

IBM Watson Assistant Object-Oriented Chatbot

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Project Statement

- The purpose of our project is to create a chatbot using IBM Watson Assistant to interpret and answer questions appropriating based on a specific topic.
- The user has the ability to ask various types of Object-Oriented questions.
- The chatbot will respond with an answer or direct the user to a webpage that provides an answer.

Project Estimates

PHASE	ESTIMATED HOURS	ACTUAL HOURS
Project Planning	15	20
Environment Setup	10	10
Design	30	25
Implementation	105	150
Testing & Edge Cases	50	45
Documentation	20	30

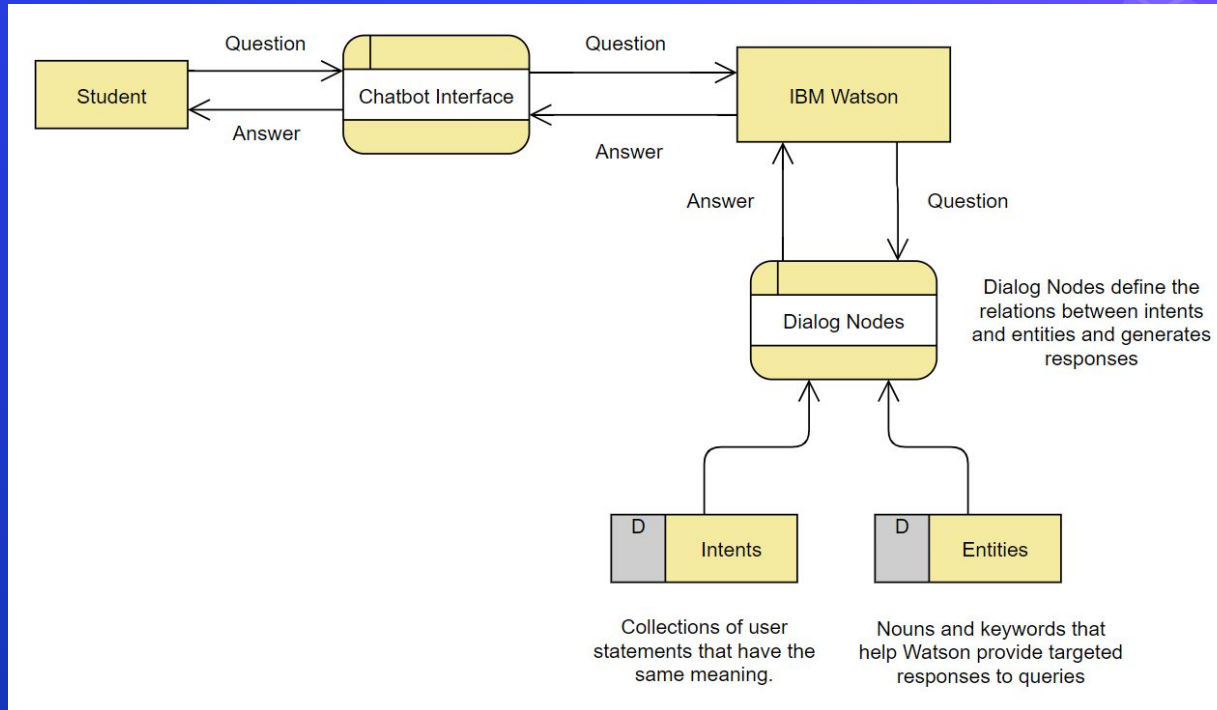
Project Estimates

Function	Estimated Lines of Code	Actual Lines of Code
General Questions	100	340
Variable Definitions	75	220
Concepts	90	200
Error Message Debugging	80	175
Syntax	85	210
Edge Case Patching	20	100

```
4112 + {
4113 +   "type": "standard",
4114 +   "title": "OutOfMemoryError",
4115 +   "output": {
4116 +     "generic": [
4117 +       {
4118 +         "values": [
4119 +           {
4120 +             "text": "OutOfMemoryError is an error that is caused by constructing objects inside of an infinite loop.
4121 +           }
4122 +         ],
4123 +         "response_type": "text",
4124 +         "selection_policy": "sequential"
4125 +       }
4126 +     ]
4127 +   },
4128 +   "parent": "node_7_1604534642639",
4129 +   "conditions": "@errors:OutOfMemoryError",
4130 +   "dialog_node": "node_5_1605723303800",
4131 +   "previous_sibling": "node_7_1605723049201"
4132 + },
```

<https://github.com/hannahmre/OOP-Chatbot/commit/3894ab7951893e44b5f118feee066c1d1d0d96b6>

Data Flow Diagram



The Data Flow Diagram shows the flow of information between the user and the chatbot.

