Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Digital Technologies and Hangarau Matihiko 2023

91898 Demonstrate understanding of a computer science concept

EXEMPLAR

Excellence TOTAL 07

INSTRUCTIONS

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

- Artificial intelligence (page 3)
- Computer security (page 9)
- Encryption (page 15).

Choose only ONE question to answer. Note that parts (c), (d), and (e) 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) Choose one of the following companies:

- Apple
- Microsoft
- Amazon
- Google (including Waymo) □ Meta (including Facebook)
- Tencent (WeChat)
- ByteDance (TikTok)

Company: Google (Including Waymo)

(ii) How does this company use artificial intelligence?

Google uses AI in a vast variety of their products and in a number of their publicly available solutions. Quite possibly the most used AI produced by Google is the AI present in the Google Search engine. This AI uses inputs from a variety of different applications to ensure relevant search results. The first input the AI takes in is past searches (search history), the AI evaluates key topics in the previous search terms and caters the priority of search results to future searches based on their relevance to past searches. Another way AI is used in Google Search is via image and sound search. The AI used in Google Search is able to determine objects and key elements of images provided to it. These objects and key points of the image can then be transformed into search terms by the AI which can then be used to search the internet accurately for similar pictures or articles. The sound AI works similarly, recognising vocal patterns to transfer an audio file into a transcription that can be used as a search term to browse the internet. Another AI solution Google uses is the Android Studio Bot. This chatbot like bot is used in Google's Android Studio application, the application is used for developing apps for their phone OS, Android. The AI bot provides several key uses as an integrated solution, being able to consistently provide error detection and fix syntax errors, and providing large scale problem solving and being able to help tackle conceptual issues in the code. The next major product Google uses AI in is the Google Translate AI, this AI has a database of dictionaries of other languages, and uses a wide array of machine learning algorithms (specifically neural networks) to allow for accurate translation of text between multiple languages. This AI is able to not only translate sentences word for word, but due to its ability to learn from previous translations and feedback, is able to make high level contextual decisions when it comes to more difficult translations.

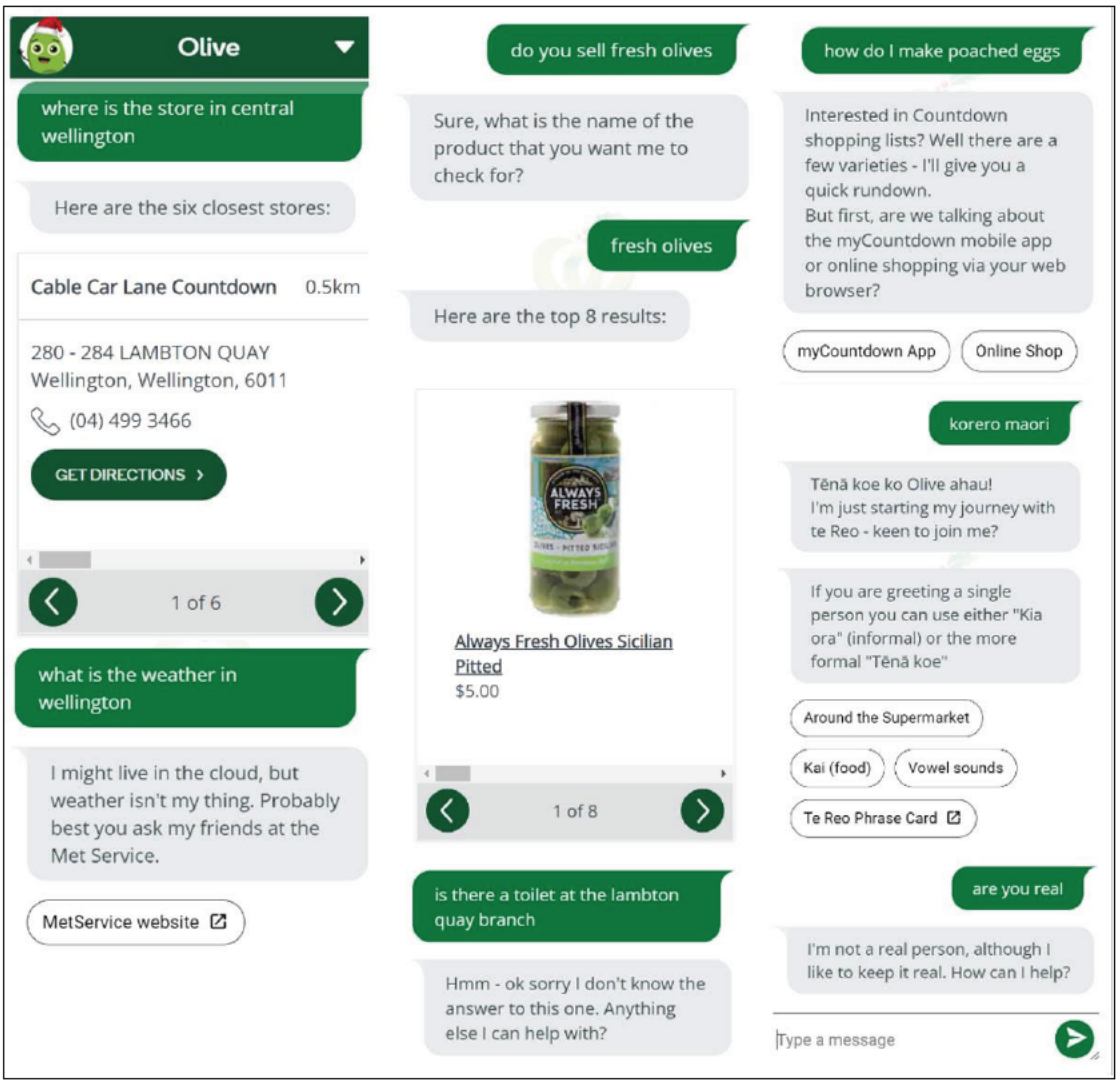
(iii) What are at least TWO advantages of this company using artificial intelligence?

