Science Bowl

Current project status: Linter passing   Unit Tests failing

Overview

An advanced program for science bowl training that will analyze rounds to provide statistics as well as use machine learning to teach players in areas they may not be as familiar.

Competition Description

> Launched in 1991, the National Science Bowl® (NSB) is a highly competitive science education and academic event among teams of high school and middle school students who compete in a fast-paced verbal forum to solve technical problems and answer questions in all branches of science and math. Each team is composed of four students, one alternate student, and a coach. Regional and national events encourage student involvement in math and science activities of importance to the Department of Energy and the Nation.

[- US DOE Website](#)

In this competition, teams compete to answer questions in "rounds" such as the one shown below.

HS Practice Qs. -Set 1, Round 1

1) BIOLOGY *Short Answer* What is the most common term used in genetics to describe the observable physical characteristics of an organism caused by the expression of a gene or set of genes?

2) BIOLOGY *Short Answer* What is the biological term most often used for the act of a cell engulfing a particle by extending its pseudopodia (read as: SU-doe-POH-dee-ah) around the particle?

3) CHEMISTRY *Multiple Choice* An aqueous solution in which the concentration of OH₋ ions is greater than that of H₊ ions is:
W) basic
X) acidic
Y) neutral
Z) in equilibrium

4) CHEMISTRY *Short Answer* Find the mass of 1 mole of cuprous oxide, or Cu_2O. Assume the atomic mass of copper is 64 and oxygen is 16.

5) PHYSICS *Short Answer* What property of a sound wave is most commonly associated with loudness?

6) PHYSICS *Short Answer* What is the MOST common term for the behavior of light where it appears to bend around small obstacles or the spreading out of waves as light passes through pinholes or slits?

7) MATH *Short Answer* What term BEST describes 2 angles with 90º as the sum of their measurements?

Problem Statement

The Science Bowl competition covers a large range of subject areas, and it is very difficult to know where to start studying. It is also quite difficult to go through practice questions and study them without another person there to read them to you. Long story short, studying for the competition is a lot of work, and there is currently no simple solution.

Project Proposal

Many of the tasks that are required for studying content such as reading rounds, figuring out what things are necessary to study, etc. can easily be automated by a computer algorithm. This project will attempt to enhance the process of completing many of these tasks. The main functions of the project will be as follows:

Steps

1. Extract data from PDF sample rounds
2. Analyze rounds and get statistics on most common topics
3. Display questions on a screen and give the users a time limit to answer them
4. Use some sort of text-to-voice algorithm to actually read the questions, so that it is more similar to an actual competition
5. Generate statistics on what topics individual users need to study
6. Implement machine learning to enhance steps 2 and 6, and to provide a better classification of topic areas
7. Sync with a database to layout what topics each member of a team is good at, and what they each need to study in order to be the most successful in the competition.

Other Possible Features

- GUI for training
- Display of questions as text
- Auto question reader
- Round selection
- Allow players to choose what rounds/categories they want to play
- Greater customizability
- Specific category selection
- Specific difficulty selection

- Round timers and controls
- Stop reading when buzzed
- Simulate real round
- Buzzer system integration

Project Design

At this point in time, the project is going to incorporate the following objects:

Main: Responsible for initializing the game, and serving up the GUI to the user. It ties everything all together.

Extractor: This class is in charge of extracting questions from round files (as shown above). It will then move them into a format that includes all of the necessary information to ask a player a given question.

User: Keeps track of information and statistics about the player.

QuestionAsker: This is responsible for formatting the questions properly to be served up in the GUI, or maybe read out loud in the future.

Analyzer: The analyzer takes in the data provided by the user and the extractor, and generates statistics both for the player's strengths and weaknesses, and well as general statistics for all of the rounds.

