

INDIAN INSTITUTE OF TECHNOLOGY

COMPUTER SCIENCE AND ENGINEERING

SOFTWARE LAB

CS699

QMARK
QUESTION BANK

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1 Introduction

QMark is an application for all of your academic needs at one place. Here you can store and access all of the questions and question papers added to our database so far, properly tagged with our multi-topic hierarchical topic.

The aim of this application is to provide a simple, intuitive, and useful interface for setting up question papers for practice and exam alike, such that the instructors has to spend minimal time in browsing through old archives and the web to set a paper. Papers can be set using old questions papers spanning across the database, or using new questions created in the application itself. Students can check their understanding of certain topics by attempting questions from these topics.

2 Motivation

Tests are conducted to assess student's knowledge in a subject, grading them, to give admission to higher education, placements, scholarships, etc. Hence, a question paper must be set in a way that can measure the change in the level of students' knowledge in a particular subject. Therefore, a good amount of care and caution is necessary for setting question papers. The types of question papers differ with the objective of the examination.

The process of setting a new question paper for an examination could be cumbersome and tedious when one has to dig through old archives and comply with the guidelines at the same time. A centralized, one-size-fits-all approach to collaborative setting of papers either do not exist or are not intuitive enough to be popular.

One has to keep in mind the difficulty level of each question, check questions against previous papers, and still cover the various topics or skills that need to be assessed. This mental overhead hampers setting up quality papers.

An aspirant usually covers her syllabi in a topic-wise fashion, wherein applications of multiple topics or skills come in later than application of individual topics. However, question banks usually do not account for this distinction between topics covered and not covered. Thus, a practice session tailored for individual needs is not trivially set up.



Figure 1: Approximate Landing Page of QMark on desktop, across 3 vertical screens

3 Installation

Installation on a Linux distribution is recommended, and we only cover installation on Ubuntu, although one can easily follow the equivalent of these steps on Windows, or other *nix distributions for the same results.

Availability of python3.x on the system is also assumed.

```
# Create a virtualenv
sudo apt install virtualenv

# Clone the repository from github
git clone git@github.com:hundredrab/QuestionBank.git
# Alternatively:
# git clone https://github.com/hundredrab/QuestionBank

cd QuestionBank/source

# Create and source a new virtualenv
virtualenv -p python3 env
source env/bin/activate

# Set up the environment
pip install -r requirements.txt

# Apply the migrations and start the development server
python manage.py migrate
python manage.py createsuperuser
python manage.py runserver
```

The above code will install all the requirements, the major ones being Django, django-rest-framework, and fitz. Once these steps are complete, the development server should be running on `http://localhost:8000/`, somewhat as shown in Fig 1.

For development, it will also be necessary to install `sass` using the following command:

```
npm install -g sass
```

4 Overview

The webapp uses Django and contains two major apps, **questions** and **accounts**. The latter is only responsible for account and user related views and logic.

The **question** app consists of the rest of the logic. The major components of this app are:

4.1 Tag

This model stores information related to tags. Each node, except the **root** node has a **parent** associated with it. The immediate children of the root node are major subject areas such as Science, Humanities, etc.

4.2 QuestionPaper

This relation is used for storing the question papers uploaded by the user.

On upload, the question paper is parsed using `fitz` and the raw text thus extracted is stored with the question paper. The uploader can go through the raw text and select certain questions from it.

4.3 Question

This stores information related to a question, such as the question **text**, **tags** related to it, it's **owner**, and also it's **difficulty**, which is an integer, which is an indicator of how much marks should be awarded for the given question.

4.4 QuestionSet

This model stores information related to QuestionSets, which are custom sets of questions which can be shared among users using, for example, a **passcode**.

