

A decorative network diagram in the top-left corner, featuring a complex web of interconnected nodes and lines. Some nodes are highlighted with blue circles, and others with solid blue dots. The lines are thin and grey, creating a mesh-like structure.

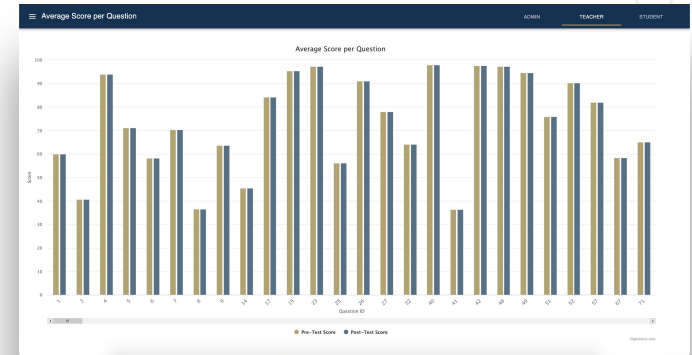
IRS.V2.1

Prem, Sukhmai, Mike, Jared

A decorative network diagram in the bottom-right corner, mirroring the style of the top-left diagram. It shows a network of nodes and lines, with several nodes highlighted in blue.

Introduction to IRSv2

- ⦿ IRS is a system for teachers, TAs and students to get feedback on the ITS system
- ⦿ IRS creates informative data visualizations for every user of ITS system, which informs decision making

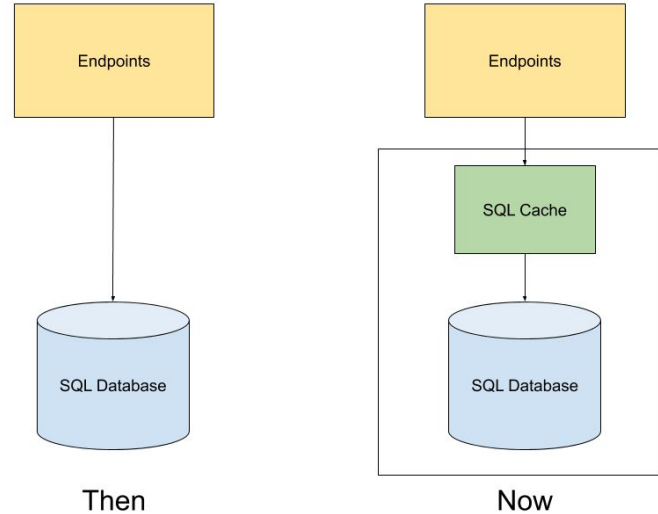


Goals

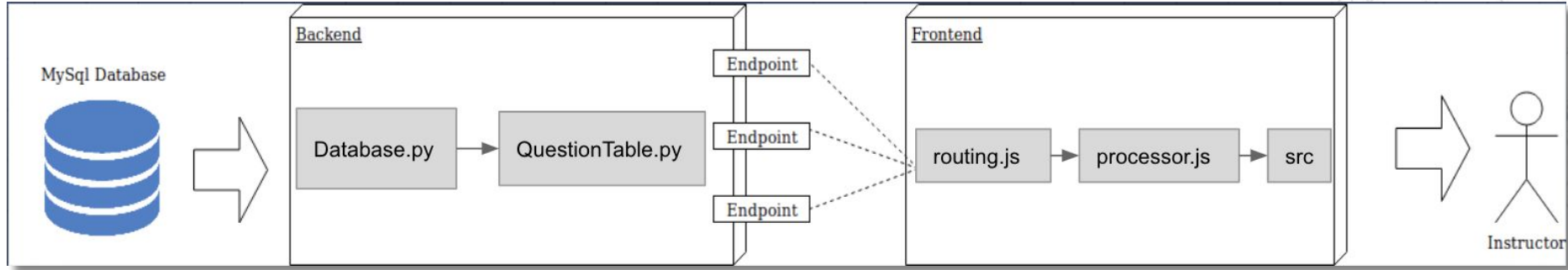
- ◎ Expand on our streamlined model
- ◎ Teacher Tab
 - More visualizations -> histograms
- ◎ Admin Tab
 - Examine query speeds and show it in the frontend
- ◎ Student Tab
 - Comparing Data -> kMeans Clustering
 - Interactive Component -> Review Questions