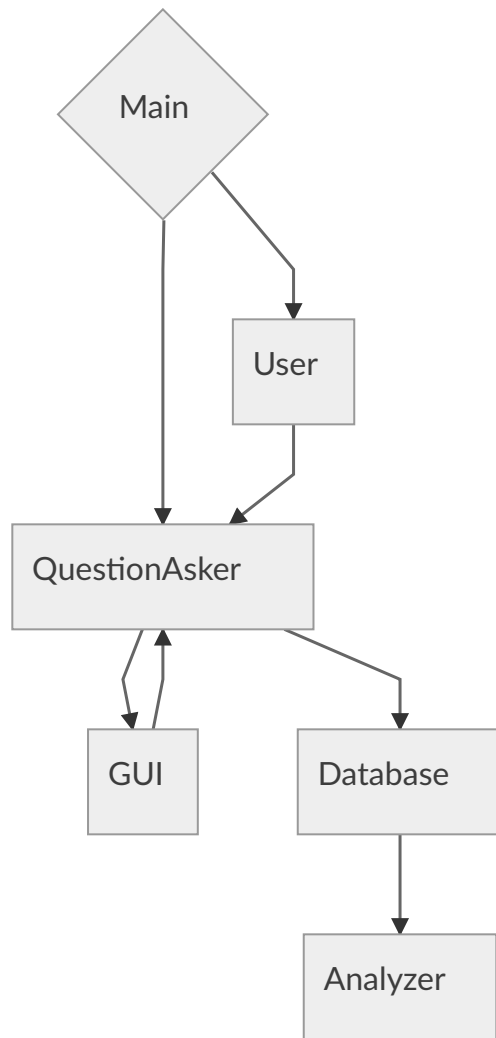Database: This object interacts with a database to help store and update data.

GUI: This is pretty self explanatory. Manages the GUI. It may integrate other objects as widgets, but that will come later.

Interface

This project is going to, in a way, be separated into two different parts. The "Game" portion, and the "Analysis" portion.
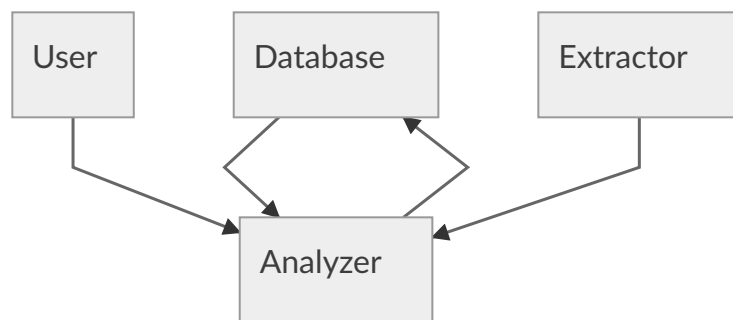
Game

The game portion is intended to ask players questions and record information about it. The game program flow may look as follows:
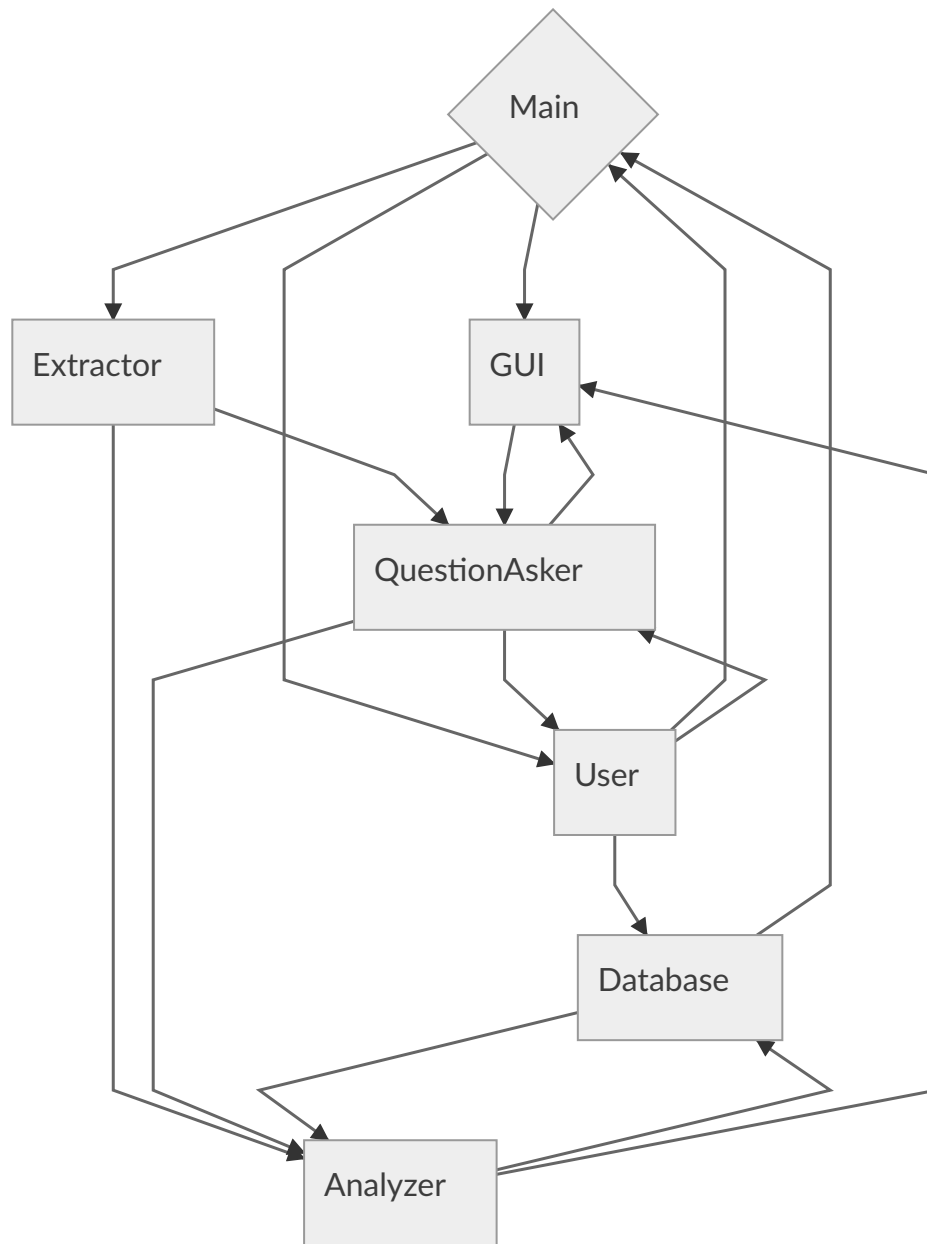
```
              ┌───────┐
              │ Main  │
              └───┬─┬─┘
                  │ │
                  │ └──────────┐
                  │       ┌────┴────┐
                  │       │  User   │
                  │       └────┬────┘
                  │            │
        ┌─────────┴────────────┴──┐
        │     QuestionAsker        │
        └──┬──────────────────┬────┘
           │                  │
      ┌────┴───┐         ┌────┴─────┐
      │  GUI   │         │ Database │
      └────────┘         └────┬─────┘
                              │
                         ┌────┴─────┐
                         │ Analyzer │
                         └──────────┘
```

