EXCELLENCE EXEMPLAR 2022

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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

**QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!**

COMMON ASSESSMENT TASK

Level 2 Digital Technologies and Hangarau Matihiko 2022

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 space below. (If your NSN has 10 digits, omit the leading zero.) It should look like "`123-123456789-91898`".

`-91898`

There are three questions in this document. **Choose ONE question to answer.**

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

Your answers should be presented in 12pt Times New Roman font, within the expanding text boxes, and may include only information you produce during this assessment session. Internet access is not permitted.

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.

Instructions

There are three questions in this assessment, on the topics of:

Choose only ONE question to answer. Note that parts (b), (c), and (d) of the question include options for you to choose from.

Read all parts of your chosen question before you begin. Do not repeat information in different parts of the assessment.

EITHER: **QUESTION ONE: Artificial intelligence**

(a) (i) Name a **specific** New Zealand-based company or organisation that uses artificial intelligence.

████████

(ii) How does this organisation use artificial intelligence?

████████ uses artificial intelligence for the betterment of New Zealand. There are several AI currently being used by the ██████ including facial recognition AI and ELLA the chatbot. Facial recognition AI is being used by the ██████ to locate people who broke the law, reducing the amount of time it takes to locate them, lowering the chance of them committing another crime, so this lowers crime in New Zealand. Another AI being used by the ████████ is ELLA the chatbot. ELLA stands for electronic lifelike assistant. ELLA is used to communicate with citizens, allowing for more people to communicate with emergency services at the same time. This AI acts as a bridge between citizens and police, allowing police to have more personal on call, making New Zealand safer.

(iii) What are at least TWO advantages of this organisation using artificial intelligence?

There are many benefits for ████████ that are granted by using artificial intelligence. ████████ are tasked with keeping citizens safe and upholding the law. The ██████ facial recognition AI assists the ████████ in these tasks. An advantage the facial recognition AI gives is that it reduces the amount of time it takes to locate people who broke the law, making it easier to capture them, the main benefit of this is that it makes New Zealand safer as it lowers crime. Another AI being used by the ████ ████████ that grants an advantage is ELLA the chatbot. ELLA allows for more people to talk with emergency services, communicating with citizens and police, allowing for police to have more officers on call to be sent to situations where they are needed. This grants the advantage of being able to redirect resources to where they are needed, in turn making New Zealand safer, just like the facial recognition AI by making ████████ ██████ more effective at their jobs.

(b)   Choose two of the following to answer:
- What common issues are found when developing an artificial intelligence solution?
- Give an example of how an artificial intelligence is trained.
- How can you evaluate the effectiveness of an artificial intelligence?

Choice (1) – (copy and paste below)

What common issues are found when developing an artificial intelligence solution?

Response

When developing artificial intelligence, there are many issues that can be encountered. There are minor issues that can be easily fixed such as a spelling mistake in the code, or something more major such as the information bias, something that is much harder to fix. The information bias is when AI performs a task incorrectly, or dislikes a group of people over another. The information bias occurs when information is provided to the AI that skews its perspective, an example of this can be found in chatbots. Advanced chatbots are capable of learning from every interaction through the use of machine learning. Machine learning is when an AI gathers data, compares it to its database, then adds it to the database, the more information the AI has, the more accurate and advanced it becomes. If a chatbot's interactions are not friendly, the AI can become offensive, as it uses natural language processing to try and understand the meaning behind words, but its definitions of words can change, so it may deem it appropriate to swear at people and not treat it as a slur. This can be encountered in every AI that can learn, so the information it learns from needs to be monitored so its perspective doesn't change and that it continues to do the correct job, providing accurate answers.

Choice (2) – (copy and paste below)

Give an example of how an artificial intelligence is trained.

Response

There are several types of AI that train in different ways, two common types of AI are rule based AI and data based AI. Rule based AI is not capable of learning past a certain extent, some are not capable of learning at all. Rule based AI are used to complete the most basic of tasks, such as following an algorithm to find the shortest path, it can be trained to find the shortest path, this limits how much it can be trained. Data based AI require immense amounts of data to become accurate depending on the task it is designed to perform. Data based AI uses machine learning to train, machine learning is commonly used by AI to improve, to become better at their tasks. Machine learning is when AI take in data from the task they do, compare it to their database to see if it is accurate, then add this new information into their database, this expands their database, improving accuracy for the AI.

