

# Time Table Scheduling Using MATLAB & Graph Theory Techniques

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**Abstract**— One of the most common academic scheduling issues in any educational system is timetable generation. The presence of vast numbers of students and offered courses makes it difficult to schedule lectures in a limited epoch of time. An appropriate schedule can be designed by utilizing different resources like courses, students, and rooms in a way to evade conflicts by fulfilling special types of constraints. The educational institute timetable should avoid such conflicts, like no two or more courses for the identical student should be scheduled in the same period. There is a need for an effective and accurate timetable for the performance of any educational institute. Graph theory techniques with MATLAB are one decent approach that can deal with a timetable scheduling problem. In this work, a systemic model has been framed by applying a graph vertex coloring approach for generating an educational timetable with the help of a course matrix generated from given data. Here course credit lists and subject combinations have been used as input data. This input data was linked considering the students who follow each subject combination. MATLAB was used to generate the adjacency course matrix from linked data and to plot the particular graph using the course matrix. Welch Powell algorithm can be used to find the chromatic number of a particular graph using MATLAB implementation. Based on the course matrix, the system would detect the colliding subjects and assign the colors to the nodes, which represent the subjects. Two courses are said to collide with each other if they are adjacent. Adjacent subjects could not be assigned the same color. Thus, optimal solutions for such a problem may be found by determining minimal colorings for the corresponding graph. Also, the timetable scheduling problem has been categorized as an NP-hard problem. That means it is unlikely to find a fast algorithm to solve this problem, and to find a solution to such a problem we need to consider all the possible solutions, and then choose the best one.

**Index Terms**— adjacency course matrix, Welch Powell algorithm, chromatic number

## 1 INTRODUCTION

Time tables are required in every educational institution. Every semester or year, the universities and colleges are required to generate timetables for conducting courses in all semesters. The presence of a large number of students and a large number of offered courses sometimes makes it difficult to schedule the timetable without having any conflict. Moreover, the timetable could not be reused because the requirements and some restrictions of the problem keep changing. If done manually, generating a university timetable is very time-consuming and requires a considerable amount of workforce which sometimes may lead to inefficiency. So it demands an automatic generation of time table with a limited number of user input parameters.

The university timetable should be generated in such a way that a particular student has only one course at a time. So this can be considered as a good constraint or restriction which must be satisfied while designing an automatic timetable generation system. There is no restriction regarding the faculty members. That means any faculty member could be assigned to conduct the lecture of any course. The courses could be conducted in any room accordingly to the availability of the room, the capacity of the room & number of students for each

course. In this work, I have contributed to formulating the university timetabling problem followed by a MATLAB implementation with some user input parameters.

### 2.1 Input

Subject Combination	index
AMAT/PMAT/PHYS	A
AMAT/PMAT/CHEM	B
AMAT/PMAT/COSC	C
AMAT/PMAT/STAT	D
PMAT/STAT/COSC	E
PMAT/ COSC/CHEM	F
PMAT/ COSC/PHYS	G
PMAT/ELEC/COSC	H
PMAT/COST/CHEM	I

Table 1: Subjects combination of University

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	Course credit list	Subject Combinations
1	AMAT 11513	A, B, C, D
2	AMAT 11522	A, B, C, D
3	CHEM 11522	B, F, I
4	CHEM 11532	B, F, I
5	COSC 11513	C, F, G, H
6	COSC 11522	C, F, G, H
7	COST 11513	I
8	COST 11522	I
9	ELEC 11513	H
10	ELEC 11534	H
11	PHYS 11512	A, G
12	PHYS 11532	A, G
13	PMAT 11513	A, B, C, D, E, F, G, H, I
14	PAMT 11522	A, B, C, D, E, F, G, H, I
15	STAT 11514	D, E
16	STAT 11521	D, E

