

Mathematical Foundation of Computer Science

Project Report

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Introduction

A timetable can be thought of as an assignment of timeslots to different events in any institution.

*So, we made this simple “**Scheduling of Class timetable using Graph Coloring**” where each color denotes a particular time slot. Time slots are reserved for each course and semester according to various factors.*

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Theory

Graph coloring problem is to assign colors to certain elements of a graph subject to certain constraints.

Vertex coloring is the most common graph coloring problem. The problem is, given m colors, find a way of coloring the vertices of a graph such that no two adjacent vertices are colored using same color. The other graph coloring problems like Edge Coloring and Face Coloring can be transformed into vertex coloring.

Applications:

Making Schedule or Time-Table

Mobile Radio Frequency Assignment

Sudoku

Register Allocation

Map Coloring

Hypothesis

- We took 'n' number of Students, for 'c' courses, which includes 's' semester and each student have 'x' subjects.
- Using this Data our goal is to find the most accurate time table schedule for 't' timeslots to accommodate classes of each subject of 's' semester of Course 'c' without clashing the time for different subject of same semester of same Course.
- We also included the case if any student in current semester have recourse of previous semesters. The time slots for previous courses and semester must be managed so that they won't clash either.

Implementation

We used python programming language.

Imported packages:

pandas	- for File Handling
numpy	- for arrays
itertools	- for iterating values
matplotlib.pyplot	- for plotting the points
networkx	- for graph making

Working

We read a file name course.txt which include records of 30 students

Record includes student's Roll no., Course, Semester, and Subjects

The file contents are: ("NaN" denotes not any more subjects)

```
import pandas as pd
data = pd.read_csv("course.txt", delimiter = ',')
df = pd.DataFrame(data)
df
```

	RollNo	Course	Sem	Sub1	Sub2	Sub3	Sub4	Sub5	Sub6
0	1	MCA	1	A	B	C	D	NaN	NaN
1	2	MCA	1	A	B	C	D	NaN	NaN
2	3	MCA	1	A	B	C	D	NaN	NaN
3	4	MCA	1	A	B	C	D	NaN	NaN
4	5	MCA	1	A	B	C	D	NaN	NaN
5	1	MCA	2	E	F	G	H	NaN	NaN
6	2	MCA	2	A	B	E	F	G	H
7	3	MCA	2	E	F	G	H	NaN	NaN
8	4	MCA	2	B	E	F	G	H	NaN
9	5	MCA	2	E	F	G	H	NaN	NaN
10	1	MCA	3	H	I	J	K	L	NaN
11	2	MCA	3	A	I	J	K	L	NaN
12	3	MCA	3	B	H	I	J	K	L
13	4	MCA	3	H	I	J	K	L	NaN
14	5	MCA	3	H	I	J	K	L	NaN
15	1	MTech	1	A	B	M	N	NaN	NaN
16	2	MTech	1	A	B	M	N	NaN	NaN
17	3	MTech	1	A	B	M	N	NaN	NaN
18	4	MTech	1	A	B	M	N	NaN	NaN
19	5	MTech	1	A	B	M	N	NaN	NaN
20	1	MTech	2	E	F	O	P	NaN	NaN
21	2	MTech	2	A	B	E	F	O	P
22	3	MTech	2	E	F	O	P	NaN	NaN
23	4	MTech	2	B	E	F	O	P	NaN
24	5	MTech	2	M	E	F	O	P	NaN
25	1	MTech	3	P	I	J	Q	R	NaN
26	2	MTech	3	P	I	J	Q	R	NaN
27	3	MTech	3	B	O	I	J	Q	R
28	4	MTech	3	B	I	J	Q	R	NaN
29	5	MTech	3	P	I	J	Q	R	NaN

Now we generated the matrix which contains the number of Subjects in Column and Semester no. in Row which tells us - in which how many subjects are taken by student in a particular semester and course.