5 Usage

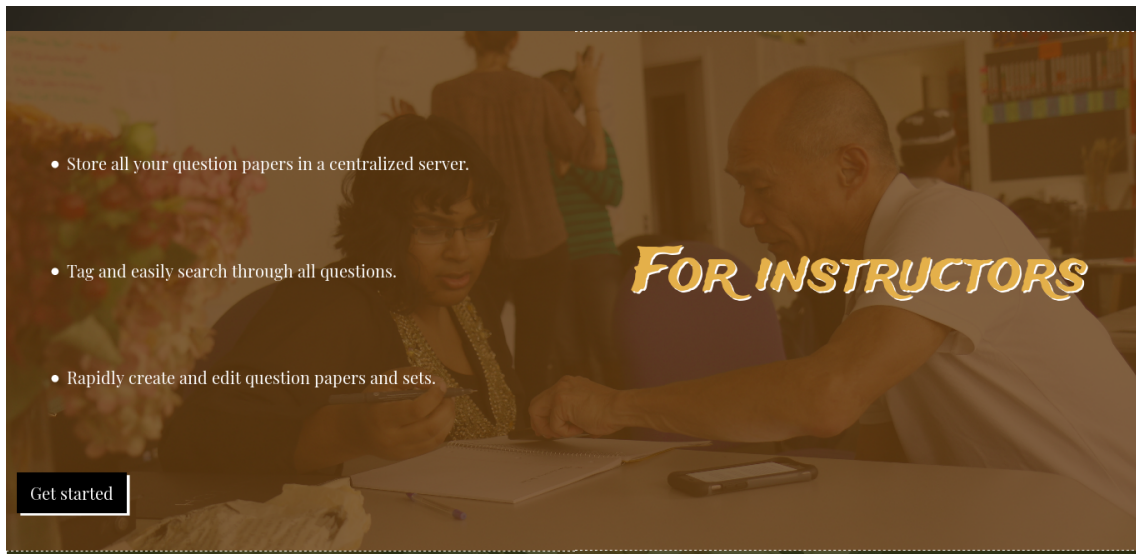


Figure 2: Approximate Landing Page for Instructors of QMark on desktop

In the figure 2 we can see the landing page for instructors. Clicking on the "Get Started" button at the bottom right corner of the screen will redirect the instructor to the login page (if not already logged in).

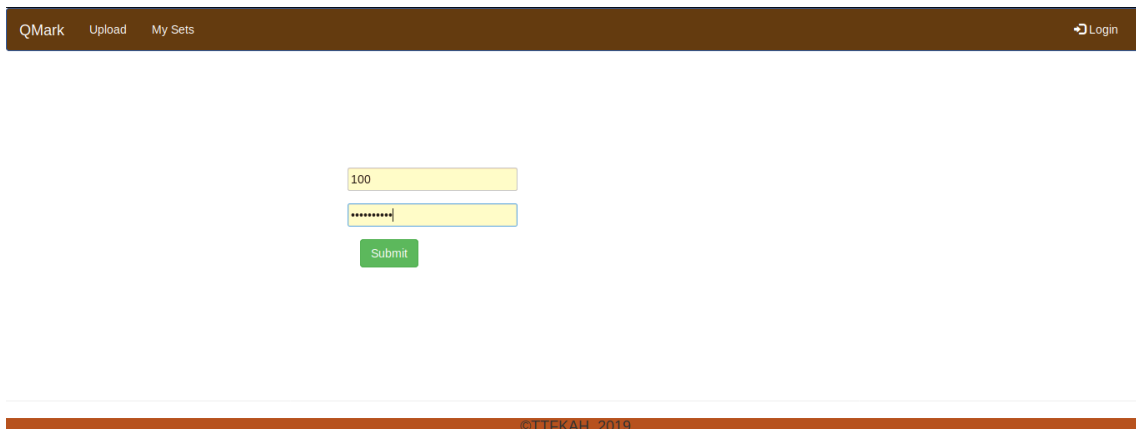


Figure 3: Approximate Landing Page for Instructors of QMark on desktop

Figure 3 shows the login page that'll be used by the instructors to log into the QMark.

The screenshot displays the QMark instructor homepage. At the top, there is a navigation bar with 'QMark', 'Upload', and 'My Sets' links, and a user profile section showing '100 [Logout]'. Below the navigation bar, there is a 'File:' section with a 'Browse...' button and a 'Submit' button. A message states: 'Before uploading, make sure you're not uploading one of the already available papers:'. Below this, a list of available papers is shown, each with a link to the file and a brief description. The papers include: 'media/papers/Mathematics_SQP.pdf', 'media/papers/15MAT661.pdf', 'media/papers/Chemistry.pdf', 'media/papers/endsem-answers.pdf', 'media/papers/073136771.pdf', 'media/papers/btech-cse-8-sem-pattern-recognition-2012.pdf', and 'media/papers/725_project_report1.pdf'. At the bottom of the page, there is a footer with the text '©TTEKAH, 2019'.

Figure 4: Instructor's HomePage

Figure 4 shows the instructor's homepage which can be used to upload pdf files with questions from which questions will automatically be extracted.

