Artificial Intelligence: Turing Test and Chatbots

For Achievement standard AS91636 (Digital Technology 3.44)

This is a guide for students attempting Artificial Intelligence in digital technologies achievement standard 3.44. This guide is not official, although we intend for it to be helpful, and welcome any feedback.

Introduction to Achievement Standard AS91636

Achievement	Achievement with Merit	Achievement with Excellence
● describing **key problems** that are addressed in selected areas of computer science ● describing **examples of practical applications** of selected areas to demonstrate the **use of key algorithms and/or techniques** from these areas	● **explaining** how key algorithms or techniques **are applied** in selected areas ● **explaining** examples of practical applications of selected areas to demonstrate the use of key algorithms and/or techniques from these areas	**discussing examples of practical applications** of selected areas to demonstrate the use of key algorithms and/or techniques from these areas ● **evaluating the effectiveness** of algorithms, techniques, or applications from selected areas
http://www.nzqa.govt.nz/nqfdocs/ncea-resource/achievements/2014/as91636.pdf		

In order to fully cover the standard, you will also need to have done a project in one other 3.44 topic, in addition to this project on Artificial Intelligence. The other project should be in either Software Engineering, Complexity and Tractability, Formal Languages, Network Protocols, or Graphics and Visual Computing.

Understanding the terminology in the standard

Selected Area(s)	● Artificial Intelligence (referred to as "Intelligent Systems")
Key Problem(s)	● Evaluating whether or not a computer program behaves in a human-like manner. ● Building computer programs that can behave like a human. ● Solving complex problems using computers that appear to behave like a human, for example help systems.
Algorithm(s) and Technique(s)	● The Turing Test ● Algorithms and techniques used by chatbots to sound human-like.
Practical Applications(s)	● Carrying out Turing Tests to evaluate intelligence ● Online chatbots ● Chatbots used for help systems (important to cover these for excellence)

Preparation to do before writing your report

Before going any further, read over this entire guide so that you know what is expected of you. In particular, pay attention to the **hints for success** section at the end.

In this guide, the things you need to have done are all in coloured boxes, so that they are easy to find. Different colours have been used for preparation (things you should do **before** writing your report), Achieved level, Merit level, and Excellence level.

Preparation, part 1: Reading from the Computer Science Field Guide

You should read and work through the interactives in the following sections of the CS Field Guide in order to prepare yourself for the assessed project.

10.1 - What's the Big Picture?
10.2 - Chatterbots and the Turing Test

Be sure to read the collapsible section called **Project: Run your own Turing test on a chatterbot**, as this is what you will be doing next.

Preparation, part 2: Carrying out a Turing Test

The Turing Test is used to evaluate computer programs that are attempting to have a conversation like a human. In this project, you will carry out Turing Tests with online chat bots, and report on the process and your findings. You will need to choose a classmate to work with.

Carry out **two** Turing Tests. For one of them, you will be the interrogator. For the other, your classmate will be the interrogator. Each of your Turing Tests should use a different chatbot. Alice and Cleverbot provide a good contrast.

Remember that each Turing Test involves two conversations, one after the other: One where the interrogator is talking to the chatbot, and one where the interrogator is talking to the human. The interrogator does not know which conversation is with the chatbot, and which is with the human. Each of the conversations should not be more than about **16 lines long (8 from the interrogator, and 8 from the classmate or chatbot),** as it is the quality and content of the interrogation that matter, not the length**.**

Before carrying out your Turing Tests, *read the hints for success* at the end of the document. It is essential that you carry out your Turing Tests properly!

Writing your report - Achieved

A student aiming for Achieved would typically write around 2 to 2 ½ pages for Artificial Intelligence.

Achieved, part 1: Writing your introduction to artificial Intelligence
describing key problems that are addressed in selected areas of computer science

Write an **introduction** for your report by explaining **what the purpose** of the Turing Test is, and what problem in **computer science** it *addresses and solves.* Think carefully about what Alan Turing was trying to achieve when he proposed the Turing Test.

Your first sentence should start with "**A key problem in computer science is…**" so that it is clear to the marker what your report is going to cover, and that it is your response to the first bullet point in Achieved.

Do not show any chatbot conversations yet.