Backend Approach - Caching

- ◎ Do less calculations at runtime
- ◎ Cache Results
 - Increase runtime speed
 - Requires initial run
- ◎ Multiple Quick Endpoints
- ◎ Heavily Parameterized
- ◎ Simplified Queries



Endpoints



- ⊙ Information to frontend in a json format
- ⊙ Why? server-client boundaries
- ⊙ Consistency of Output -> Postman and Debugging
- ⊙ Endpoints -> pull from cached information

Endpoints (Postman Visualization)

/get_question_table

```
"1": {
  "mean_duration_post": null,
  "mean_duration_pre": 17.2278,
  "mean_score_post": 60.0,
  "mean_score_pre": 60.0,
  "question": "Given:<PRE class=MATLAB>FS = 11025;\nntt
  use to generate the appropriate DTMF signal to re
  "title": "DTMF Signal Generation 1"
},
"3": {
  "mean_duration_post": null,
  "mean_duration_pre": 15.9787,
  "mean_score_post": 40.7407,
  "mean_score_pre": 40.7407,
  "question": "The meaning of \"negative frequency\" in
  "title": "Negative Frequency"
},
```

/get_categories

```
"1": [
  "MATLAB",
  "DTMF"
],
"3": [
  "frequency",
  "fourier series"
],
"4": [
  "MATLAB",
  "concatenation"
],
"5": [
  "MATLAB",
  "D-to-A"
],
"6": [
```

**/get_questions_per_chapter?
chapters=2,3**

```
"2": [
  17,
  52,
  57,
  112,
  256,
  316,
  335,
  410,
  411,
  423,
  424,
  530,
  554,
  582
],
"3": [
  26,
  49,
  78,
  145,
  220,
  244,
  248,
  385,
  390,
  414,
  428,
  477,
  484,
  574
],
```

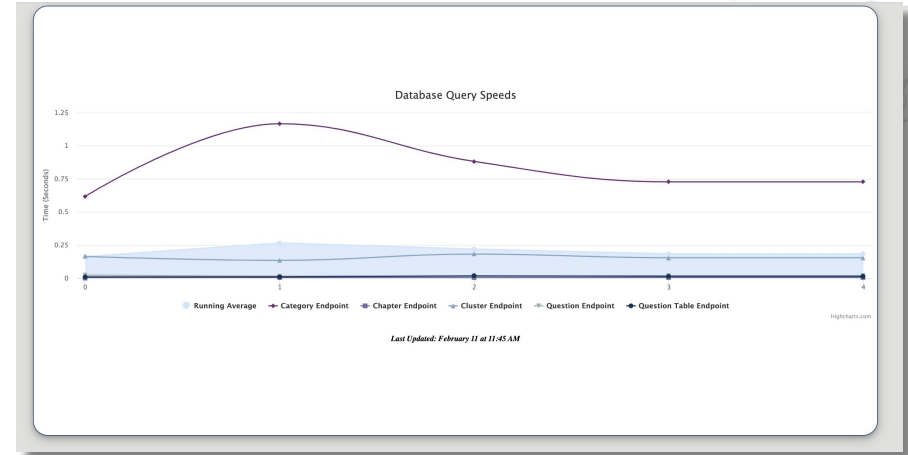
Admin

- Useful to verify efficiency of system
- Speeds are stored in database using caching method
- Speeds are constantly updated

```
{
  "categories": {
    "categories": {
      "speed1": 0.726494,
      "speed2": 0.645892,
      "speed3": 0.639971,
      "speed4": 0.588919,
      "speed5": 0.588919
    }
  },
  "chapter": {
    "chapter": {
      "speed1": 0.00348806,
      "speed2": 0.00346518,
      "speed3": 0.00331998,
      "speed4": 0.0029707,
      "speed5": 0.0029707
    }
  }
},
```