Another way artificial intelligence may be trained is through the use of artificial neural networks. This mimics the way the human brain functions, by having neurons communicating with each

other to reach an end goal, the output changes constantly as the neural network constantly changes. Artificial neural networks function by having neurons that communicate with each other, in each neuron it can input data and output data. Each neuron is given a different weighting based on the information the artificial neural network receives, if it is similar to the neuron, it is given a larger weighting than others, meaning it has an even greater influence on the output. These artificial neural networks have input layers, hidden layers and output layers. Input layers are where the network first receives its information. Hidden layers and between the input and output layers, these hidden layers process the information passing and can influence it, hidden layers cannot be seen and these hidden layers can also be made, the more there are, the more accurate the artificial neural network can be. The more information provided to the neural network, the more accurate it becomes as well. Artificial neural networks are a way of training AI, making the AI more accurate and adaptable, making sure it remains relevant in the future.

(c) Choose ONE of the following to answer:

- What positive effects might artificial intelligence bring in the future?
- What negative effects are artificial intelligences currently having on people?

You should consider this question in the context of the organisation you wrote about in part (a).

Choice (copy and paste below)

> What negative effects are artificial intelligences currently having on people?

Response

Artificial intelligence can be seen to be doing great things around the world, although when it does its job wrong, there can be serious consequences. This can be seen with the ▮▮▮▮▮▮▮ facial recognition AI. This facial recognition AI is capable of identifying people, although it may target specific groups of people more than others. When the AI is asked to identify someone, and there are factors that cover the face of the person, it may identify the wrong person. This may have serious negative effects for the person who was falsely identified leading to them getting arrested and the wrong person getting charged for crimes they did not commit. This is a negative effect of the facial recognition AI, and if this AI is not constantly monitored, this can end up becoming a common occurrence. Another negative effect of the facial recognition AI is that it can be considered to be a violation of privacy. People don't enjoy being watched all day every day, which is exactly what this facial recognition AI is doing. This can influence people's behaviour, making people uncomfortable in public spaces.

ELLA the chatbot isn't currently having any negative effects on people, but it is capable of having negative effects on people. This is because ELLA the ▮▮▮▮▮▮ chatbot currently isn't nationwide, it isn't answering calls for help. If ELLA the chatbot does begin answering calls, it isn't capable of comprehending the severity of the situation, how one situation may be more dangerous than another. This is because ELLA is a specific AI, while it uses natural language processing to understand what is being said, to try to understand the situation and make an appropriate response, ELLA can only complete specific tasks, and not a wide range. Since ELLA isn't a general AI, the severity of a situation cannot be comprehended, a general AI can complete a wide range of tasks, and in a call, there are many things to listen out for, including the tone of voice, how fast their speaking and the background noise, this is outside the abilities for ELLA the chatbot. As a result there may be a situation where police are sent in underequipped, all because ELLA told them it was an ordinary situation, although it may be much more severe.

Weak AI refers to systems that are programmed to accomplish a wide range of problems but operate within a predetermined or predefined range of functions. Strong AI, on the other hand, refers to machines that exhibit human intelligence.

Source (adapted): http://www.differencebetween.net/technology/difference-between-strong-and-weak-ai/

(d)   Choose ONE of the following to answer:

● Organisations have a choice of developing "weak AI" or "strong AI". Explain why an organisation may choose one over the other. What are the risks and opportunities for an organisation changing from "weak AI" to "strong AI"?

OR

● The Turing test originated in 1950. How likely is it that your chosen organisation's artificial intelligence would pass the test?
Discuss how relevant the test is in evaluating the effectiveness of your chosen organisation's artificial intelligence.

Choice (copy and paste below)

> The Turing test originated in 1950. How likely is it that your chosen organisation's artificial intelligence would pass the test?
> Discuss how relevant the test is in evaluating the effectiveness of your chosen organisation's artificial intelligence.