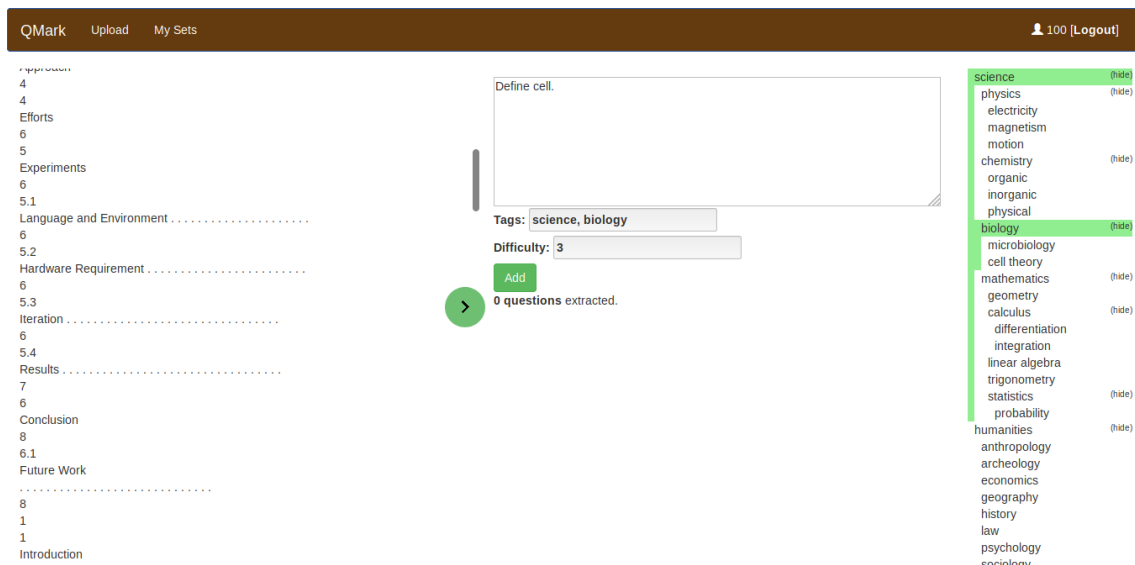


Figure 5: Question Upload page

Once we select and upload a pdf file from Figure 4, we'll be redirected to the page in figure 5. This page consists of three sections. The leftmost section has the extracted questions from the uploaded pdf file. The section in the middle will be used for adding questions to the Question Bank and the leftmost section is there for tagging questions.

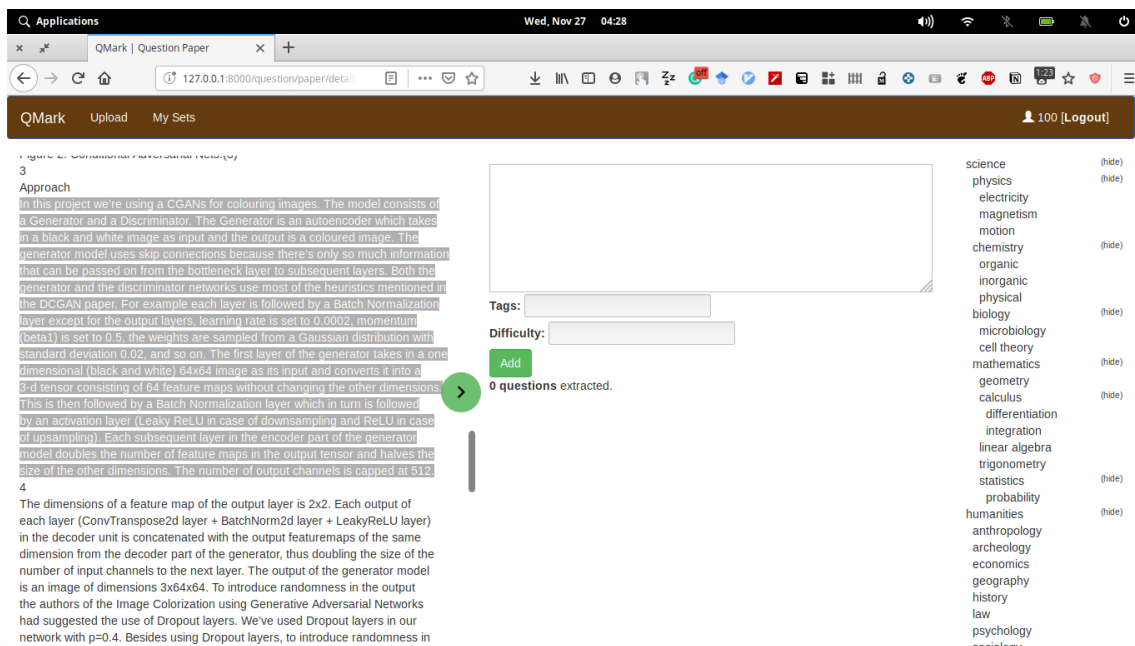


Figure 6: QuestionPaper details page where questions can be added.

