



HackRush 2022 – IITGN Hackathon

What is a Hackathon?

A hackathon is an event where people collaborate to solve real-life problems in a finite span of time. Hackathons are popular competitive events in the software industry as well as in universities due to their benefits to both the participants and the organizers. The idea of a hackathon is to solve a problem from scratch and come up with a working prototype.

Watch this TEDx talk: <https://youtu.be/6VakF2hZFPQ>

Why participate?

For the participants, a hackathon is a fun and risk-free opportunity to showcase their talent, challenge themselves, network with peers, learn new skills, and give life to their ideas.

Team Registration

Please fill this form: <https://forms.gle/X3HUpGSyywg41hMDA>

Fill this form by 1:00 AM.

About this document

This document contains the problem statements for the hackathon. You'll present your solution, or progress towards a solution, on **Sunday – March 27, at 11:00 AM**.

In some problems, we want you to come up with a solution to a particular (and mostly - very important) problem, given certain constraints. These are marked [S].

Other problems are framed as competitions wherein participants will be pitted against each other with winners being decided at the end of the Hackathon. These problems are marked [C].

The problem statements are not exhaustive. They are meant simply to give you a general idea about what the problem is, and guidelines you should follow to solve it. We have only provided details if they are crucial for you to understand the problem. Make your own assumptions and prepare your own models.

You can work in teams. You can consult friends and faculty (make sure you acknowledge this).

Join the Discord server [here](#).

We're sure that trying to solve some of these problems will teach you a lot. Even if you aren't able to solve them completely - it should be a great learning experience for you.

Problem Statements

1. Graduation Requirements Tracker [S]	4
2. Cyber Security: HackRushCTF [C]	6
3. Hardware Challenge: FPGAworks [C]	8
4. ML Challenge [C]	10
5. Optimization Problem [C]	11
6. Technical Council Website[S]	12

1. Graduation Requirements Tracker [S]

Stakeholders: Viramgami Gaurav 19110106, Pushkar Mujumdar

Background

- IITGN offers all of its students the freedom to choose their courses and tailor their education during their time here according to their interests but this freedom of choice also complicates the process of tracking the courses that students have already taken and the courses they need to take to complete graduation requirements.
- Currently, most students use spreadsheets to informally keep track of their grades and credit requirements which is not optimal.

Features

Basic Requirements:

- A dataset of courses will be provided. You will need to make a schema having the following minimal details for each course:
 - Course Code: CS 614
 - Course Name: Advanced Algorithm
 - Counted Towards: Extended Core (possible for CS Major)/ CS Minor/ Open elective
 - Credits: 4
- You can find the sample schema of the dataset [here](#). Note: This is just a sample schema of the raw input data of courses. Values such as number of credits required are empty which can be filled as per knowledge from advisory (or dummy values). Few rows and values are filled as an example.
- Add/remove courses along with the requirement they are being counted towards (Core/Ext. Core/BS/HS/Minor/Dual Major/Honors etc)
- User Login and Persistence –
 - Users should be able to sign-up to the portal
 - Users should be able to login/logout
 - Data entered by each user should persist
- User should be able to select the majors/minors they are pursuing and the application should show unfulfilled credit requirements along with their breakup (HS/BS/Core/Ext. Core/Minor)
- User should be able to tentatively plan courses for upcoming semesters

Extra Features:

- Admin privilege –
 - Admin should be able to change the properties of a course such as core/ext. core for the subsequent semesters in the stored database
- Users should be able to filter courses based on various parameters (such as Core/Ext. Core/HS/BS/Minor etc, Number of credits, Odd/Even Semester)
- Auto-detection and suggestion of core/ext.core courses based on selected major/minor
- Users should be able to export their graduation plan/current completed courses in any suitable format (for example visualize the Core/Ext. Core/BS/HS/Open Elective breakup of credits as a pie chart)

Feel free to add any feature which is not mentioned above after discussing it with the stakeholders.

Resources

- [Pass/Fail Calculator](#): This is a nifty tool for calculating the CPI and SPI after using the Pass/Fail option. It can serve as a reference/starting point for your ideation.
- Related Advisories for understanding graduation requirements can be found [here](#).

Development Resources

We expect you to build a web application preferably. You are also *free to use the tech-stack of your choice* apart from the below mentioned: (Since the Student Academic Council website uses NodeJS in the backend, it is preferred to use NodeJS for easier integration in the Academic Council website later)

- [NodeJS](#), [Django](#), [PHP](#), [MongoDB](#), [MySQL](#), [FastAPI](#), [Postgres](#) (backend & database)
- [ReactJS](#), [AngularJS](#), [Bootstrap](#), [HTML](#), [CSS](#) (frontend)
- [Google Firebase](#) (All in one service for faster development)

2. Cyber Security: HackRushCTF [C]

Stakeholders: Dishank Goel

This category introduces you to the world of **Hacking and Computer Security**! If you are interested in developing a deeper understanding about Computers, how attackers leverage vulnerabilities and how to avoid them, this event is for you.