Control Description

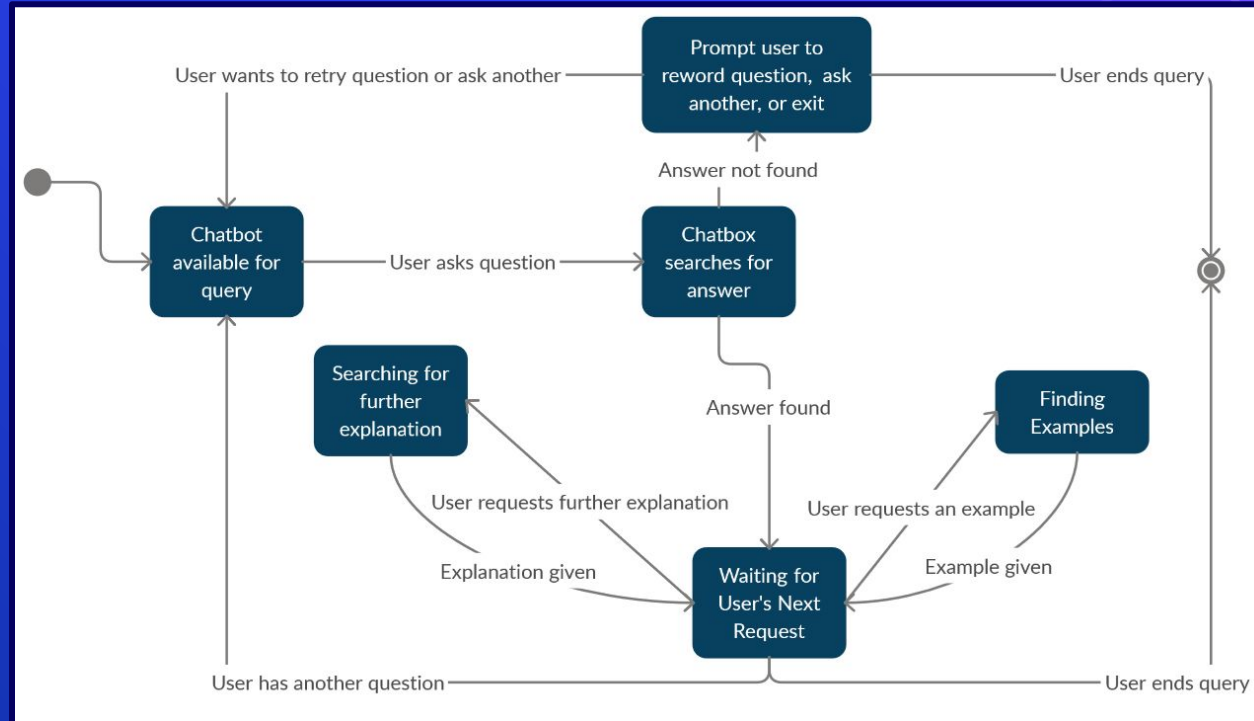
We know our fundamental user requirements thoroughly.

The user will enter in a question. The chatbot then will search a database for the exact or similar question.

If these parameters are satisfied the search will return an answer.

This way the user's interaction with the software is simple.

