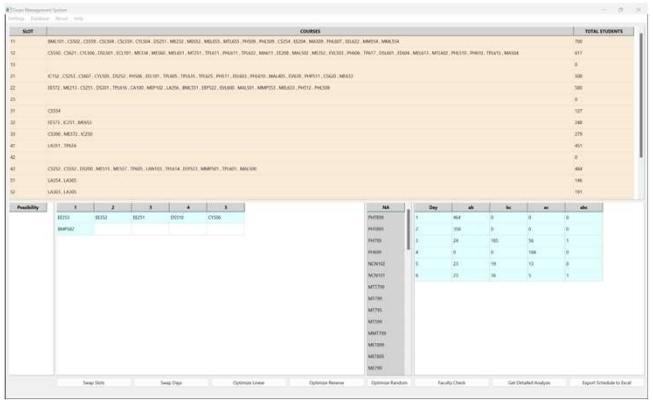
Exam Scheduling Software



By Shubham Yogesh Mahajan (12241730) a BTech student in the discipline of CSE

Motivation

1st February 2024

After encountering a hectic mid semester examination schedule , I visited the Office of Academic Affairs as the Class Representative of CSE'26 batch.

I observed that the prevailing practice of creating the time table for exams was done entirely manually using excel spreadsheets.

Any changes in the time table required the staff to perform tedious , repetitive operations in the vast excel workbook

This prompted me to develop a software that could help create the exam time table optimally and efficiently.

Where did the old method lack?

Previously the exam scheduling was done entirely manually using excel spreadsheets

1) Extremely tedious and time consuming
2) Repetitive
3) There was no way of knowing how many and, which students will have to attempt more than one exam in a day.
4) No optimization possible due to lack of data
5) No convenient way of knowing how the presence of a particular course affects the overall Time Table.
6) No possible slots for scheduling are known before hand thus, making the process of scheduling a course a very difficult, and exhausting hit and trial process.
7) No convenient record of which courses are scheduled and which are yet to be scheduled, thus requiring constant manual verification.
8) High Scope for manual errors
9) Incorporating any suggestions extremely tedious, as the ripple effect of changes can't be anticipated
10) Unorganized

How will the Software help?

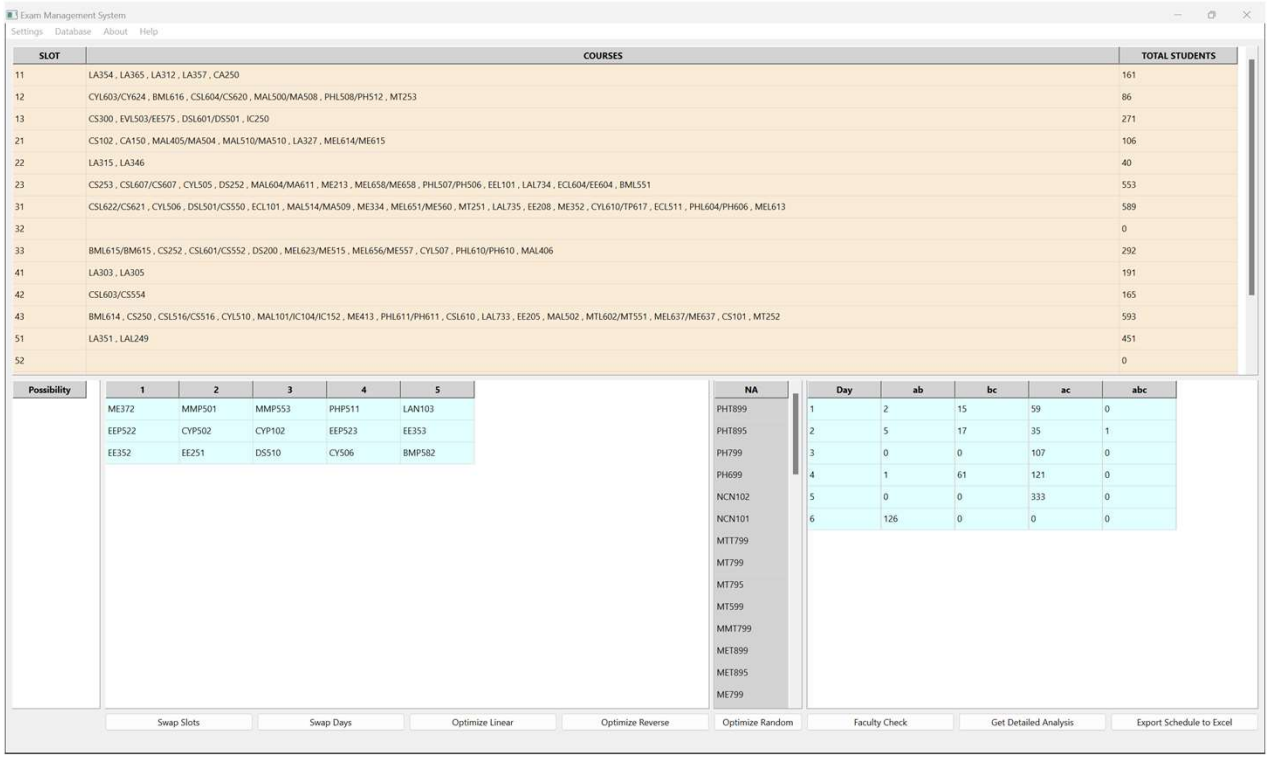
1) Easy to use and extremely fast
2) The software handles all the repetitive and tedious tasks by providing complete automation
3) Simplified User interface allows an organized, and efficient method of creating the Schedule
4) Detailed analysis given about students who have to attempt more than one exam in a day
5) One-Click Optimization possible due to presence of accurate data
6) The effect a course will have on the overall time table can be easily determined
7) With a simple click you get all the possible slots in which a particular course can be scheduled.
8) Tables present to keep track of all the scheduled and unscheduled courses
9) Little to no possibility of manual errors due to automated processes.
10) Incorporating changes and suggestions extremely easy due to fast and accurate algorithms