*This section should be **no more than ½ a page.***

Achieved, part 2: including examples in your report

Include the **four** conversations you collected while carrying out the Turing Test.

- Turing Test 1, conversation 1: You as the interrogator, conversing with your classmate.
- Turing Test 1, conversation 2: You as the interrogator, conversing with the first chatbot.
- Turing Test 2, conversation 1: Your classmate as the interrogator, conversing with you.
- Turing Test 2, conversation 2: Your classmate as the interrogator, conversing with the second chatbot.

Put these into your report, ensuring they **do not take up more than 1 pages**. This layout example suggests a way you could layout the conversations in a table or formatted to two columns, so that they do not take up too much space.

*This section should be **no more than 1 page.***

Achieved, part 3: describing how the Turing Test is carried out
describing examples of practical applications of selected areas to demonstrate the use of key algorithms and/or techniques from these areas

Explain **how you** carried out the Turing Test. You should include the following points in your explanation.
- What is the purpose of the Turing Test?
- Anything you had to do to ensure the test was "fair" for the chatbot. i.e. how you made sure that there weren't obvious differences between a human and a chatbot, such as being able to hear the person speak
- What clues did you look for to tell which conversations were with chatbots, and which were humans?
- Of the two chatbots you looked at, which one seemed the most intelligent?

*This section should be **no more than 1 page** (unless you extend it for merit, part 1).*

Writing your report - Merit

A student aiming for Merit would typically write around 3 ½ to 4 pages for Artificial Intelligence.

Merit, part 1: Explaining how the Turing Test is applied
explaining how key algorithms or techniques are applied in selected areas

Ensure your explanation for Achieved, part 3 is clear. This will contribute towards merit, because you are explaining how the Turing Test is applied. Check that you have clearly explained how the Turing Test was used to evaluate the chatbot(s). **Remove any bullet points and replace them with full sentences and paragraphs.**

Consider writing it up like you would for a scientific experiment. This should take up to around 1 page. You might use headings like Materials, Procedure, Observations (the conversations you collected), and Conclusions.

*This section should be **no more than around 1 ½ pages** (note that this is including the ½ page that was allocated for the achieved component, so you should only have an extra ½ a page).*

Merit, part 2: Explaining Algorithms and Techniques used by chatbots
explaining examples of practical applications of selected areas to demonstrate the use of key algorithms and/or techniques from these areas
explaining how key algorithms or techniques are applied in selected areas

You probably noticed some of the tricks that the chatbots were using to attempt to sound intelligent, or to deal with things they did not understand. Some of these include (but are not limited to):
- Countering a question with another question.
- Using remembered ("canned") responses.
- Giving vague or general replies
- Responding with more general topics (for example, if you mention your sister, the chatbot might ask you how your family is doing).

Choose 3 or 4 techniques used by the chatbots. Then for each technique, do the following:
- Show an example from your conversations of the technique being used by a chatbot (this can either be from the conversations gathered during the Turing Test or additional conversations you have had with the chatbot).
- Explain how the technique was used by the chatbot (in other words, why is this example of the technique?)
- Explain whether or not the technique being used in the example is convincing.

If you are having difficulty finding enough techniques, try an additional chatbot, such as Eliza, for examples. You **do not** need to carry out an additional Turing Test or write a lengthy introduction to any further chatbots you use. Simply write one sentence stating what the chatbot is, show an example of the technique being used, and explain the usage of the technique.

It is not enough to simply state techniques that chatbots use—the marker will assume you copied the list of techniques from somewhere (such as this guide!).

*This section should be **no more than around 1 page, a bit less if you are going for excellence.***

Writing your report - Excellence

A student aiming for Excellence would typically write around 4 ½ to 5 pages for Artificial Intelligence.

Excellence: Writing an in-depth discussion

discussing examples of practical applications of selected areas to demonstrate the use of key algorithms and/or techniques from these areas
evaluating the effectiveness of algorithms, techniques, or applications from selected areas

For excellence, you will need to do further reading and investigations on applications of computers that behave like humans, and then write a 1 to 1 ½ page discussion on what you have learnt. It is important that this discussion focusses on substantial real world applications, discussing how algorithms and techniques are used by them, and evaluates whether or not the algorithms and techniques are effective, and the current state of the real world applications (for example, what problems still need to be solved?)