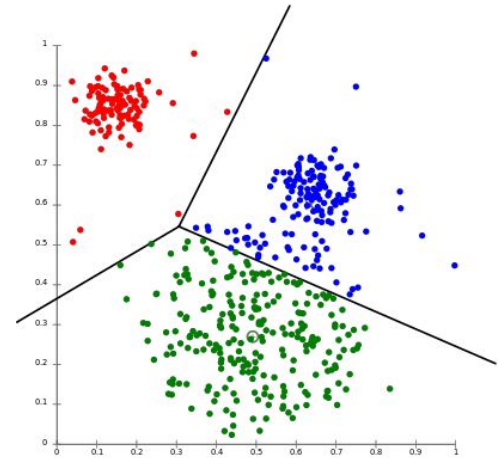
Admin

- ⊙ Be able to compare endpoint speeds
- ⊙ Should optimize the categories endpoint
- ⊙ Can see if a particular query deviated heavily in speed



kMeans Algorithm

- ◎ Cluster questions based on a mean center
- ◎ Allows for natural grouping of similar data, “categorizing” them



kMeans Integration

- ⦿ Pre-made question caches allow for quick calculations
- ⦿ Options:
 - Table:
 - Semester
 - K:
 - 1-6
 - Column
 - Score
 - Duration
 - Both
 - Difficulty

	KEY	VALUE
<input checked="" type="checkbox"/>	table	Fall_2017
<input checked="" type="checkbox"/>	k	2
<input checked="" type="checkbox"/>	column	both

<input checked="" type="checkbox"/>	column	difficulty
	Key	Value

Body Cookies Headers (5) Test Results

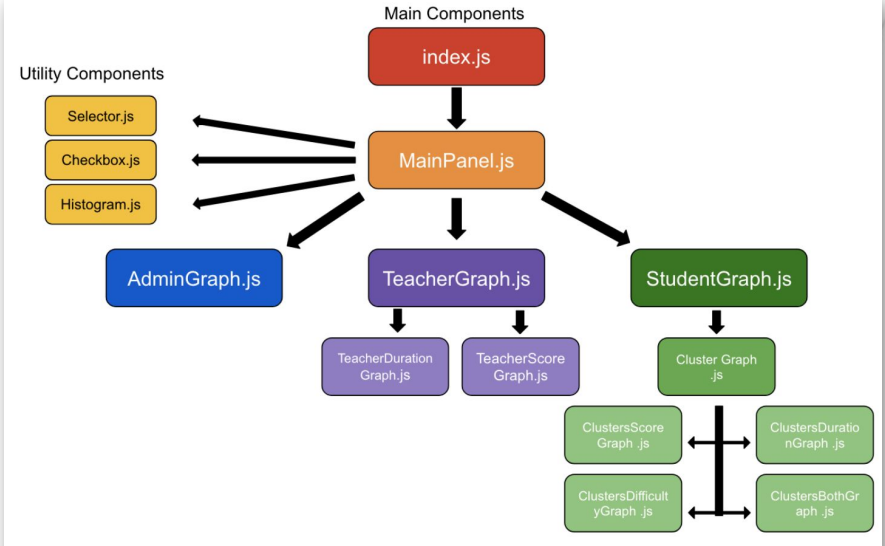
Pretty Raw Preview Visualize BETA JSON

```
1 {
2   "clusterCenters": [
3     18.318171428571432,
4     47.968099173553725
5   ],
6   "questionIdsbyCenter": {
7     "0": {
```

Frontend Structure

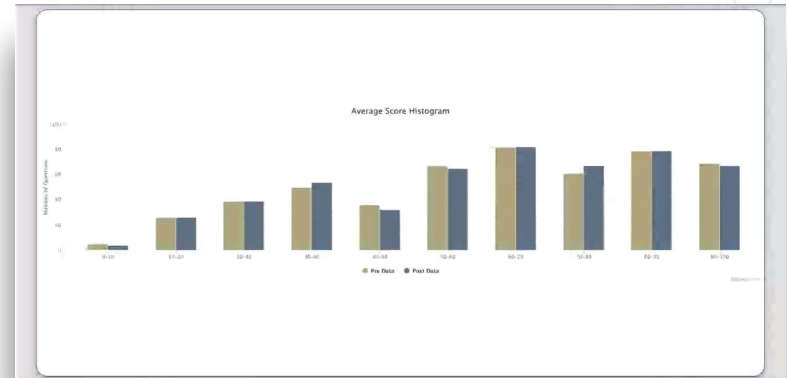
Utilizing React Components

- ⦿ Separating tabs
- ⦿ Distributing functionality as much as possible
- ⦿ Each file represents one function