In this case, Subjects are named as letters in English Alphabets:

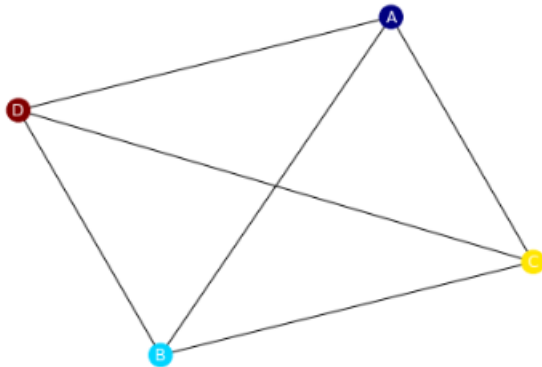
List of Subject semester wise:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0
2	1	1	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0
3	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
4	1	1	0	0	1	1	0	0	0	0	0	0	1	0	1	1	0	0
5	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1

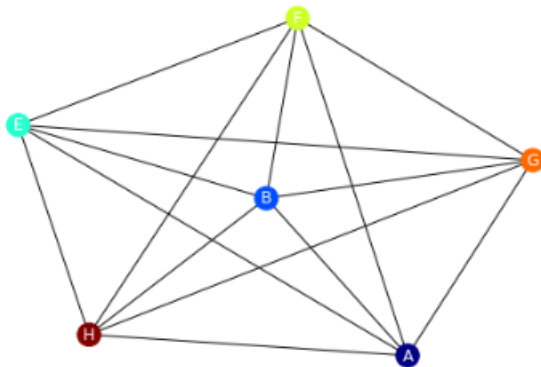
Now for Course 1,

We have 3 semesters and, in each semester, - students have different subjects, so our goal is to plot a graph of subjects in each semester and color them so that each subject in one semester is allotted a different color. Here each subject is denoted by a unique color vertex.

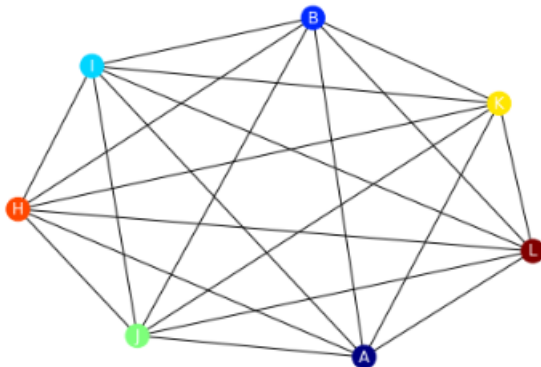
Complete Graph for Subject of Sem 1 :
['A', 'B', 'C', 'D']



Complete Graph for Subject of Sem 2 :
['A', 'B', 'E', 'F', 'G', 'H']

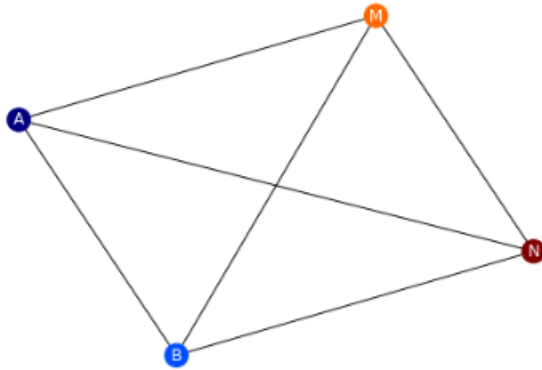


Complete Graph for Subject of Sem 3 :
['A', 'B', 'H', 'I', 'J', 'K', 'L']

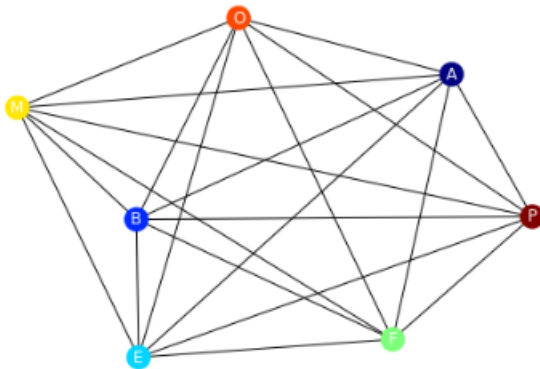


Similarly, for Course 2:

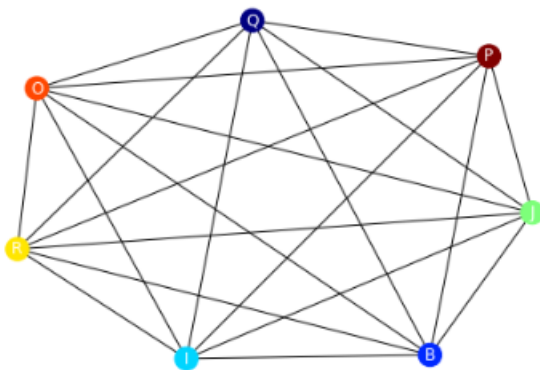
Complete Graph for Subject of Sem 1 :
['A', 'B', 'M', 'N']



Complete Graph for Subject of Sem 2 :
['A', 'B', 'E', 'F', 'M', 'O', 'P']

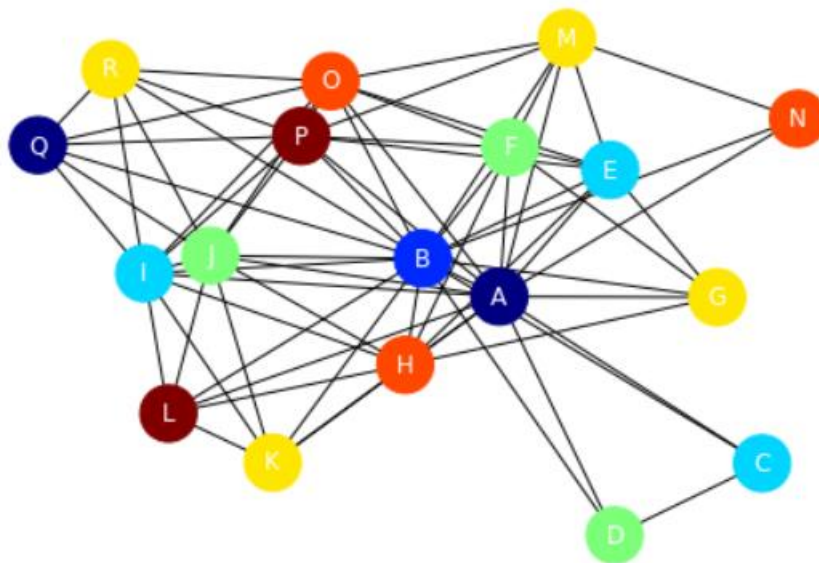


Complete Graph for Subject of Sem 3 :
['B', 'I', 'J', 'O', 'P', 'Q', 'R']



After combining all the graphs:

Graph for All Subjects



Now we have Colors for every subject:

Colors allotted to Each Subject

A - 0
B - 1
C - 2
D - 3
E - 2
F - 3
G - 4
H - 5
I - 2
J - 3
K - 4
L - 6
M - 4
N - 5
O - 5
P - 6
Q - 0
R - 4

These Colors denotes the Time-slot (in which timeslot which subject's class will take place)

Conclusion

After using graph coloring concept, we are able to find timeslots for each subject.

Let's generate the time table:

Final Schedule For Each Semester:

	Course	Sem	Slot1	Slot2	Slot3	Slot4	Slot5	Slot6	Slot7
0	MCA	1	A	B	C	D			
1	MCA	2	A	B	E	F	G	H	
2	MCA	3	A	B	I	J	K	H	L
3	MTech	1	A	B			M	N	
4	MTech	2	A	B	E	F	M	O	P
5	MTech	3	Q	B	I	J	R	O	P

Here, if any student has recourse for previous semesters then he/she can attend those classes. If no recourse, then class of particular semester can take place at same time without any modification.