Analysis

The analysis portion analyzes the rounds and the game data. Here is what the flow of the analysis side may look like:

```
  ┌───────┐     ┌──────────┐     ┌───────────┐
  │ User  │     │ Database │     │ Extractor │
  └───┬───┘     └────┬─────┘     └─────┬─────┘
      │              │                 │
      │         ┌────┴─────┐           │
      └─────────┤ Analyzer ├───────────┘
               └──────────┘
```
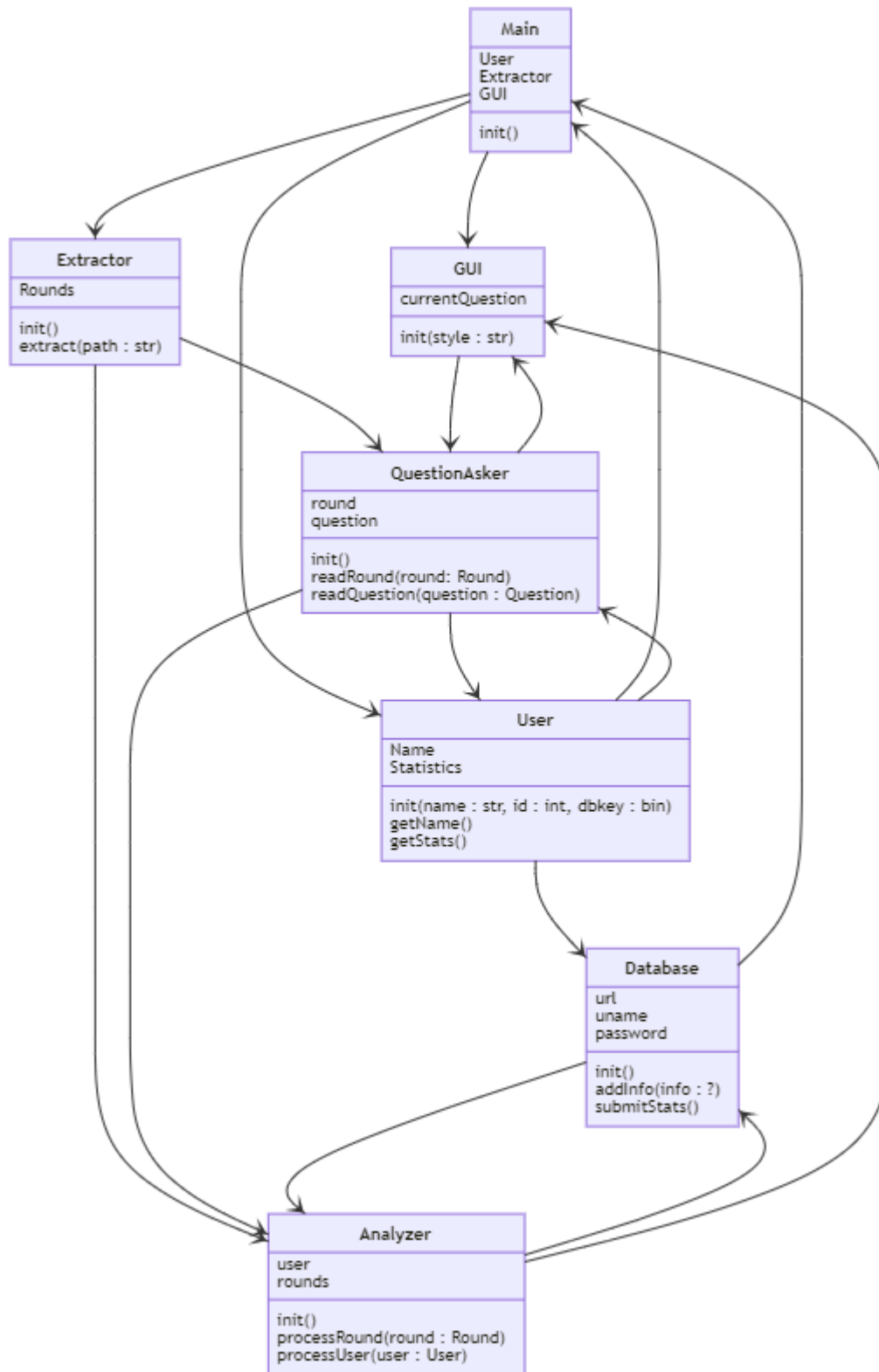
Complex Program Flow