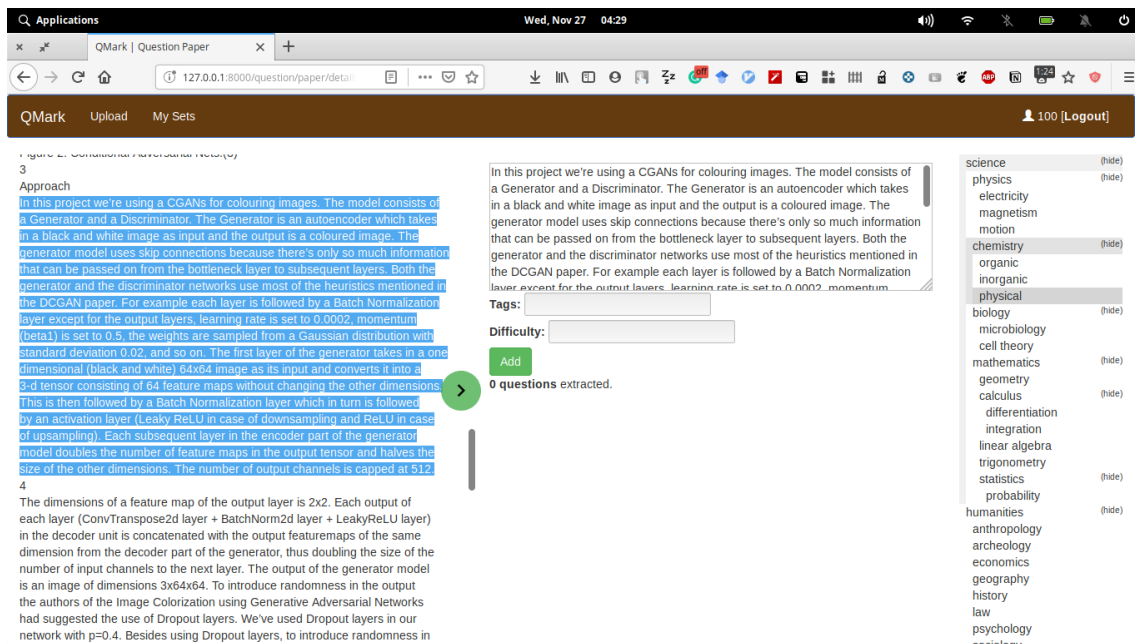


Figure 7: Text selection to add as a question.

To select a particular question from the extracted questions, all we need to do is to select the question and click on the green arrow button. The question will automatically appear in the textbox as can be seen in figure 7. Questions can also be entered manually by typing the question in the textbox.