State Transition Diagram



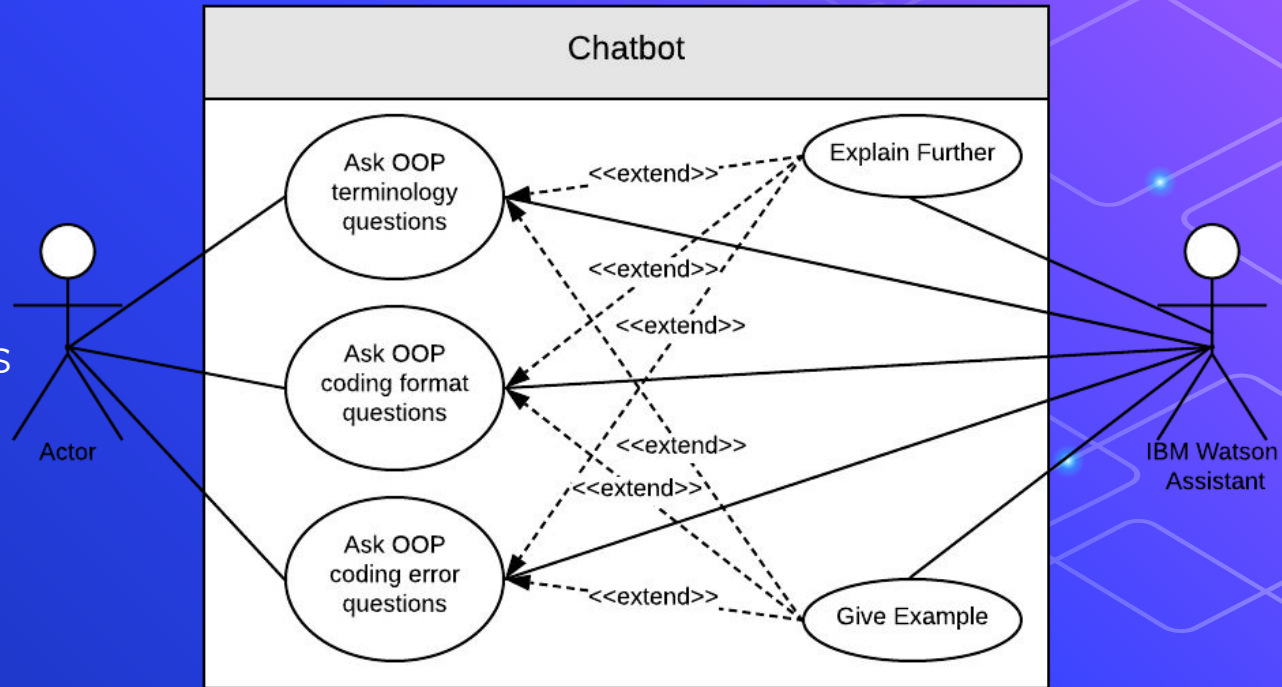
Use Case

StakeHolders

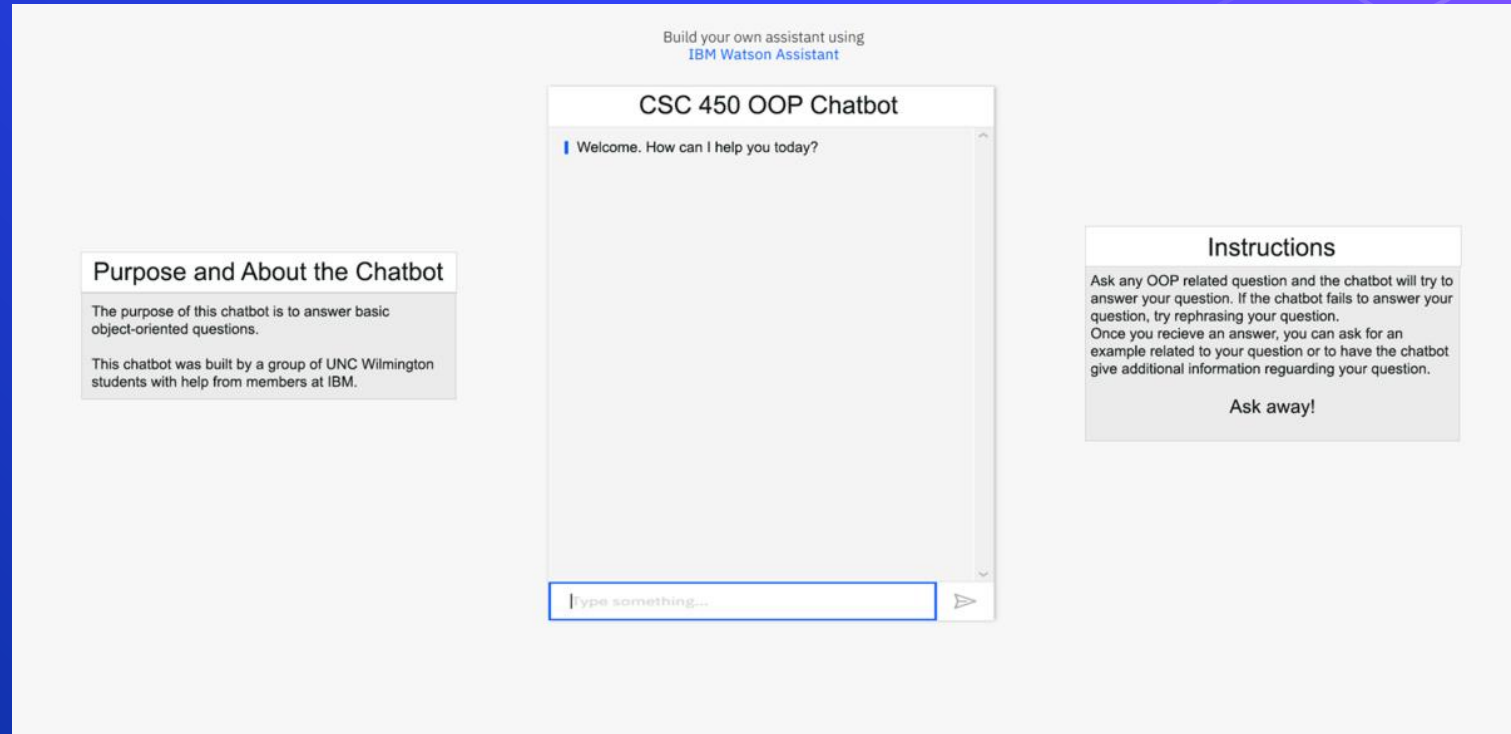
- Users:
 - Students
 - TA's
 - Professors
 - Tutors
- Universities
- Businesses