The first major advantage of using this AI technology impacts both users and Google themselves. By allowing search terms to be more catered towards users, the AI insures the priority of more relevant searches (how high up the are in the list of search results) is increased, and by proxy decreasing the priority of less relevant searches. By being able to rank searches accurately catered to a single user, Google increases the probability that the result the user is actually looking for arises on the first page of results. This creates a major advantage for the user, as on average they are more likely to spend less time combing through large amounts of search results to find the required information, rather, spending far less time on menial tasks. This benefits the user as their time is spend more wisely, and as user experience benefits, so does the number of users that Google can bring in, and for a company like Google, which relies on a growing user base, a major advantage is seen.

The next major advantage of using AI technology comes with the ability to translate phrases accurately. Learning to be able to fluently read, speak, listen, and write in a language is a task that requires many hours of hard and dedicated work. Google's Translate tool provides a solution to this problem, by allowing users to accurately and reliably translate over 150 different languages. This translate tool, coupled with the aforementioned Google search audio and image AI, allows users to read and listen to languages they would otherwise not understand and in doing so solves the major problem of language barriers. This technology could prove useful when travelling to another country and attempting to converse with the locals and read road signs, by insuring the accuracy of this product, Google makes sure that minor disagreements, or issues with language barriers, such as following the wrong direction sign are bypassed. A major advantage to the user base, and like mentioned previously Google as a whole.

The final advantage relates to productivity, the Android Studio Bot improves the productivity of app developers and users of the solution as they are no longer required to spend as much time on small issues in their code, syntax errors for example. Fixing these errors is simple, but time consuming, by removing this small task from their workflow means productivity is improved a staggering amount. This is because less time is spent going back looking of errors in the code and more time is spent writing. This improvement in productivity means that more app developers look to use the Android Studio application, due to the increased usefulness of their workers, and in turn Google gains more users.

Refer to the *Countdown* chatbot interactions below in your answer to part (b). Your answer must be based only on what you see in the screenshots; you may not access the internet.



(b) (i) How effective is this chatbot in performing the task it was designed for?