HackRushCTF will be a 36-hour Jeopardy-style Capture the Flag (CTF) event. Your main goal is to collect as many flags as possible. But wait, **what is a CTF?**

Refer here: <https://ctfd.io/whats-a-ctf/>

HackRushCTF is beginner friendly i.e. you don't need to have any prior knowledge in this field to participate. The only prerequisite is an interest in learning.

Here is the platform link: <http://20.219.137.184:5000/>

Flag format: HackRushCTF{.*}

Please join the discord server if you're interested in the problem:

<https://discord.gg/VRmBB6fMYG>

Your submission of flags will only be considered valid if you provide a writeup of the solution of the challenge. A writeup includes a systematic way of how you solved the challenge, what things worked for you, why did they work, any difficulties that you faced etc. For example, here is a writeup of PicoCTF 2018 by the team Galaxians.

https://github.com/shiltemann/CTF-writeups-public/tree/master/PicoCTF_2018

At the end of the hackathon, you are supposed to give a presentation that will include the following:

- The write ups of all the challenges that you solved
- Unsuccessful attempts at solving a challenge. The approaches that you considered, why it did not work etc.
- Your learnings.

The presentation should summarize all the work done by your team in 36-hours.

Important Instruction:

This event asks you to perform attacks, with our permission, against a set of targets that we are providing for this purpose. Attempting the same kinds of attacks against other systems without authorization is prohibited by law and institution policies. You must not attack any system without authorization! You are required to respect the privacy and property rights of others at all times.

Make sure that you agree to these terms before you begin your work.

Here are some resources to get you started:

<https://ctf101.org/>

<https://www.youtube.com/channel/UClcE-kVhqyiHCcjYwcpfj9w> (liveoverflow)

<https://picoctf.org/resources>

Similar such contests:

<https://picoctf.org/> <https://backdoor.sdslabs.co/> <https://overthewire.org/wargames/>

<https://ctftime.org/> (you can find active CTFs here)

3. Hardware Challenge: FPGAworks [C]

Stakeholders: Shruti Prakash Gupta

This is a **CTF challenge** designed around **FPGA development**. To understand it better, you can have a look at the questions below:

Here is the platform link: <http://20.219.137.184:8000/>

Here is the discord server link: <https://discord.gg/VRmBB6fMYG>

Here is the Google Form link for getting the Basys3 Board issued:
<https://forms.gle/XtzVg5QDoS3s3Fo18>

Introduction:

1. What is an FPGA?

A Field Programmable Gate Array or simply an FPGA is a piece of hardware, which is configurable. It does not have any predefined logic in it, and you can think of it as a collection of inactive logic gates. The user can then decide the application and program the board, such that a specific combination of these gates becomes active, and the board performs as per the requirement.

2. Are FPGA boards similar to those present in Arduino projects?

No. The Arduino board is a microcontroller, which is pretty different from an FPGA. For ex, a microcontroller will have well-defined components such as the processor, memory, and peripherals, and one can use the software to program them in a specific combination, but FPGAs do not have these restrictions. They only have the logic blocks which can be assembled with "Hardware Description Language (HDL)" code, and thus the same section of the FPGA can act as a processor or memory block in two different projects.

3. Why should I work with FPGA?

The concept of writing HDL code for FPGAs and ASIC (commonly known as "computer chips") is the same. Thus if you have worked with an FPGA, you can easily extend it to IC Design. Also, FPGAs provide a quick way of implementing/running your design on hardware and using it in projects which is not feasible to be done with ASICs.

4. I haven't worked with an FPGA before. Can I participate?

Yes. The problems are designed from the beginner's level and sequentially increase in difficulty. No prior knowledge of Verilog is required, given that you are open to exploring and Googling.

5. What's there at the event?

Each team will be getting a [Xilinx Basys 3 Artix-7 FPGA Board & Cable](#) (only for the duration of the event), and we will help them to create the setup for interacting with the board.

There will be several challenges around the same, where the aim is to find a string called "Flag". These flags can be hidden inside the code or the board itself, and the teams will get points on submitting the correct flag. The one with the highest score will be at the top. While solving the problems, participants will explore several features of the board and the tool used with it.

Following the CTF Format, participants will have to submit a small writeup essentially including the steps they took to solve a problem. Towards the end, we will have a presentation where everyone will share what all they have learnt throughout the event.

Objective:

The objective of the event is to know **how FPGAs work** and how to program them. The participants will also understand the **difference between writing a Software-level and Hardware-level code**, and what it means to **run a code on hardware, or precisely "Bare Metal"**. Those who are interested in working in this field will also get to know about some handy **open-source tools**, as they would have experienced that getting industry-level tools and resources in this domain is not so cheap and easy.