Actors

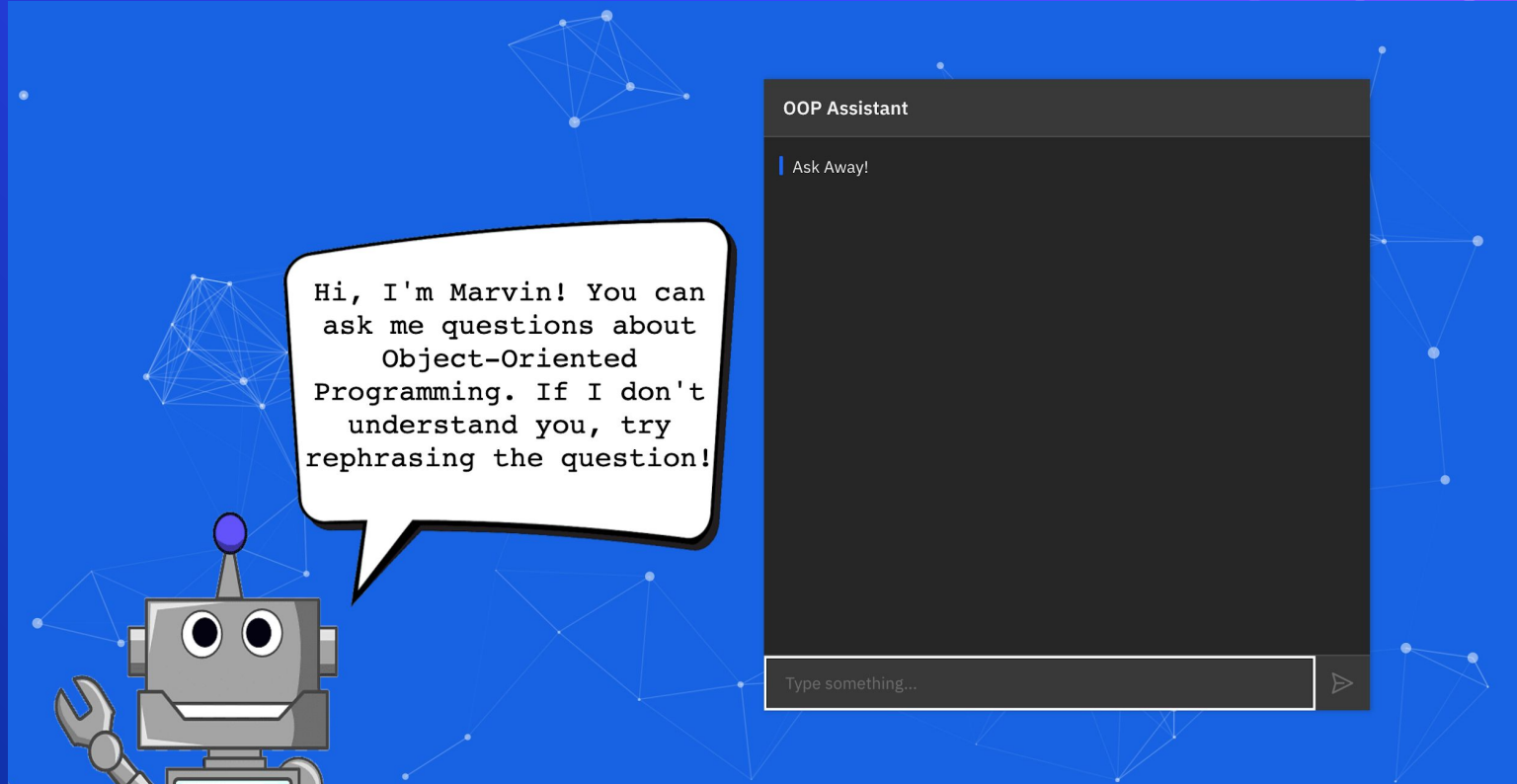
- Students
- TA's
- Tutors



Interface Design Plan



Interface Design



Test Plan

- Testing is spread between functional testing and integration testing.
- Testing occurs each and every time changes are made to the chatbot
- Functional testing is done both manually by one of the team members or automatically using the [WA-Testing-Tool](https://github.com/cognitive-catalyst/WA-Testing-Tool/) from IBM
- Tool performs k-fold cross-validation and blind testing on the chatbot.

<https://github.com/cognitive-catalyst/WA-Testing-Tool/>

Test Plan - Blind Test Output

can you tell me v	#error_message	error_messages	0.9422376156	errors:Illegal Sta	This is a commo https://stackoverflow.com/questions/115143/illegal-state-exception
if you don't creat	#how_to_use	how_to_use	0.9435673714	howtouse:base r	Yes, it is possible
when trying to ov	#how_to_use	how_to_use	0.8109642029	howtouse:overlo	Operator keywor
regarding an at	#how_to_use	how_to_use	0.9364663601	howtouse:abstra	Zero instances v
is a parameter re	#how_to_use	how_to_use	0.8986721039	howtouse:param	No, we do not re
what do I write to	#java_syntax	java_syntax	0.9261449814	terms:array	type[] variable =
					if (condition) { // block of code } else { // block of code }
what is the form	#java_syntax	java_syntax	0.5929533005	terms:if-else	
					for (statement1; // code block to }