Not very effective. The chatbot is present on the Countdown application, Countdown being a shopping centre likely relies on this AI to provide information such as store location and products available to consumers much like a human would. Providing the currently lacking ability to converse with human workers on a wide scale, as it is simply impractical to have a large portion of a workforce focused on providing information to consumers. The bot is able to answer seemingly relevant questions like 'Where are the closest stores' in a way that would be expected of it. Not only is the response helpful, but it is very much the way a human would be expected to answer the question. However, for instance, when the bot is asked about selling fresh olives, it falters, unable to find the meaning of the question, rather having to a garner a specific response to provide any meaningful assistance. The AI in this case is far less effective than a human, unable to give the required assistance likely due to a lack of training data, meaning they are unable to find the useful parts of a sentence to provide a response based on. This sort of response is a major downside of this AI, hindering user experience by forcing a specific regiment of question asking to provide viable feedback. For this kind of chatbot, you want it to be as human like as possible, to allow for your consumers to have the best experience and not be hindered by the fact that they are talking to an AI, something that causes bias to form. This issue can be seen once again when asking for a recipe for poached eggs, the bot completely misunderstands the

intent of the message and goes off on a tangent about Countdown shopping lists, this sort of misunderstanding and behaviour is something completely against what the bot is designed for, reducing its effectiveness. Another issue is seen when asked about information in specific stores, like whether there is a bathroom at a certain location. This likely is not a fault of the AI, rather not being provided with this information in the first place, however, the AI should be expected to know details about its store due to the fact that it is catered towards a certain goal. This inability to answer certain questions, makes the AI hard to use, and means a wide variety of users would be turned away from using the product, due to its rather limited use case.

(ii) Describe at least one technique used by the chatbot.

The chatbot is a form of weak AI, used to provide a very focused or small range of functions. This use of weak AI is useful in the case of the Countdown chatbot, allowing it to very easily turn away irrelevant or dangerous questions. For instance, when asked about the weather, a question outside the scope the AI was designed for, it points you to Met Service, a common source of trusted weather information and continues the conversation. This is a great technique, stopping the AI from providing misinformation, and preventing any issues that come with it. As a company Countdown is responsible for the information passed down by its AI tools, and by being able to insure the validity of the answers Countdown avoids major consequences.

Another technique used by the chatbot is demeanour, it has been trained to act much like a human, this means that bias towards AI can be essentially avoided. Bias towards AI occurs as humans find it inherently easier to converse and communicate with humans, this causes major changes in personality towards AI, and could lead to a lack of understanding of behaviour by the AI and unintended results or outputs. By acting like a human the chatbot allows the problem to be mitigated, however, as previously mentioned, the chatbot doesn't always do a great job with this. However, when asked to converse in Maori with by a human, the bot reacts well, stating its unsure nature in the field but willingness to learn, just like a human would. It is this type of interaction that builds trust between user and AI, and in doing so allows the issue to be mitigated in this conversation

The final technique used by the AI is integration with the Countdown shopping tools. Being a bot made by Countdown to help users with shopping using the company, the bot has integrated tools to allow it to interact with the Countdown website flawlessly. This means for instance, up to date links with images of items can be shown on the bot without fear of incorrect information.

(c) Choose ONE of the following to answer:

- What factors need to be considered to train the AI in a self-driving car?
  OR
- Give an example of how an artificial intelligence is evaluated.

Choice (copy and paste below)

Give an example of how an artificial intelligence is evaluated.

Response

One way AI is evaluated is the Turing Test. The Turing Test was created in the 1950s as a method of determining the advancement of AI. If an AI solution is able to pass the Turing Test, it is said to be an advanced AI. The Turing Test tests the ability for AI to converse like a human, testing the ability of AI in the particular field. The Turing Test has one human participant have a conversation with two other participants, one which is an AI tool, and another which is a human. The human participant talking to both is unable to see or hear the other two participants, but converses with both, asking questions as they please. At the end of conversations, the human is asked to decide which of the two other participants was human, and which of the other was an AI. If the human is able to accurately give the decision (identifying the AI and human correctly), the AI is distinguishable from humans, and is therefore not at the level of advancement of humans. If they are unable to correctly identify the two, the AI is indistinguishable from humans, thereby it is human-like in intelligence and an advanced AI. An important factor to note in the Turing Test is its relevance to different forms of AI, for instance, a voice recognition AI would not be able to partake in the Turing Test, as it has no real form of conversational intelligence, rather only chatbots are relevant in this test.

(d) Choose ONE of the following to answer:

- How can the impact of human factors be considered when developing artificial intelligence for self-driving cars?

  OR

- What are the potential positives of future-proofing an artificial intelligence?

Choice (copy and paste below)

How can the impact of human factors be considered when developing artificial intelligence for self-driving cars?

