# ACA Semester Project
# Task List 2

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# A Helpful Tool - Git

You'll find Version Control System tools like Git helpful for this project. So create a user ID on github.com if you don't have one.

- What is this thing? : https://git-scm.com/book/id/v2/Getting-Started-About-Version-Control
- How to use Git? : https://www.atlassian.com/git/tutorials/setting-up-a-repository
- Summary of this Git thing? : http://rogerdudler.github.io/git-guide/

Your task:

- Create a Github repository and give me read access to that repository.
  My github user ID : anujnag
- Upload all your code work regularly on Github so that I can keep a track.

# Algorithms

### Graph Algorithms - Moving a step ahead

Assuming that you all have gone through lecture 22 which was an intro to graphs, now it's about time to move a step ahead. In the one drive folder, you can find 6 more lectures on three famous graph algorithms:

- Breadth First Search (BFS) Traversal
- Depth First Search (DFS) Traversal
- Dijkstra's Algorithm

These are lecture 23-27 and 38. You'll have to go through them to complete this task (In case you are not able to absorb the algorithms from the lectures, you can refer online sources also for learning).
Now I have something in my mind which I want to know if that can be implemented or not. You can find IITK Map in the onedrive folder. Using the locations and distances from that map, is it possible to use Dijkstra's shortest path algorithm to find the shortest route from point A to point B in IITK? If possible, can we develop an application which will take input as two locations in campus and can tell you the route with directions highlighted on that 2D map (just like google maps)? Try something along these lines.

### Competitive Coding

Those who are falling in love with algorithms can start visiting coding websites like codechef, codeforces, hackerrank, hackerearth, topcoder etc. You can find some websites like geeksforgeeks to be very useful.
You can follow this guide by a Y12 senior I know, Triveni Mahatha (the God :P):
http://sportprogramming.blogspot.in/2014/07/getting-started-with-sport-of.html

## Python

### Your own Tic Tac Toe Game

Your last task was to learn python. Now let's build something using that...ummmm...how about a Tic Tac Toe game?
What you have to do is to make a python program which plays Tic Tac Toe game with you. Here are the implementation details:

- The code must print a 2D tic tac toe board after every move and ask for your move. For example:

```
   |   |
 O |   | O
   |   |
-----------
   |   |
 X |   |
   |   |
-----------
   |   |
 O |   | X
   |   |
What is your next move? (1-9)
```

- The user will input his move using digits 1-9 where 1 means first square, 2nd means second square and so on.
- The AI's algorithm should be like:
  - First, see if theres a move the computer can make that will win the game. If there is, take that move. Otherwise, go to step 2.
  - See if theres a move the player can make that will cause the computer to lose the game. If there is, move there to block the player. Otherwise, go to step 3.

  - Check if any of the corner spaces (spaces 1, 3, 7, or 9) are free. If so, move there. If no corner piece is free, then go to step 4.
  - Check if the center is free. If so, move there. If it isnt, then go to step 5.
  - Move on any of the side pieces (spaces 2, 4, 6, or 8). There are no more steps, because if the execution reaches step 5 the side spaces are the only spaces left.

- Handle all the warning messages like "You can't move in that square as it is already marked" or "Computer Won and You Lost" etc.
  Happy Coding! :D

### Web Scraping

Most of you don't know about flipped classrooms in IIT Kanpur which was started from MSO201 course taught to my batch. So what they do is they post online videos on an online portal and you have to watch videos from that portal on a weekly basis. There won't be any lecture for that course and only one tutorial and one discussion hour per week. Sounds fun? (Not exactly :P)
Now the issue is the video player in that portal isn't very user-friendly, so people prefer watching videos from youtube. What I want is a lecture wise sorted list of youtube videos for that course so that I can watch them one by one before exam day without any trouble (that's what I actually did one night before MSO201 exams here :P). If you search on youtube "MSO201 IITK", you can get a complete playlist of youtube videos there. Can you write a python script that can fetch all the youtube links and writes them in a simple txt file line by line?