This is a demo of how the program might function as a whole.

CRC Cards

Main

Responsibilities:
- Operates program as a whole
- Creates User, Extractor, and GUI

Collaborators:
- User
- Extractor
- GUI
- Database

Attributes:
User, Extractor, GUI, other general game info

User

Responsibilities:
- Pass info to database
- Record statistics about user from round
- Get info from Question Asker/pass info to question asker
- Be analyzed

Collaborators:
- Main
- Database
- QuestionAsker

Attributes:
User statistics and information

GUI

Responsibilities:
- Render information to the screen

Collaborators:
- Main
- QuestionAsker
- Analyzer

Attributes:

Extractor

Responsibilities:
- Extract questions from PDF rounds
- Give QuestionAsker rounds to be asked
- Give rounds to Analyzer to be analyzed

Collaborators:
- Main
- QuestionAsker
- Analyzer

Attributes:
Rounds

QuestionAsker

Responsibilities:
- Get info about rounds
- Format questions in a good format and give to GUI
- Record what happens (whether player got question right or wrong, etc.)

Collaborators:
- Extractor
- GUI
- Analyzer
- User

Attributes:
Round results, questions

Analyzer

Responsibilities:
- Analyzes rounds from extractor
- Displays statistics through GUI
- Store info in Database

Collaborators:
- GUI
- Extractor
- Database

Attributes:
Round, user data, processed stats

Database

Responsibilities:
- Get info from other objects
- Compile info
- Pass info to online database

Collaborators:
- Main
- User
- Analyzer

Attributes:
Statistics, online db

Object Interfaces

Main

User
Extractor
GUI

init()

Extractor

Rounds

init()
extract(path : str)

GUI

currentQuestion

init(style : str)

QuestionAsker

round
question

init()
readRound(round: Round)
readQuestion(question : Question)

User

Name
Statistics

init(name : str, id : int, dbkey : bin)
getName()
getStats()

Database

url
uname
password

init()
addInfo(info : ?)
submitStats()

Analyzer

user
rounds

init()
processRound(round : Round)
processUser(user : User)

GUI Layout

Still in progress

GUI Object Layout

Still in progress

Resources

Tools to make project overview:

- [Mermaid Live editor](#)

Pre-existing options

- [High School Science Bowl Practice](#)

- [Tycho](#)

- [Protobowl](#)

Links

- [MS Sample Questions](#)

- [HS Sample Questions](#)