Response

Humans are unpredictable, they often make poor or rash decisions when on the road or as pedestrians. This unpredictability of humans is a major issue that is faced when creating or developing an AI driven self-driving car. Being able to recognise possible next moves and planning for them is the best course of action for these AI vehicles. There are many ways that predictive AI like this can function, the most widely used in the scope of AI vehicles and specifically Waymo, the self-driving car developed by Google, is neural networks. Neural networks are a form of a AI meant to mimic the way humans and animal brains function, using artificial neurons. These neural networks have an input layer, where data is provided to network in arrays of numbers, for instance in the Google Image Recognition AI where images

are provided to the network in arrays of numbers corresponding the image. The information provided to the input layer is then passed on to a large number of hidden layers. These hidden layers are where the artificial neurons are located, these neurons perform complex calculations and tasks with the input values, eventually providing an output. These outputs have certain weights depending on the neuron. At the end of the large number of hidden layers comes the output layer, where probabilities of the objects the image contains are shown. These probabilities are compared to the label on the data and the process of back propagation occurs, where the AI looks back at what neurons negatively affected the end probabilities and their weightings are either increased or decreased to have a greater or lesser effect on the end outcome. The larger the dataset, the more accurate the weighting of neurons and the final output will be. In the case of Waymo and predictive AI, these inputs are taken in from LiDAR sensors present across the vehicle, used to determine accurate distances to possible hazards. The inputs are also taken from cameras once again present across the vehicle to decipher road signage and hazards, microphones to hear things such as emergency sirens for hazards. As outputs the self-driving car uses motors to allow the car to move around and traverse the terrain. Possibly the most important system used in the selfdriving car however is GPS, used as an input in order to find out where the car needs to move. For this predictive analysis of human behaviour, datasets are provided for all the inputs as well as a corresponding event sometime in the future. The process of training the neural network is then set into effect, to decide possible next actions of fellow cars and pedestrians. Being able to accurately predict human decision making takes large amounts of time and high quality datasets, that being said, is a vital step in ensuring the safety of humans on the road and pedestrians, as making a wrong decision is the matter of life and death. Why does having a predictive AI actually improve decision making? By allowing the AI to determine possibilities, they are also able to use the same AI to determine possible reactions, the key part is, because its predictive this is done in advance. This means that reaction time is not only improved upon in the space of AI, but it is likely that at a point the AI becomes better at avoiding spontaneous crashes as a result of human error.

(e) Choose ONE of the following to answer:

- Many smaller businesses do not have an online solution that includes artificial intelligence. Explain the advantages and disadvantages of this. *OR*
- Refer to the company you discussed in part (a). Explain some key issues your chosen company faces in developing artificial intelligence solutions for the products they create.

Choice (copy and paste below)

Refer to the company you discussed in part (a). Explain some key issues your chosen company faces in developing artificial intelligence solutions for the products they create

Response

There are 3 major issues Google face when developing their AI solutions, the first being bias. When training an AI, a dataset is provided, this dataset has items, labelled with the intended solution. When using AI, Google commonly uses what is called a neural network, a form of a AI meant to mimic the way humans and animal brains function, using artificial neurons.

When creating a dataset to train your neural network on it must be representative. If your dataset is unrepresentative, for instance only contains images of a certain type of computer, it is highly likely that neurons relating to the computers that have not been encountered have been attributed inaccurate weighting. This means when a picture of a new type of computer is seen, an inaccurate prediction is likely to be encountered, this is a form of information bias, where certain groups of people or things lead to incorrect results. In the case of this tool the issues aren't likely to be that widespread or serious. But in the case of Google's product Waymo (self-driving car) issues with bias could cause serious injury or death. Issues like this have already been seen in the past, where self-driving cars made by Toyota have hit pedestrians crossing the road, being unable to deem them as hazards due to bias meaning it was unable to recognise a person with their build or race as something that they have to react to. Google takes massive steps in attempting to prevent this issue in their products, insuring a key policy of not reinforcing or creating negative or unfair biases, a massive step toward fighting and mitigating the issue.

Other issue that arises out of datasets is the ability to get information for these datasets, for example, in terms of the Google Search image recognition AI, being able to find high quality representative sets of data. To ensure high levels of accuracy, like Google requires to maintain a happy user base and avoid any issues with mistakes in identification, large amounts of data are required, not only large datasets, but also those that are representative to avoid bias. The major issue comes when attempting to find this data, it has already been stated the wide scale issues that come with having inaccurate or non-representative data, a matter of life and death in some circumstances, being able to rely on the data and information found is a major step in the training of AI.