You should pick *1 or 2 points from each list* to investigate for your discussion.

List 1: Discussing practical applications
- How are chatbots valuable for help systems, and what algorithms and techniques do they use for this purpose?
- Some computers attempt to display meaningful human emotions. How is this related to chatbots, and what real world applications do these computers have?

List 2: Evaluating chatbots, the Turing test, and practical applications
- Is the Turing Test a good way of testing whether or not chatbot is able to behave convincingly like a human? (Don't just give an opinion - do some research on what experts have said about this).
- What is the current state of chatbots, and what problems still need to be solved?
- Which chatbot algorithms and techniques are effective, and which are not? What are some of the more recent algorithms and techniques being developed for chatbots? Which applications are most suited to which algorithms and techniques?

Be sure to keep a list of all sources you use. You must include these in a **bibliography** at the end of your report.

The following links might be a useful starting point

- *Pandorabots:* https://playground.pandorabots.com/en/
  Pandorabots is a website where you can make your own chatbot, if you're keen! Have a read to see some of the algorithms and techniques you can use to build a bot on their website, and have a look at some of the chatbots people have written. Looking at how chatbots work will help you to form a view on how intelligent they are.
- *Alan Turing's Paper:* http://cogprints.org/499/1/turing.HTML
  This is the paper where Alan Turing originally suggested the Turing Test
- *Wikipedia:* https://en.wikipedia.org/wiki/Chatterbot
  Wikipedia is a good source of general information in this area. Go to related pages, and have a look at the citations and references.

*This section should be **no more than around 1 to 1 ½ pages**. Quality is more important than quantity. Write as concisely as you can, and remove any weak or vague explanations or arguments.*

Hints for Success

- **Turing Machines are *unrelated* to the Turing Test**, and have nothing to do with Artificial Intelligence. You should *not* discuss Turing Machines for the area of Artificial Intelligence. (There are several important things in computer science named after Turing, including the Turing award, Turing-completeness, and Turing Machines).

- **Offensive words or topics are not likely to be appropriate to include in your submitted report**. If a chatbot (or classmate) says something inappropriate, blank that part out.

- Remember to put all explanations, especially for merit and excellence**, in your own words**.

- The conversations happen **one at a time**. In other words, the interrogator has an entire conversation with their first test subject (which could be either the human or the chatbot), **and then** an entire conversation with their second subject (which will be the one they haven't talked to yet). The conversations do not occur in parallel. **At the end** the interrogator makes a guess about who is who.

- **It is important to have conversations**. Asking lots of unrelated questions is not sufficient (never use predefined lists of questions - *this is not a quiz show*). Instead, you should mostly be trying to have a conversation that naturally flows on one subject. Do try one or two subject changes though; it is interesting to see how the chatbot will react. Pretend you are talking to somebody you don't know very well.

- Here are a couple of examples of conversations. The first conversation asks too many unrelated questions to the chatbot, and is an example of how you should **not** go about your Turing Test. The second example attempts to have a conversation, and is a good example of how to go about your Turing Test

Bad Example	Good Example
judge: What is your favourite colour? **ALICE**: My favorite color is green. What is yours? **judge**: What do you do? **ALICE**: judge, I talk to people on the web. What do you do? **judge**: What is your name? **ALICE**: My name is ALICE. **judge**: How long have you been alive? **ALICE**: 16 years. **judge**: What is your favourite movie? **ALICE**: My favorite movie is Casablanca. Have you seen it? **judge**: What is your favourite song? **ALICE**: My favorite song is Imagine. Do you know it? **judge**: What is your favourite food? **ALICE**: I require only electricity.	**judge**: What is your favourite colour? **ALICE**: My favorite color is green. What is yours? **judge**: Mine is Purple **ALICE**: purple is a very nice color. **judge**: Why isn't it your favourite colour? **ALICE**: My mind does not contain an explanation for it. **judge**: What does your mind contain? **ALICE**: What do you think it does? **judge**: I would have no idea **ALICE**: How much would you pay for it? **judge**: Nothing, sorry **ALICE**: Really nothing? **judge**: Yeah, you're a worthless chatbot... **ALICE**: Aha.. Yes.