Features and Functionality

1) A User Friendly Interface
2)Settings to control number of days of the exam and the max capacity of lecture halls.
3) Automatic Generation of the exam time table with further optimization options
4) Analysis
5) Scheduling mechanism which includes student clash detection as well as max capacity change feature
6) Descheduling mechanism
7) Facility to find alternate slots
8) Optimization
9) Facility to Swap exam days and swap exam slots
10) Faculty report generation which reflects the workload on the faculties
11) Feature to export the created schedule to excel

A User Friendly Interface

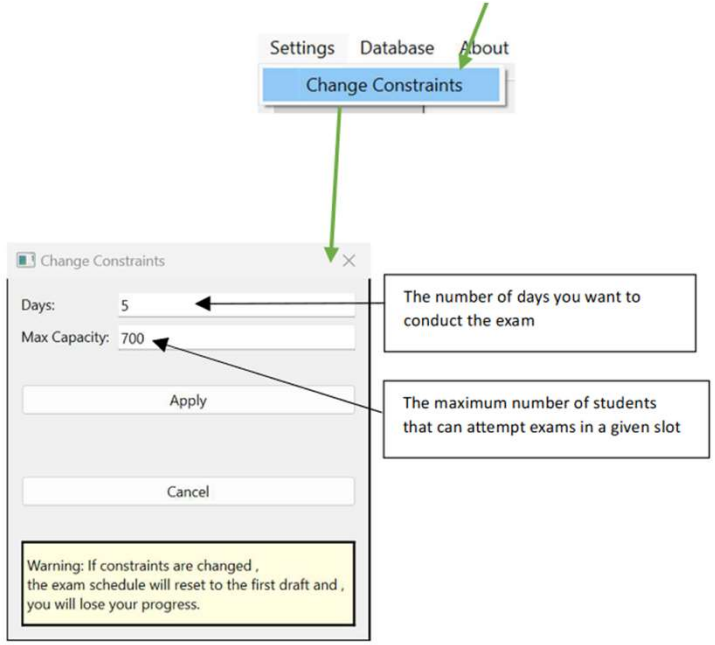
A graphical user interface allows the entire operations of exam scheduling to be performed using a single, easily understandable window .



Settings

The user has control over the following constraints:

1) Number of days the exam will be conducted for
2) The maximum number of students that can give exam in a particular slot.



Automatic Generation of the Timetable

Based on the given input and constraints the software automatically creates a valid timetable for the exams using a special algorithm.

It is ensured that –

1) No student will have to give more than one exam in a particular slot (Conflict Prevention)
2) The Maximum Capacity defined will be followed for each slot (Constraints implementation)

This First Draft can be conveniently modified to ensure that no student is overloaded on any given day (discussed later)

Live Analysis

The user will always know the exact number of students who have to give more than one exam in a day with the help of the analysis table.