whats the struct	#java_syntax	java_syntax	0.527188015	terms:for-loop	Where statemen
when making a v	#java_syntax	java_syntax	0.6066052914	terms:variable	type variable = v
					For single-line co //Your comment
					For multi-line co /* Your comment */
how do I comme	#java_syntax	java_syntax	0.7557583332	terms:comment	

Functional Testing

1. **Onboarding** - Are users understanding what the chatbots purpose is and how to interact with it when the chatbot is opened?
2. **Understanding** - What is the chatbot able to understand?
3. **Answering** - How well is the chatbot responding? Are the responses relevant to the users input?
4. **Navigation** - How easy is it to go through the chatbot conversation?
5. **Error Management** - How good is the chatbot when dealing with an unrecognized input?

Category	Test Case	Expected Result	Actual Result
Onboarding	Open chatbot from website	Chatbots purpose is obvious when first visited	Marvin tells the user that the chatbot is for answering OOP questions
Understanding/ Answerings	See Table 10		
Navigation	Ask a series of questions	Answer each question with no errors	Chatbot answered each question correctly with no confusion with user input
Error Management	Ask a OOP question that has not been implemented into chatbot	Give the user websites that may help answer their question	User is prompted with a list of websites that may help.

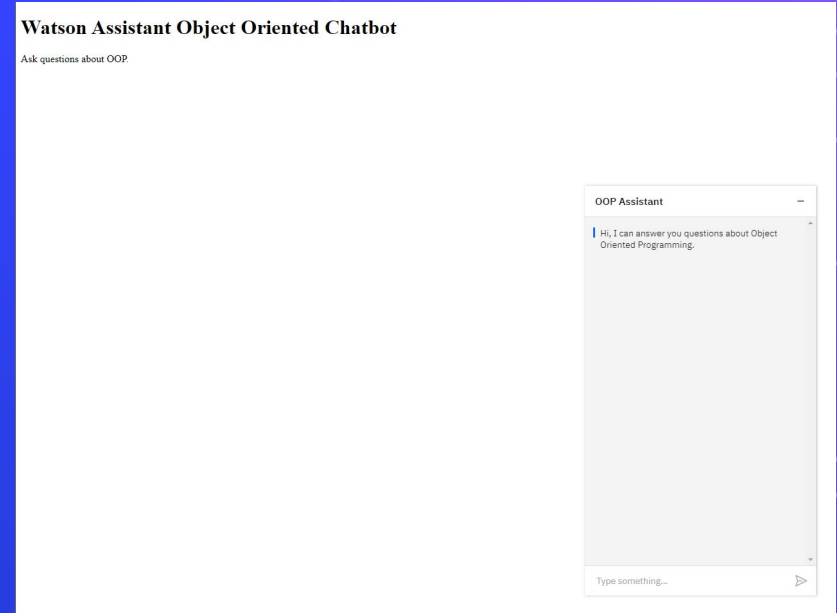
Functional Testing cont.