You need to install the Vivado Lab Edition tool for this event. You can find the details for installation and other links for reference below:

1. [What's an FPGA](#)
2. [FPGA vs Microcontroller](#)
3. [Intro to Basys3](#)
4. [Basys3 User Manual](#)
5. [Vivado Tool Installation Guide](#)

You can join the event's Discord server [here](#). Further details will be conveyed on the same.

4. ML Challenge [C]

Stakeholders: Shivam Sahni , Varun Jain

Challenge Link: <https://www.kaggle.com/t/d252da71fc43473fba20d78cba896be0>

In an alternate universe, due to the unbalanced workload among the faculty of Stanford University, the university is suffering from high rates of faculty attrition and has faced a lot of mockery from the public. There has also been a petition to rename it to Standard University due to this mismanagement.

To combat the inevitable backlash, the university aims to build a system that can tell the number of students that will enroll in a course in a given academic year. Such a system will not only allow the university's stakeholders to smartly recruit faculty to balance faculty workload but also gauge the students' interest in a given course which can allow the stakeholders to decide if the given course should be offered or not.

Now the question is about how to build these systems? That's where you come in!

In this challenge, you will develop a model that tries to forecast the future total student enrolment for courses offered at the university based on the historic enrolment trend of the last 200 years.

The rankings would be determined by the accuracy with which your model forecasts future course enrollment trends.

Throughout the hackathon, several pointers will be provided to assist you in developing better solutions.

Some useful resources that you might need before coming to HackRush.

- [Kaggle \[A place where all ML practitioners meet\]](#)
- [ML for Beginners](#)
- [Some Inspiring Works](#)

We will also be providing a similar time forecasting tutorial challenge, the overall performance across both the questions will be judged to determine the ML Champion of IITGN.

5. Optimization Problem [C]

Stakeholders: Manas Mulpuri, Sanskar Sharma, Saatvik Rao,
More Yash Hiren 19110123

Tools and knowledge required: Any programming language of your choice.

Rules are on the contest page.

Contest Link: <https://www.hackerrank.com/optimisation-challenge-hackrush-22>

Test Cases and Judge have been uploaded here:

<https://drive.google.com/drive/folders/1EtMMx8TLFyXKq9cw6t5OV8ezxrR5ZUhh?usp=sharing>

6. Technical Council Website[S]

Stakeholders: Aniket Rajnish, Reuben Devanesan

Your task is to design and develop the official website of the technical council of IITGN with the webpages of different clubs as subdomains.

Basic Requirements:

- About page: Should contain a short description of the council and 3 main points: Our mission, our plan and our vision
- Clubs page: The six technical clubs are Metis, Digis, Mean Mechanics, Odyssey, Torque. The page should also contain short descriptions of these clubs with their current secretary, logo and links to their respective websites.
- Team Page: Should contain name, images and email addresses of the current members along with their current position in the council.
- Past Council Members Page: Should contain names of all the members of the council arranged chronologically.
- Events, Workshops page to display past and upcoming events and workshops.
- There should be a common footer on all pages with information such as contact email, some useful links for fast navigation and links to all the social media accounts of the council.

For clubs:

- About page: Should contain a short description of the club and 3 main points: Our mission, our plan and our vision
- Resources page: Should display the resources, their descriptions and links.
- Events, Workshops page to display past and upcoming events and workshops.
- Projects page to showcase the completed projects that were undertaken by students.
- Team Page: Should contain name, images and email addresses of the current members along with their current position in the club.

Note: Members of the council are technical secretary, technical coordinator, management coordinator, secretaries of the club, general members.

Currently the past and present council members are maintained in a google sheet. It would be nice to continue using google sheet for entering data. It is absolutely fine if

you choose any other back-end. The only constraint is that it should be easy to understand and should be scalable without any issues.

For now you can take any dummy data like 'lorem ipsum' for descriptive components of the website.

Additional Features:

- Timer for upcoming events
- Rating mechanism for past projects

Metis:

- Active Member Standings, a page to display the list of active members. Should get automatically updated whenever the data changes.
- Projects include github repos, websites and apps.

DigiS:

- Showcasing simulations, games and various other things developed by the club.
- Slideshow of various events conducted by the club.
- Showcasing active members and ongoing activities.
- Hosting various WebGL games developed by the club.

Development Resources:

We expect you to build a web application preferably. You are also *free to use the tech-stack of your choice* apart from the below mentioned:

- [NodeJS](#), [Django](#), [PHP](#), [MongoDB](#), [MySQL](#), [FastAPI](#), [Postgres](#) (backend & database)
- [ReactJS](#), [AngularJS](#), [Bootstrap](#), [HTML](#), [CSS](#) (frontend)
- [Google Firebase](#) (All in one service for faster development)