Day	ab	bc	ac	abc
1	2	15	59	0
2	5	17	35	1
3	0	0	107	0
4	1	61	121	0
5	0	0	333	0
6	126	0	0	0

Analysis Table

*A row like = **2**(day) ; **34**(ab) ; **27**(bc) ; **45**(ac) ; **19**(abc)*

Would imply that on **2nd** day,

34 students are giving exam in the **1st and 2nd slot (ab)**
27 students are giving exam in the **2nd and 3rd slot (bc)**
45 students are giving exam in the **1st and 3rd slot (ac)**
19 students are giving exam in the **1st 2nd and 3rd slot (abc)**

Detailed Analysis

Get Detailed Analysis

With the click of a button, the user can obtain a detailed report of the data present in the “Analysis Table”

Day	ab	bc	ac	abc
1	464	0	0	0
2	358	0	0	0
3	24	185	56	1
4	0	0	184	0
5	23	19	13	0
6	23	36	5	1

The report excel file can be found in ‘Analysis_Reports_Folder’

Sheet 1 only gives the report about the students who have to give exams in all 3 slots of the day

	A	B	C	D	E
1	Day 1				
2					
3					
4	Day 2				
5					
6					
7	Day 3				
8		12140890	CS300	CS554	EE573
9					
10					
11	Day 4				
12					
13					
14	Day 5				
15					
16					
17	Day 6				
18		12141430	CS250	LA346	ME615
19					

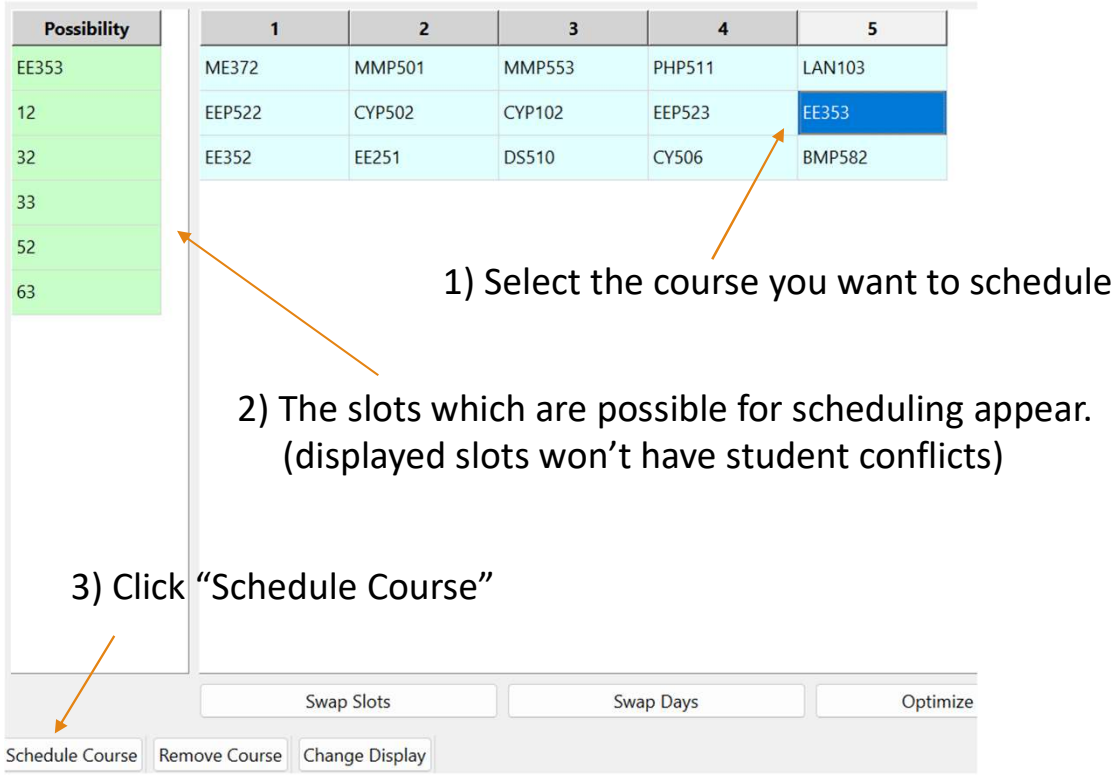
Sheet 2 gives detailed report about all the students who have to give 2 or 3 exams in the day