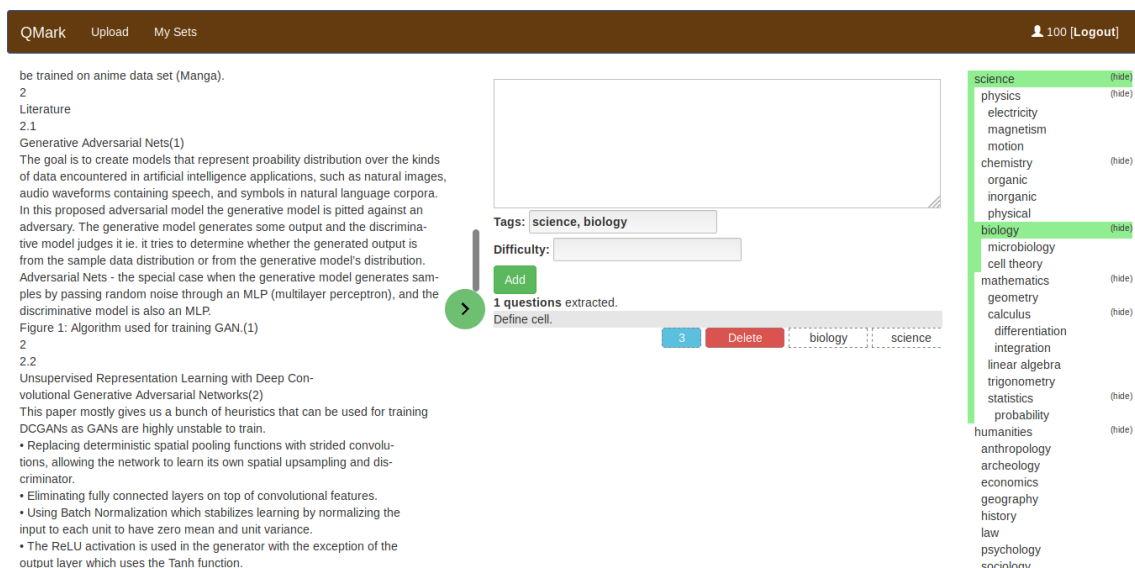


Figure 8: Selected tags while adding a question.

Questions can be tagged by putting the question in the text box and then selecting the appropriate tags, as shown in 8. Since tags follow a strict hierarchy, if any tag is selected, all its ancestors are selected, too. Similarly, if any selected tag is unselected, all its descendants will be unselected, too.

Since most questions in a paper are mostly related, the tags used in the last question are saved and can be reused the next time this page is visited.

Also, difficulty can be added from the same form.

The screenshot shows the 'Aspirant Landing Page' interface. At the top, there is a navigation bar with 'QMark', 'Upload', and 'My Sets' on the left, and a user profile icon with '100 [Logout]' on the right. The main content area is divided into three sections:

- Left Sidebar:** Contains the question ID '1', class information 'Class - XII', 'MATHEMATICS- 041', 'SAMPLE QUESTION PAPER 2019-20', time 'Time: 3 Hrs. Maximum Marks: 80', and general instructions. The instructions include: (i) All the questions are compulsory. (ii) The question paper consists of 36 questions divided into 4 sections A, B, C, and D. (iii) Section A comprises of 20 questions of 1 mark each. Section B comprises of 6 questions of 2 marks each. Section C comprises of 6 questions of 4 marks each. Section D comprises of 4 questions of 6 marks each. (iv) There is no overall choice. However, an internal choice has been provided in three questions of 1 mark each, two questions of 2 marks each, two questions of 4 marks each, and two questions of 6 marks each. You have to attempt only one of the alternatives in all such questions. (v) Use of calculators is not permitted.
- Center Panel:** A large text box for entering the question. Below it, there is a 'Tags' field with a dropdown menu showing 'mathematics, science'. A 'Difficulty' field is also present. A green 'Add' button is next to the tags field. Below the text box, there is a green circular button with a right arrow. A list of questions is shown, each with a 'Delete' button and a tag selection dropdown. The questions are:
 - 6 questions extracted. What is the distance(in units) between the two planes $3x + 5y + 7z = 3$ and $9x + 15y + 21z = 9$?
 - There are three coins, one is a two headed coin (having head on both the faces), another is a biased coin that comes up heads 75% of the time and the third is an unbiased coin. One of the three coins is chosen at random and tossed. If it shows head. What is probability that it was the two headed coin?
 - A speaks truth in 80% cases and B speaks truth in 90%cases. In what percentage of cases are they likely to agree with each other in stating the same fact?
 - Two tailors A and B earn ₹150 and ₹200 per day respectively. A can stitch 6 shirts and 4 pants per day, while B can stitch 10 shirts and 4 pants per day. Form a L.P.P to minimize the labour cost to produce (stitch) at least 60 shirts and 32 pants and solve it graphically.
- Right Sidebar:** A list of tags categorized by subject. The 'science' category is expanded, showing sub-tags like 'physics', 'electricity', 'magnetism', 'motion', 'chemistry', 'organic', 'inorganic', 'physical', 'biology', 'microbiology', and 'cell theory'. The 'mathematics' category is also expanded, showing sub-tags like 'geometry', 'calculus', 'differentiation', 'integration', 'linear algebra', 'trigonometry', 'statistics', and 'probability'. Other categories like 'humanities', 'anthropology', 'archeology', 'economics', 'geography', 'history', 'law', 'psychology', and 'sociology' are listed without sub-tags.

Figure 9: Aspirant Landing Page

In the figure 9 we can see the landing page for aspirants. Clicking on the "Get Started" button at the bottom of the screen will redirect the aspirant to the login page (if not already logged in).