### Want a little flavor of Python Scripting?

I have uploaded a script named Deleter.py in the onedrive folder. Can you guess what it is doing? It is cleaning your webmail automatically. Try out some more fun activites like this such as posting your info into a google doc directly using a python script ;)

## Web Dev

### I want a homepage!

There comes a new professor in Earth Sciences Department who wants his own homepage. Now you are doing a course under this professor and surely want a good grade in that course. He visits Prof. Namboodiri's homepage (http://www.cse.iitk.ac.in/users/vinaypn/) and gets envious. Being a CSE student, he asks you to create a homepage for him which looks exactly like Prof. Namboodiri's page but with his own details.
Some help:

- You'll require basic HTML and CSS knowledge. Refer w3schools.com to learn these things.
- As far as website content is concerned, you can write anything for now (it doesn't matter that much). You can write some arbit earth sciences stuff for now.
- Where to host this homepage? - Obviously your IITK homepage. You can use this: https://www.iitk.ac.in/ccnew/index.php/12-services/28-hosting-home-page

# Cyber Security Wargames

### Basic Bash Scripting

One of the issue we (ACA coordis) faced during CSE Y16 intro was how to invite you guys i.e. how to find a mailing list for CSE Y16. So what Pallav did was he scraped all the email Ids from office automation website and gave me a csey16.txt file which you can find in onedrive folder. Now this file contains all the email IDs in a single column but I wanted a comma separated file (.csv file) to send a mail. Can you write a basic bash script to generate a csey16.csv file (also there in onedrive folder).
You'll probably want to google these things and learn them before starting this task:

- Bash Scripting Tutorial
- Grep Tutorial
- Sed Tutorial
- Awk Tutorial

### My First Wargame

This wargame will teach you basic shell commands: http://overthewire.org/wargames/bandit/
Solve only first 12 levels.

# Intro to Machine Learning

This task you will give you an idea regarding a basic machine learning algorithm (basic knowledge of linear algebra required). You can find two files in the shared folder with names starting with 771A - Go through them. Now you'll have to implement this algorithm in Matlab and test it on a standard dataset - MNIST Dataset(google it to know more).
The task is to implement a multi-class extension of the distance from means classifier (lecture-2) and apply it on the MNIST digits classification problem (10 classes, representing digits 0-9). You will be working on a small subset of the data, provided in the mnist.mat

file in the shared folder. Each image is represented as a 784-dimensional vector of pixel intensities (between 0-255). Loading the data in MATLAB will show:

- dataX: Cell array containing the training data. Within this, dataX{1} denotes the feature matrix (each row is an example) of all training images for digit 0, dataX{2} denotes the same for digit 1, and so on.
- X test: This is the feature matrix of test data with each row denoting the feature vector of a test image.
- Y test: This is a vector of containing the ground truth class of each of the test images. You will use it to test the accuracy of your implementation.

Implement the distance from means classifier (using Euclidean distance) and experiment with the following setting: Vary the number of training examples per class from 50 to 2000 with increments of 50. For each case, apply the learned model on the test data and compute the classification accuracy. Plot a curve of the test accuracy vs the number of training examples per class. What trend do you see in the plot?

## LaTeX

I am typing this whole task list in LaTeX. Do you also want to learn this? You can search on youtube "Sharelatex tutorial" and find a playlist with 7 videos. Go through them before going to next task.

### Professor in Hurry

Prof. A.K. Lal has decided to give a summary lecture on eigenvalues and eigenvectors before the midsems. Unfortunately he becomes sick one night before the lecture and calls you (his brightest student) to prepare a presentation for him for tomorrow's lecture which contains the summary of the topic with all necessary formulas.
Some help:

- A.K. Lal has provided his lecture notes in the shared folder. Lecture 6 is the one that you require.
- Go through this beamer tutorial: https://www.sharelatex.com/learn/Beamer It'll help you
- What are you waiting for, start preparing a nice presentation!