Lecture Notes for Lecture 15 of CS 5001 (Foundations of CS) for the Fall, 2018 session at the Northeastern University Silicon Valley Campus.

A Chatbot Name "ELIZA"

Philip Gust,
Clinical Instructor
Department of Computer Science

Lecture 14 Review

Functions with variable number of arguments

- Previously, we considered functions functions with a fixed number of arguments of fixed types.
- However, we learned that in C and many other languages, it is possible to create functions with variable numbers and types of arguments.
- We saw discovered that we were already familiar with such a function: *printf()*, which takes a format string and additional arguments that provide values to the format string.
- In this lesson, we studied how to process variable numbers of arguments and looked at several examples of how this technique is used.

Lecture 14 Review

Processing program arguments

- In this lecture, we also saw how arguments can be passed to a program at runtime and used to customize the program behavior each time the program is run.
- We looked at how to pass arguments to a program using the Run or Debug dialog in Eclipse, and how to access the arguments through parameters passed to *main()*.
- We saw that there are two styles of arguments: positional, and using either short or long option names to specify which argument was specified.
- Finally, we looked at how to process arguments in each style, but doing it ourselves, and using the C getopt library.

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Introducing chatbots

- For this final lecture, we will look at an interesting application of many of the programming techniques we have studied this semester: *chatbots*.
- With the advent of social media on the web, a new phenomenon known as a *chatbot*" has becoming more pervasive.
- A chatbot is a computer program that conducts a conversation a human via text or voice.
- Chatbots are designed to convincingly simulate how a human would behave as a conversational partner, thereby passing the *Turing test*.

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Turing's test

- The Turing test, developed by Alan Turing in 1950, tests a machine's ability to exhibit behavior equivalent to, or indistinguishable from, that of a human.
- A human evaluator would judge a natural lauguage conversation between a human and a machine designed to generate human-like responses.
- The evaluator is aware that one of the partners is a machine, and all participants would be separated from one another.
- The conversation would be limited to a text-only channel so the result do not depend on the machine's ability to render words as speech.

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Turing's test

- If the evaluator cannot reliably tell the machine from the human, the machine is said to have passed the test.
- The test results do not depend on the ability to give correct answers to questions, only how closely one's answers resemble those a human would give.
- Rather than asking whether machines can think, Turing's question was: "Are there imaginable digital computers which would do well in the imitation game?"

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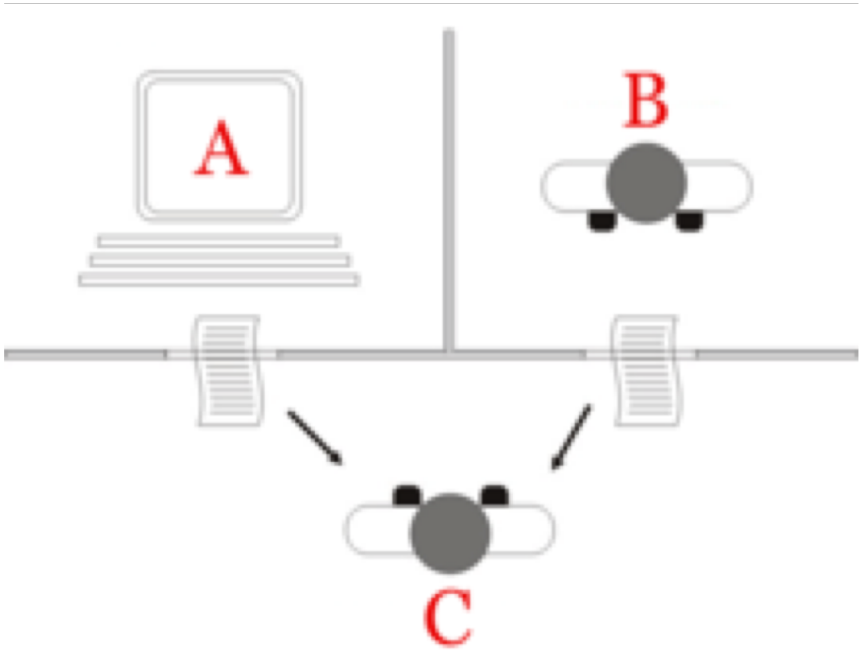
Turing's test



A Chatbot Name "ELIZA"

- Applications of chatbots include:
  - Customer service
  - Reference assistance
  - Telephone solicitation
  - Influencing public opinion
- Some chatbots use very sophisticated natural language processing systems with underlying reasoning capabilities
- Simpler systems use keywords within the input, and create a reply based on matching patterns in a prepared set of responses
- We will look at the simpler kind of chatbot, based on the ground-breaking work of AI expert Joseph Weizenbaum in the mid 1960s at MIT.

A Chatbot Name "ELIZA"

- AI expert Joseph Weizenbaum wrote the program ELIZA between 1964 and 1966 at MIT to demonstrate how superficial common human communication is.
- ELIZA reads sentences from a human, looks for keywords, selects a response sentence pattern, customizes it with words from the input sentence, and outputs the response.
- The program was named after "Eliza Doolittle" in Bernard Shaw's play, *Pygmalion*.
- Weizenbaum created a DOCTOR script for the program with keywords and responses that parody a non-directional Rogerian psychotherapist.

A Chatbot Named ELIZA

Results

- ELIZA program gave deceptively intelligent responses that deceived many individuals when first using the program.
- Weizenbaum and several others have anecdotes of users becoming emotionally attached to the program, occasionally forgetting that they were conversing with a computer.
- Weizenbaum's own secretary reportedly asked Weizenbaum to leave the room so that she and ELIZA could have a real conversation.
- Weizenbaum later wrote, "I had not realized… that extremely short exposures to a relatively simple computer program could induce powerful delusional thinking in normal people."

Chatbots Today

- With the advent of the web and social media platforms, chatbots or “chatterbots” today are big business.
- There are many thousands of chatbots deployed today on platforms like Facebook and Twitter. Many use simple keyword based technology.
- Chatbots are widely used by corporations and political organizations to influence pubic opinion using carefully crafted and frequently updated scripts.
- Chatbots are also taking over from human phone solicitors at fundraising organizations (often very successfully for certain demographics like seniors)
- Some companies specialize in creating and operating custom chatbots on behalf of companies. They are big business.

Inside a Chatbot

- We will look at a C implementation of Weizenbaum's ELIZA program to see how it works.
- The code is available on the 2018FACS5001SV GitHub organization as lecture-15.
- The program, "eliza.c" includes a sample DOCTOR script that is built in for convenience. In Weizenbaum's version, the script was read form a file.