else will do, you can only prepare for when they do it.

The loss of jobs is yet another concern with artificial intelligence. As A.I. become more and more capable it is estimated that they will take over more and more jobs which will likely lead to the loss of certain jobs altogether with this being mainly down to a few factors. A.I. are cheaper, more efficient and more accurate in the tasks they perform than human workers.

Job loss to A.I., however, doesn't necessarily mean the number of overall jobs will decrease, in fact, it was estimated that the number of jobs created by A.I. would be greater than the number that it removes. While things like taxi drivers or office workers might become obsolete, many more jobs will open up in fields that aid in the maintenance and development of artificial intelligence. This alongside the fact that jobs like teachers, artists, directors, etc. are near irreplaceable by A.I. due to the levels of emotional intelligence and creating thinking required to perform such a job. So, while it's estimated jobs will be lost to artificial intelligence, that just means there are more opportunities to find a more stimulating and interesting job in amongst the many new jobs being created by A.I.

Excellence Exemplar 2020

Subject	Digital Technologies	Standard	91898	Total score	07

	Grade score	Annotation
	E7	*Computer science concept: Artificial Intelligence* In part (a) the candidate gave two examples of where AI is found in chat bots and self-driving cars. Good detail was provided demonstrating sound understanding. Part (b) discussed medical issues and did not repeat the examples used in (a). In part (c) machine learning and the Turing test were discussed. These examples had no overlap and had sufficient depth. In part (d) the candidate gave a number of excellent examples that reinforced their well-written answer. In part (e) the candidate discussed a number of examples and did so in depth sufficient to demonstrate Excellence.