**Table 2: Course credit list with relation of Subjects combination**

## 2.2. Out put of MATLAB

2.2.1. Generating the course matrix and plotting the particular graph using the course matrix from MATLAB.

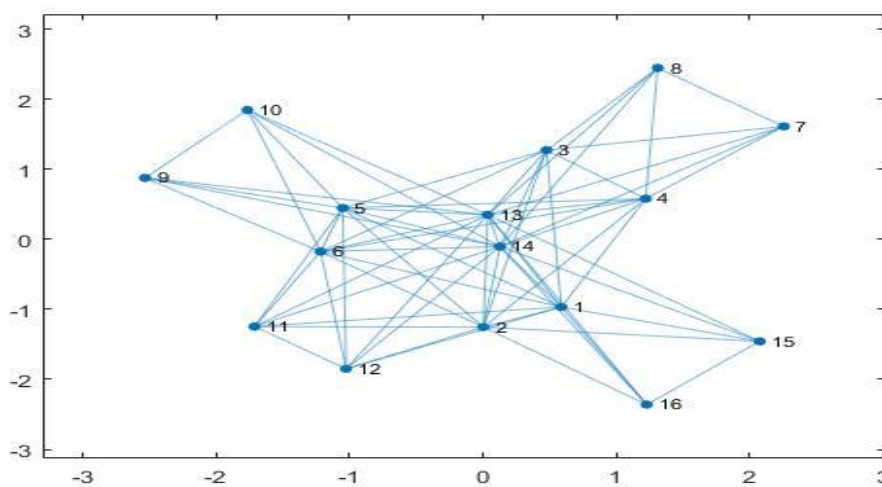


Fig.1: Uncolored course matrix plot

### 2.2.2. Coloring the particular graph using MATLAB implementation.

Based on the course matrix, the system would detect the colliding subjects and assign the colors to the nodes, which represent the subjects. Two courses are said to collide with each other if they are adjacent. Adjacent subjects could not be assigned the same color. Here Welch Powell algorithm have used for MATLAB implementation. The chromatic number of the following graph is 8.

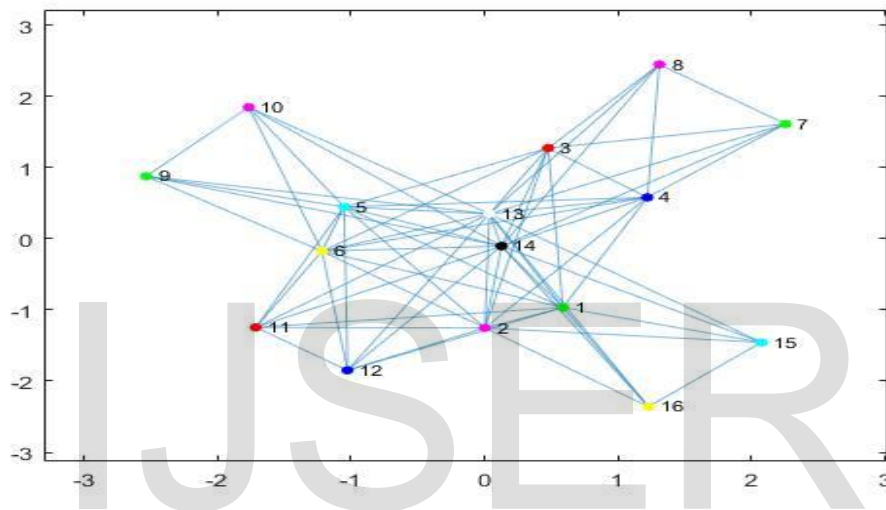


Fig.2: Colored course matrix plot

Now, time slots can be assigned for such subjects considering the chromatic number, the color of course, and capacity of the room. If the total number of students is greater than any single room capacity, then I allot more than one room for conducting the course. And the capacity of the allotted rooms should be greater than or equal to the number of students.

## 3 RESULTS & DISCUSSION

In this work, colors for the courses based on the course matrix using MATLAB were assigned. To assign a color to courses, we need to find out the colliding courses. The courses are said to collide with each other if they are adjacent. Adjacent Courses could not be assigned the same color. From the above-colored graph, the chromatic number can be identified as 8. The chromatic number implies the minimum number of slots without constraints. The Time table scheduling problems are directly related to the number of constraints involved. The higher number of constraints might raise more numbers of complexities. There is no fixed algorithm to solve this class of problems.

## REFERENCES

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