Project 1, Linear programming Problem - Lecture room scheduling

Team assignment: The assignment can have at most 3 members.

Objective: The aim is to schedule the IIT Goa lecture rooms so that there is no clash between lectures.

Input: The input will be given as as a json file. The format is given below. The following information about the lecture rooms, and lectures will be part of the json file.

The input consists of the type of class rooms we have (partitioned into three categories), the class rooms we have (LH1, CL1 etc) and its associated type. We then have a list of courses, which mentions the faculties in charge of a course (there can be multiple faculties), the size of the course, how many hours each lecture is conducted per day in a week (for eg. [1.5,1.5] means in a week we need two lectures each of 1.5hrs) and the list of batches which can take the course.

You should also have a provision for inputing faculty preferences (that is, a particular faculty might want to take lectures only on Monday, Tuesday, Wednesday etc) - you can come up with your own input format for this.

Program: It should encode the input into an Integer Programming problem such that there is a schedule if and only if the problem returns a satisfying solution. This solution can then be used to build a schedule.

Programming language: You can use python

Output: Print a schedule with the information on when and which classroom a lecture will be held. The best format is to print it like a calendar.

Deliverables: 1) A write up on Integer programming modelling. This should include what are the variables and how you constructed the Integer program.
2) The program source code

Assumption on time: Lectures are of 1hr, 1.5hrs, 2hrs or 3hrs time slots.

INPUT json file format:

```
{
	"Room Types": ["small", "big", "chemistry", "physics"],
	"Institute time": [
		[8.50, 12.50],
		[14.00, 17.00]
	],
	"Classrooms": [
		["T1", "small"],
		["LH1", "big"],
		["physics lab", "physics"],
		["T2", "small"],
		["LH2", "big"]
	],
	"Courses": [
		["cs201", "small", [1.5, 1.5],
			["Amal", "Clint"], 2
		],
		["cs25", "big", [1, 1, 1],
			["Neha"], 3
		],
		["cs228", "small", [1, 1, 1],
			["Sreejith"], 3
		]
	]
}
```

Project 2, Image Decompression - GIF/JPEG decompression

The objective is to decompress either GIF or JPEG pictures and convert it into a BMP file. A BMP file is an uncompressed image format (there are some BMP versions which are compressed though. you can work with the uncompressed versions).

1) You can see the following video to understand how to read and write BMP files: https://www.youtube.com/watch?v=xB0ifokXdWs
2) There are many different versions of GIF. You can choose a GIF which uses LZW compression. This is similar to Huffman coding.
3) There are many versions of JPEG also. The modern JPEG uses wavelets. If you are interested in wavelets you can choose this. Otherwise you can choose a version which uses DCT encoding.

Programming language: C++

Input: An image in GIF or JPEG file
Output: The image as a BMP file

Deliverables: You are expected to give a program which either converts GIF to BMP or a JPEG to BMP. You are obviously free to do both.

I do not expect you to decompress any kind of GIF or JPEG. Any one version will be enough. Either any GIF version which uses LZW or any JPEG version.

Project 3, Digital signature

The team will need to understand
1) Private key-public key encryption
2) Hash functions
3) Digital signature

You are interested in digitally signing a BMP file. How to read and write BMP files can be found in: https://www.youtube.com/watch?v=xB0ifokXdWs

The objective of the project will be.
1) Generate a private-public key.
2) Hash the BMP file information
3) Create a digital signature for the BMP file.
4) Store the signature in the file.
5) Check if the signature is correct.

Programming language: Python or C++
Team size: 3 to 4

Deliverables:
1) A program to generate a public key-private key in system.
2) A program to add a digital signature to a BMP file.
3) A program to verify if the digital signature is correct.

Project 4, Edit distance

In this project you are required to write a program to find the edit distance of two strings. The strings can be very very big. For example, it can be DNA sequences (which run into GBs). I will share the input sequences for test purposes.

Edit distance can be found in CLRS book.

Programming language: C++

Deliverables: A program which given two strings (as files) outputs the edit distance between them. The letters of the string will be given as input.