Frontend Part 1. Expanding Teacher Tab

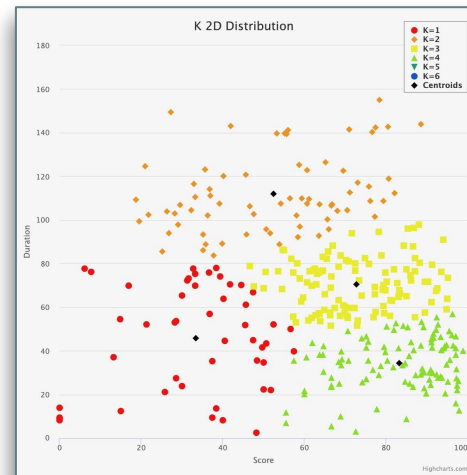
- ⦿ Histogram
 - Dynamic
 - Shows distribution of scores
 - Implement proper filtering
- ⦿ Restructuring System
 - Removed difficulty graph
 - Added “histogram checkbox”



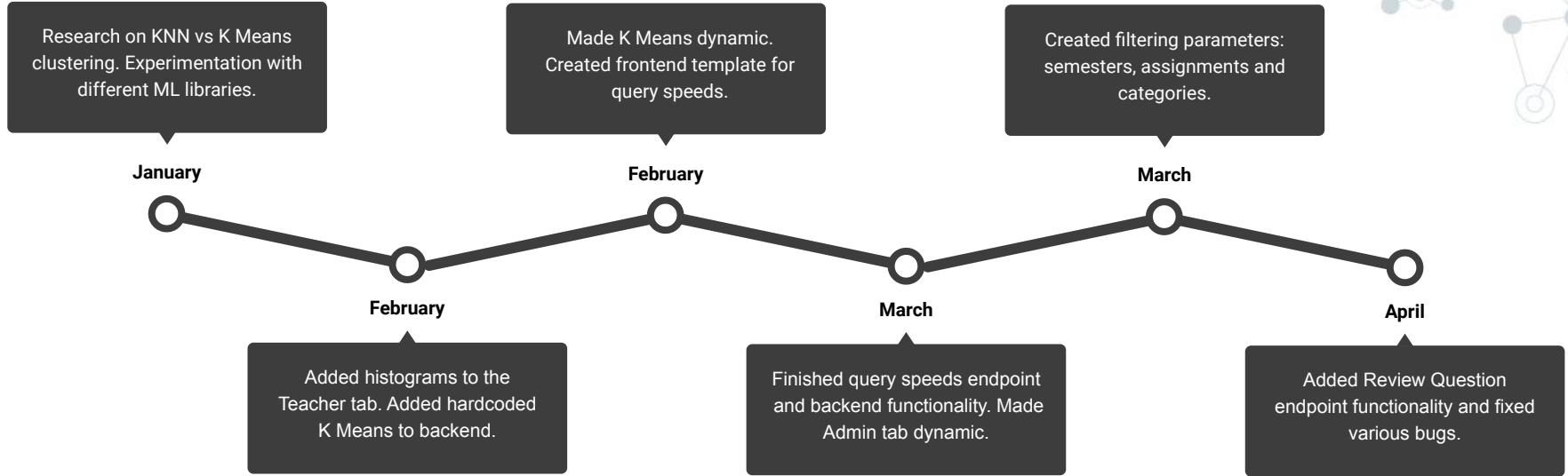
Frontend Part 2 New Tabs

- ⦿ Student Tab
 - Graph kMeans results for sake of comparisons
 - Implement graph filtering
 - Add interactive review questions

- ⦿ Admin Tab
 - Display recent query speeds
 - Identify endpoints that can be optimized