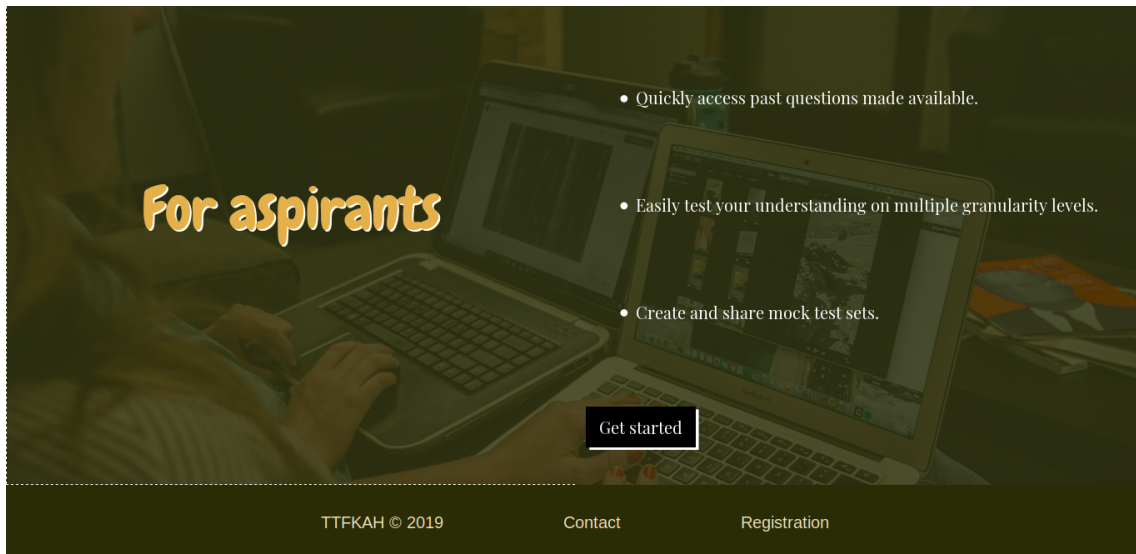


Figure 10: Page for creating new question set.

In figure 10 we can see the page that can be used to create new question set once the aspirant has logged in.

QMark
Upload
My Sets
100 [Logout]

Create new question set

Name

Enter a name of your choice

Passcode

Use this if you want this to be accessible to only people who have this passcode.

Start time

Use this if you want this to be accessible only after a certain time.

End time

Use this if you want this set to be accessible only until a certain time.

Create

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Figure 11: A question paper with many questions parsed and added.

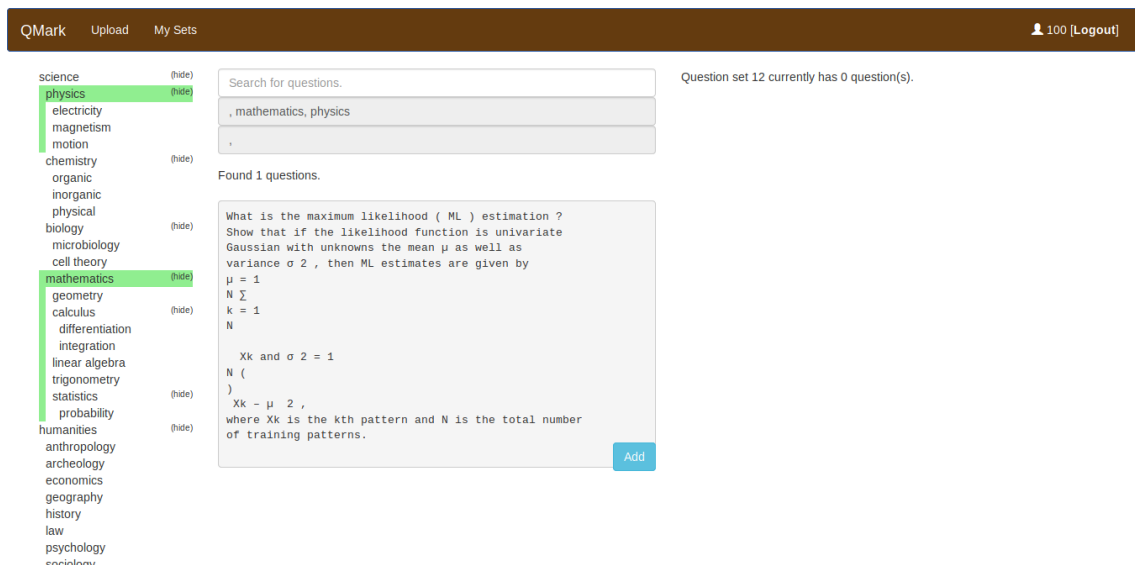


Figure 12: Finding questions based on the tags selected. Tags highlighted in green are tags that are white-listed.