The obvious step to solve the problem is, use the internet. Other than the possibility of inaccuracy in the dataset, the next major issue arises. That being legality. When people post images on the internet, often they have some form of copyright, stating fair use, in the case of AI, the legality and ethical implications of using copyrighted images, often without consent is the topic of debate. This ambiguously is often the Achilles heel of AI solutions, being able to use data without being slapped by the legal issues that follow suit. Companies including Google have faced issues with this in the past, using copyrighted work in training their AI solutions resulting in large fines, and even the removal of the solution completely. For a company like Google that relies on the AI to provide their quality user experience, the item that brings them so many users, this is a major problem to solve.

The final issue that Google faces in the creation of their AI tools regards job loss and ethical concerns. Take the Android Studio Bot tool for example, it provides an increase in productivity to users by allowing simple, rather time consuming issues in code to be fixed in an integrated environment. The issue really arises when looking at the other uses of the bot, specifically in wider scale conceptual problem solving. For app development problem solving is the key part of why human interference is necessary, at this point in time the tool is still in its early stages but as the tool advances, the need for humans in the job space diminishes, being able to write large amounts of high quality error free code, not only provides the task of app development but does it better than most humans. This means a decrease in job opportunities in the work force, as obviously AI has major benefits such as lack of a salary and time off. This major drop in the job requirements for the field means that many would likely lose their jobs, causing significant distress to a large group of people. Similarly, the issue can also be faced in the rise of Waymo, Google's product for self-driving cars, where as the cars become more advanced, the need for taxi drivers, and other jobs that require driving are taken over by AI, removing the need for humans. To combat this issue Google has a policy on AI, that being that all AI tools they produce and release be socially beneficial.

This means if Google deems that a tool would cause more harm than good in general society, they will not release it and in doing so play their role in mitigating the issue. Obviously Google holds a large amount of power here, and the policy has only Google's discretion when releasing a tool, meaning the issue is only mitigated, not solved.

OR: **QUESTION TWO: COMPUTER SECURITY**

(a) (i) Choose one of the following companies:

- Apple
- Microsoft
- Amazon
- Google (including Waymo) Meta (including Facebook)
- Tencent (WeChat)
- ByteDance (TikTok)

Company:

(ii) What issues does this company face to protect the security of its users?

(iii) What are TWO steps this company has taken to deal with these issues and protect its users?

Refer to the email below in your answer to part (b). Your answer must be based only on what you see in the screenshot; you may not access the internet.

From: facebook@freeemail.com
To: jakematerich12345@nzmail.com

Dear jakematerich12345
FACEBOOK ANNUAL FEE
Your Facebook fees are overdue and your account will be DELETED very very soon
We at FacBook have previously contacted you. This is your FINAL not ice. FIX IT NOW
If you do not use Facebook anymore you must pay a fee to close your account. If you Do NOt all information including bithdays, password etc etc will not be protected and can be seen by anyone who wants to knoe
Make sure you protect yourselves by clicking on this link NOW. This will take you to a special secret Facebok server that has many many layers of protection to keep you safe
The annual fee is $99USDollars. If you want to seculey close your Twitter account then it will cost $149USD Dollars

We are disappointed you have not already paid this fee and you must PAY it NOW to keep your facebook account open and to protect all your really really confidential data

Pay now by clunking on the link to demostate what an intelligent person you are

Jo Santa
kooxda ammaanka buugaagta

(b) (i) Discuss the warning signs that this email may not be genuine.

(ii) Explain what actions should be taken in response to receiving this email.

Choose ONE of the following to answer:

(c)

What are the main reasons organisations require their clients to use two-factor authentication?

OR

- What is reCAPTCHA, and how does it help limit criminal activity?

Choice (copy and paste below)

Response

Choose ONE of the following to answer:

(d)

How can an organisation protect against the impact of human factors with computer security?
OR

- What can be done to future-proof computer security against unknown threats?

Choice (copy and paste below)

Response

Choose ONE of the following to answer:

□

(e)

What advice would you give to a young person to protect themselves and their computer when going online for the first time? Explain the reasons for your advice.