Progression



Conclusion

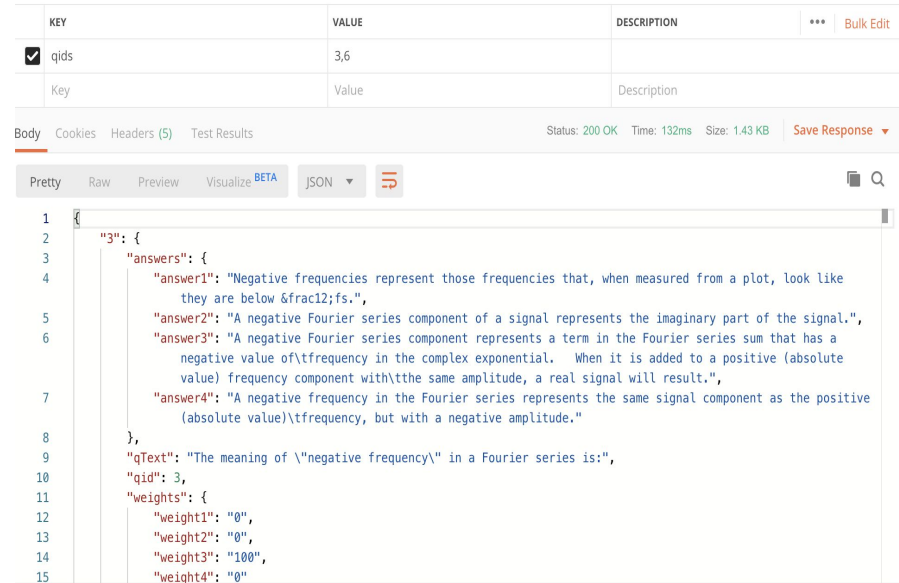
- ⦿ Added **query speeds** graph to evaluate endpoints
- ⦿ Added **histograms** with filtering options
- ⦿ Added **kMeans** insight between questions
- ⦿ Added the ability for students to **review**

Challenges

- ⦿ **Student prediction** without individually tracking each student
- ⦿ **Formatting** data with machine learning libraries
- ⦿ Determining **valid questions** to add to review
- ⦿ Determining **when to evaluate** endpoint speed

Future Implementations

- Review question endpoint frontend implementation
 - Review question endpoint is already fully working
- Our current vision for the frontend involves listing review questions under the graphs in the student tab



The screenshot displays a REST client interface. At the top, there is a table with columns for KEY, VALUE, and DESCRIPTION. The first row shows a checked checkbox next to the key 'qlds' with a value of '3,6'. Below the table, there are tabs for 'Body', 'Cookies', 'Headers (5)', and 'Test Results'. The 'Body' tab is active, showing a JSON response. The JSON is formatted in a 'Pretty' view and contains an object with a '3' key, an 'answers' array of four strings, a 'qText' string, a 'qid' number, and a 'weights' object with four keys.

KEY	VALUE	DESCRIPTION
<input checked="" type="checkbox"/> qlds	3,6	
Key	Value	Description

Body Cookies Headers (5) Test Results Status: 200 OK Time: 132ms Size: 1.43 KB Save Response

```
1 {
2   "3": {
3     "answers": [
4       "answer1": "Negative frequencies represent those frequencies that, when measured from a plot, look like
5         they are below &frac12;fs.",
6       "answer2": "A negative Fourier series component of a signal represents the imaginary part of the signal.",
7       "answer3": "A negative Fourier series component represents a term in the Fourier series sum that has a
8         negative value of \tfrequency in the complex exponential. When it is added to a positive (absolute
9         value) frequency component with \ttthe same amplitude, a real signal will result.",
10      "answer4": "A negative frequency in the Fourier series represents the same signal component as the positive
11        (absolute value)\tfrequency, but with a negative amplitude."
12    ],
13    "qText": "The meaning of \"negative frequency\" in a Fourier series is:",
14    "qid": 3,
15    "weights": {
16      "weight1": "0",
17      "weight2": "0",
18      "weight3": "100",
19      "weight4": "0"
20    }
21  }
22 }
```


Future Improvements

- ◎ Deploy on Server (ex. AWS hosting)
- ◎ Increase Speed of Category Endpoint
- ◎ Add Authentication System
- ◎ Breakdown data by students
- ◎ Update with live database



A decorative background featuring a network diagram with nodes and connections. The nodes are represented by circles of varying sizes and colors (blue, grey, white), connected by thin lines. The diagram is positioned in the corners of the slide, with a larger, more detailed section on the left and a smaller, more sparse section on the right.

**Visualize on
the Application!**

A decorative background featuring a network diagram of nodes and connections in the corners. The nodes are represented by circles of varying sizes and colors (gray, blue, and white with blue outlines), connected by thin lines. The network is more dense in the corners and fades out towards the center.

Questions?