Response

> The Turing test is something that is designed to see whether AI can pass as a human, if the AI has passed as a human, it is considered to be an advanced AI. The Turing test, designed by Turing himself, a person considered to be the godfather of artificial intelligence, is flawed in modern times. This test is flawed because it only applies to chatbots, AI designed to pass as a human. This only applies to a very small number of AI, as AI is used to complete a wide variety of tasks, one such is the ⬚ facial recognition AI. This doesn't apply to the Turing test as it isn't a chatbot, it is not designed to pass as human, it is designed to identify people through a camera using computer vision. Computer vision is the act of a machine looking through a camera into the real world, making it capable of identifying objects, and in this case, faces.
>
> The Turing test is when a person communicates with 2 things, 1 human and 1 chatbot. The person talking with them doesn't know which is a human and which is the AI, the AI and the human talk with the person, trying to convince them that they are the human. The person then has to choose which is which, if they think the AI is human, then the AI has passed the Turing test. This applies to ELLA, the ⬚ chatbot AI. This chatbot is designed to mimic humans, to provide a service. ELLA the chatbot is currently unlikely to pass the Turing test, this is because it is still in the early stages of development, while being capable of having a conversation, it doesn't completely understand human speech. ELLA uses natural language processing to communicate with people. Natural language processing allows AI to understand the meaning behind words by comparing the conversation to its database, this allows for more 'human-like' responses by the AI. The Turing test is relevant in evaluating the effectiveness of ELLA the chatbot, this is because it is designed to be 'lifelike', so the closer to a human, the better. If ELLA passes the Turing test, it can be said that it is an effective AI, and that it is ready to be used nationwide. This is because if

people can't discern ELLA between AI and human, then ELLA can be used more for policing purposes such as becoming an emergency operator, giving the callers the same sense of trust they feel with a real human, instead of being cold to AI.

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OR: **QUESTION TWO: Computer security**

(a) (i) Name a **specific** New Zealand-based company or organisation that has had **issues** with computer security.

(ii) What were the issues this organisation had with computer security?

(iii) What are TWO steps the organisation took to deal with these issues?

(b)   Choose TWO of the following to answer:

- What are common issues all individuals or organisations have with computer security?

- What steps can an organisation take to protect its computer security?

- What are the signs an individual might recognise that help them identify they are being targeted by a scammer?

Choice (1) – (copy and paste below)

Response

Choice (2) – (copy and paste below)

Response

(c)   Choose ONE of the following to answer:

- How can the security of computers be protected against future risks?
- What impact do peoples' attitudes and behaviour have on computer security?

You should consider this question in the context of the organisation you wrote about in part (a).

Choice (copy and paste below)

Response

(d)   Choose ONE of the following to answer:
●   Operating systems, drivers, software, and firmware all require updates. Discuss the purpose of these different updates in maintaining computer security.
●   Organisations commonly have firewalls at the entry point of the internet as well as on individual computers. Discuss why these are needed to maintain computer security.

You should consider this question in the context of the organisation you wrote about in part (a).

Choice (copy and paste below)

Response

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OR: **QUESTION THREE: Complexity and tractability**

(a)   (i)   Name a common example of complexity and tractability.

        (ii)   Explain in detail why this is an example of complexity and tractability.

(b) Choose TWO of the following to answer:

● Give a practical example where it would be good for a solution to an intractable problem not to be found.

● Give a practical example where it would be good for a solution to an intractable problem to be found.

● Give a practical example of a mechanism that can be used to partly solve an intractable problem. What are its limitations?

Choice (1) – (copy and paste below)

Response

Choice (2) – (copy and paste below)

Response

(c)   Choose ONE of the following to answer:
- What are some ways that complexity or tractability can be future-proofed?
- What positive or negative effects does the field of complexity or tractability have on people?

Choice (copy and paste below)

Response

(d) Choose ONE of the following to answer:

- A real-world "solution" to an intractable problem, such as route planning, includes a number of additional factors such as one-way streets. Discuss how effective these solutions need to be and how you can measure their effectiveness.

- The "travelling salesman problem" is easy to solve with only a small number of destinations. Discuss why this becomes intractable as more destinations are added.

Choice (copy and paste below)

Response

Excellence Exemplar 2022

Subject	Digital Technologies Level 2		**Standard**	91898	**Total score**	07

Q1	Grade score	Annotation
(a)		The candidate chose a NZ company and gave two different examples of how Artificial Intelligence (AI) aids them in the performance of their tasks.
(b)		The candidate discussed bias, giving a detailed explanation of the issues with training. There was solid evidence the candidate understood the process of training an AI.
(c)		The question was on "negative effects", however the candidate gave a response showing both sides of discussion that was well thought out.
(d)	E7	The discussion of the Turing test was very well done. It was well-argued, explaining its limitations and relevance.