OR

□ Refer to the company you discussed in part (a). Your chosen company has considerable data on their clients and their habits. Explain the risks to the clients in the ways the company may choose to make use of this data.

Choice (copy and paste below)

Choose ONE of the following to answer:

□

Response

OR: **QUESTION THREE: ENCRYPTION**

(a) (i) Choose one of the following companies:

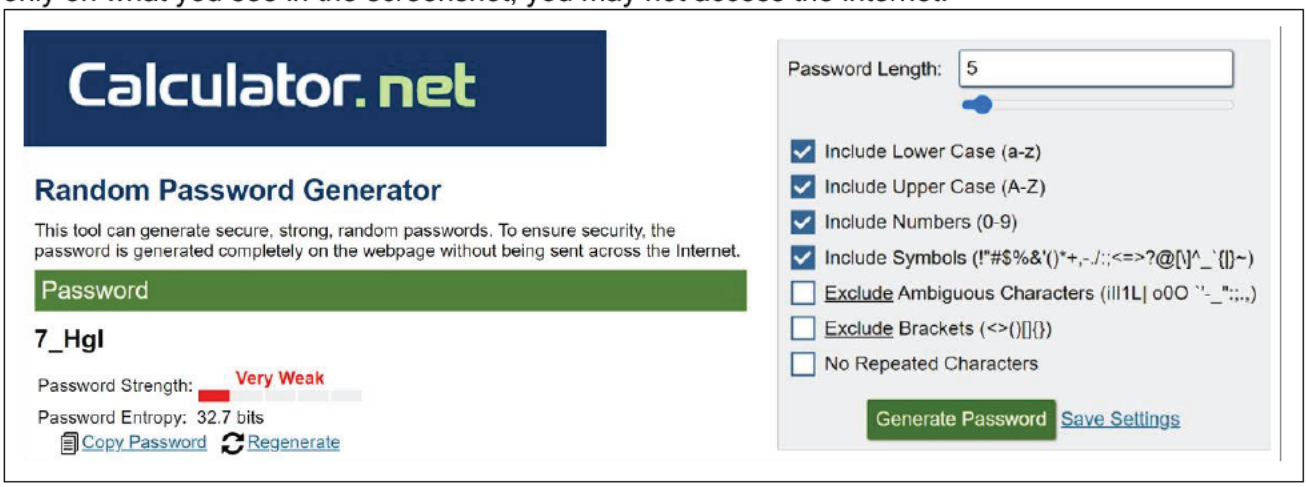
- Apple
- Microsoft
- Amazon
- Google (including Waymo) Meta (including Facebook)
- Tencent (WeChat)
- ByteDance (TikTok)

Company:

(ii) How does this company use encryption?

(iii) What are at least TWO advantages of this company using encryption?

Refer to the random password generator below in your answer to part (b). Your answer must be based only on what you see in the screenshot; you may not access the internet.



(b) (i) What are the advantages and disadvantages of using a password generator?

(ii) Is it a good idea to use these settings to generate different passwords for all accounts? Explain why or why not.

Choose ONE of the following to answer:

-

(c)

Explain what HTTPS is and why it is recommended instead of HTTP. *OR*

- Explain the difference between how encryption works on passwords compared to how it works on private / public keys.

Choice (copy and paste below)

Response

Choose ONE of the following to answer:

□

(d)

After an organisation has a data breach, how can it future-proof to reduce the impact?

OR

- What are the human factors an organisation must consider when it closes down and has a large amount of customer data?

Choice (copy and paste below)

Response

Choose ONE of the following to answer:

□

(e)

Criminal activity on the internet is increasing, with many individuals and organisations losing large amounts of money. Explain what can be done to combat this problem. *OR*

- Explain a major development in computer encryption and why it is important.

Choice (copy and paste below)

Response

Choose ONE of the following to answer:

□

Excellence

Subject: Digital Technologies and Hangarau Matihiko

Standard: 91898

Overall grade: 07

Grade	Marker commentary
E7	Overall, this candidate demonstrated an in-depth understanding of their chosen topic, artificial intelligence. They made good choices about the questions they answered and often went beyond the minimum requirements for Excellence. They also demonstrated that they could apply their knowledge to other situations. The candidate chose questions that avoided duplication in all answers, and they demonstrated understanding throughout. For example, this knowledge was evident in the candidate's response on the limitations of the Turing Test.