Topics can be white-listed by clicking on the appropriate tag once. White-listing two topics shows us questions that have both the tags.

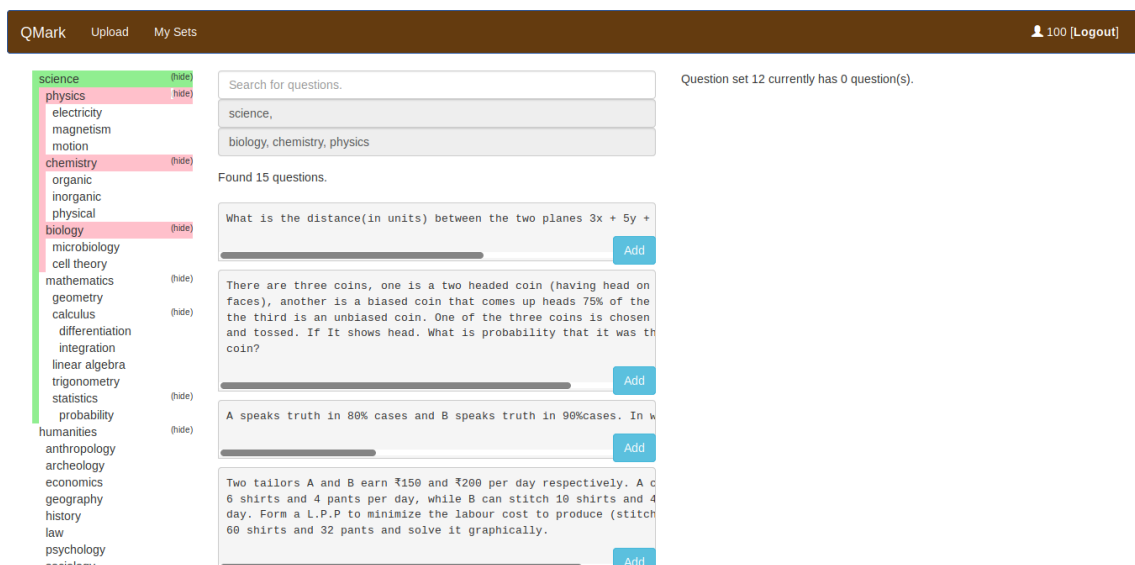


Figure 13: Tags highlighted in pink are black-listed.

Topics can be black-listed by clicking on the corresponding tag twice. Black-listed tags are high-lighted in pink. Clicking on the selected tag for the third time causes the tag to be unselected.