Test Case	Input	Expected Result	Actual Result
Input “definition based” question	“Can you tell me what encapsulation means?”	Definition of Encapsulation	“Encapsulation is used to hide the values or state of a structured data object inside a class, preventing unauthorized parties’ direct access to them”
Input “common error message” question	“What does the error incompatible types mean?”	Explanation of error	“This error message indicates you are attempting to perform an operation on a data type that is not compatible with that operation. Here is a StackOverFlow thread that may help your understanding. *url*”
Input “oop concept” question	“What are the basic concepts of oop?”	List of 4 main concepts of OOP	“The four main concepts of OOP are Abstraction, Encapsulation, Inheritance and Polymorphism”
Input “how to use” question	“What is the use of finalize method”	Explanation of finalize method	“Finalize method helps to perform cleanup operations on the resources which are not currently used. Finalize method is protected, and it is accessible only through this class or by a derived class.”
Input “difference between terms” question	“What is the difference between early binding and late binding?”	Definition of both early and late binding	“Early binding refers to the assignment of values to variables during design time, whereas, late binding refers to the assignment of values to variables during run time”
Input “java syntax” question	“What is the syntax of an array”	Example of creating an array	“Type [] variable = {item1, item2, item3};”

Integration Testing

Integration Strategies:

Due to the relative simplicity of the integration we are using continuous integration testing.



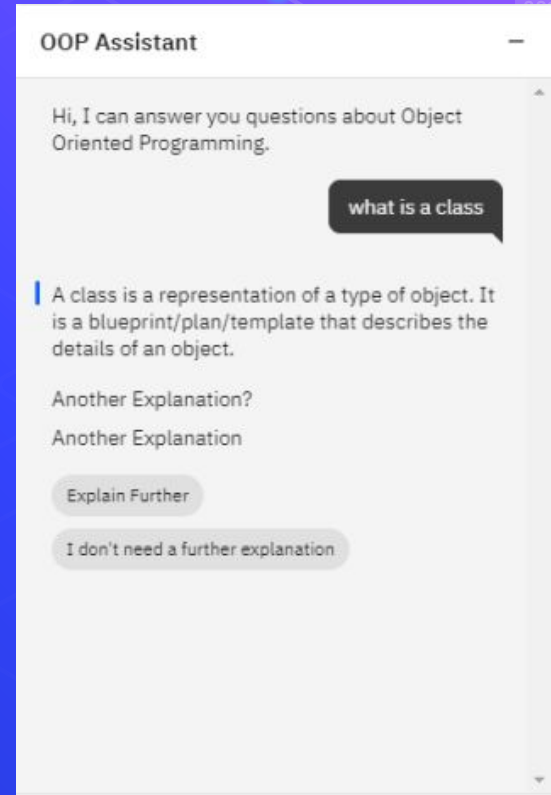
(early version of web interface)

Integration Testing - Test Cases

Test Case	Expected Result	Actual Result
Opening the chatbot	An icon appears on the website that can be clicked to open the chatbot	After opening the webpage a chat icon appears in the bottom right corner that can be clicked to open the chatbot
Minimizing the chatbot	A minimize button can be clicked to minimize the chatbot	While the chatbot is open you can click the minimize icon in the top right corner of the chatbot interface that minimizes the chatbot back to the chat icon
Asking the chatbot one question	The chatbot will return an answer to the question	User types "What is a class?" and is returned the answer "A class is a representation of a type of object. It is a blueprint/plan/template that describes the details of an object."
Asking the chatbot multiple questions	The chatbot will return an answer to the first question before allowing more questions to be asked which will also return answers	User types the first question and is returned an answer and then types "What are the four main concepts of OOP?" and is returned the answer "The four main concepts of OOP are Abstraction, Encapsulation, Inheritance and Polymorphism."

Test Evaluation

- Overall, the testing went great!
- We ran into very few bugs/issues
 - Chatbot returns “Another Explanation” twice [see picture]
 - Testing Tool from IBM



Demo

[Click Here for Demo](#)

<https://github.com/hannahmre/OOP-Chatbot>

Thanks!

Any questions?