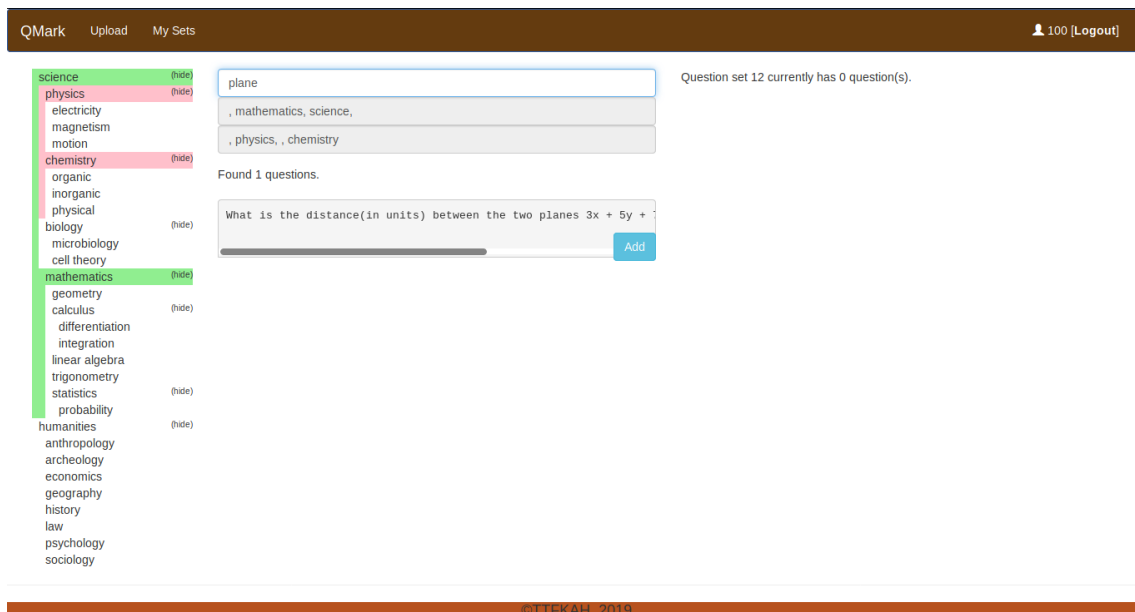


Figure 14: Black-listing and white-listing topics

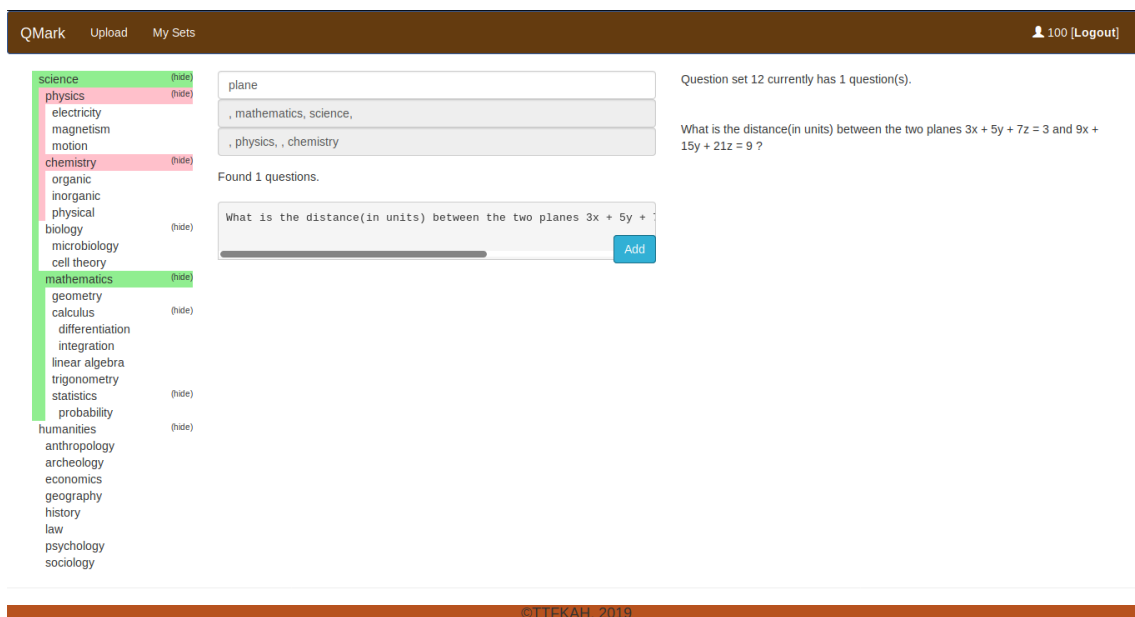


Figure 15: Selecting a question from the set of questions.

A question can be added to the question set by clicking on the "Add" button as can be seen from figure 15.

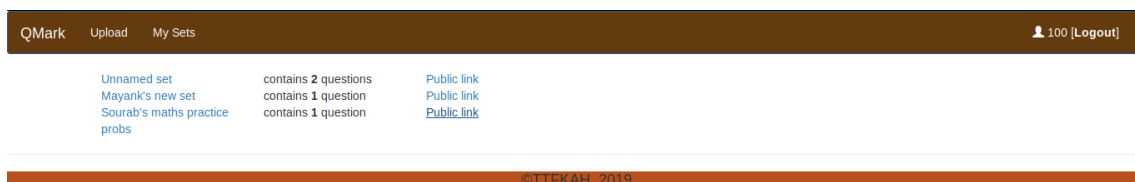


Figure 16: List of question sets.

Figure 16 shows the list of question sets created by an aspirant. The question set can be visited by clicking on the "Public link" link.



Figure 17: Question Set

6 Future Work

This project can be used by instructors to add questions to a question bank. The question bank will contain tagged questions. Aspirants will be able to select questions from here based on white-listed and black-listed topics. The user interface is pretty intuitive and easy to use. Future work includes:

- developing APIs that can be used to integrate QBank with Moodle and SAFE App.
- adding Machine Learning Algorithms, once we have enough questions in our tagged questions database, that can be used to suggest possible tags for a question.