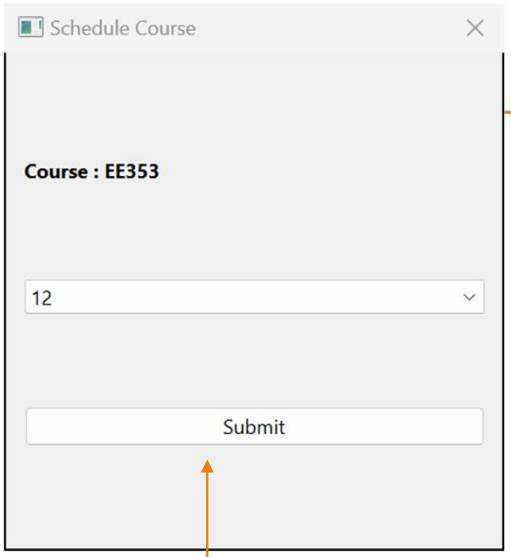
	A	B	C	D	E	F
1	ID	a	b	c	Day	
2						
3						
4	12342030	BML101	ECL101		1	
5	12342070	BML101	ECL101		1	
6	12342330	BML101	ECL101		1	
7	12041310	CS502	MT251		1	
8	12140800	ME652	ME334		1	
9	12340300	BML101	ECL101		1	
10	12311190	MEL655	MEL651		1	
11	12041710	CS559	CS621		1	
12	12140340	CS254	CS550		1	
13	12341340	BML101	ECL101		1	

Scheduling of a course

With simply 4 clicks the user can schedule a course and, even understand how scheduling that course in that particular slot affects the overall Time Table.

Overview of the Scheduling Process:

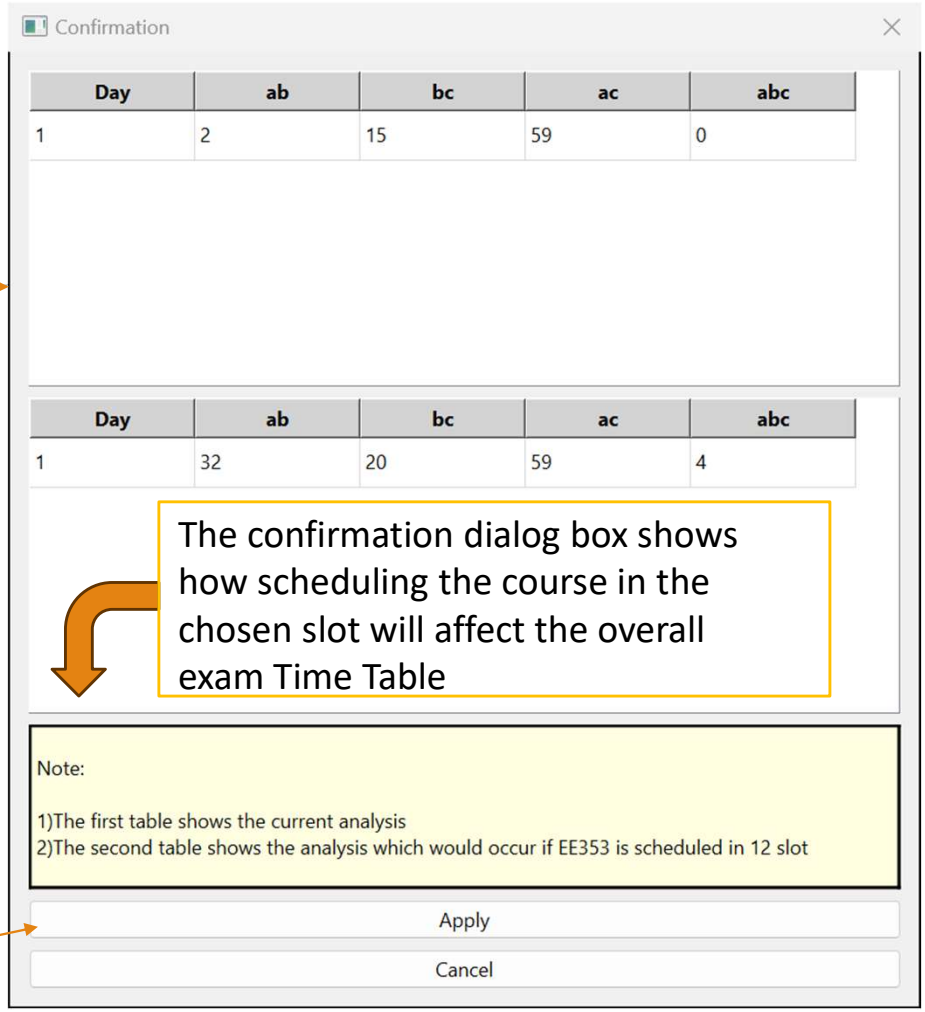




4)Choose the appropriate slot from the dropdown and click Submit

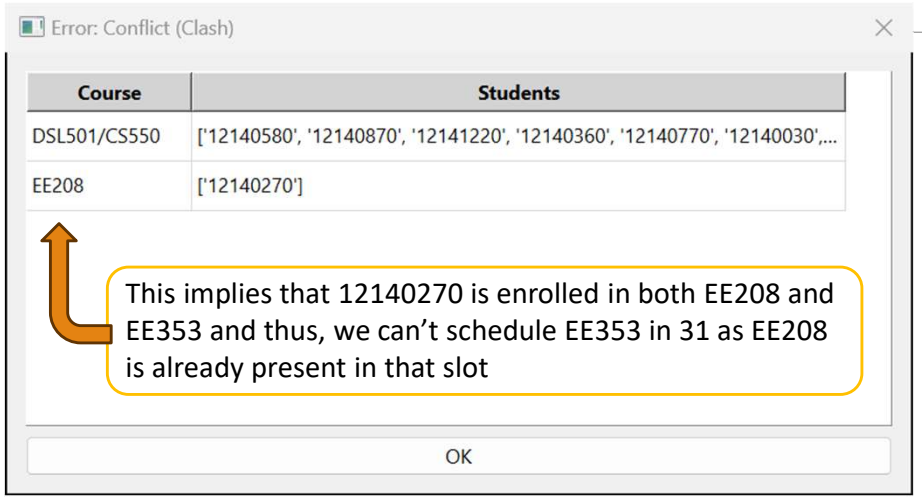
5) Confirmation Dialog Box appears if :

a)there are no student conflicts
b)the max capacity specified is not being exceeded



6) Click Apply to Schedule the course

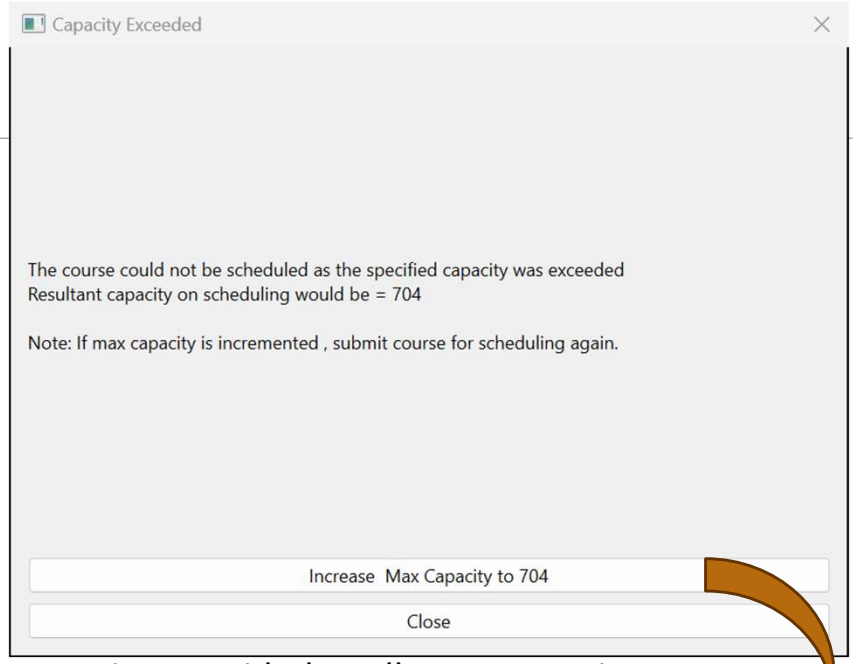
Student Conflict Example:
Attempting to schedule EE353 in 31 slot



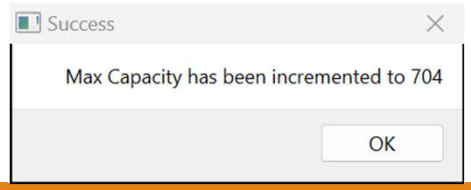
In case a slot is chosen which raises a student conflict , a detailed summary is given –

a) The IDs of the student
b) The course in the slot in which the conflicting student in enrolled

Capacity Exceeding Example
Attempting to schedule PHT899 in slot 53



An option provided to allow users to increase the max capacity conveniently



De-scheduling a course

With simply 3 clicks the user can de-schedule a course and observe its overall effects on the Time Table

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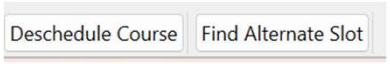
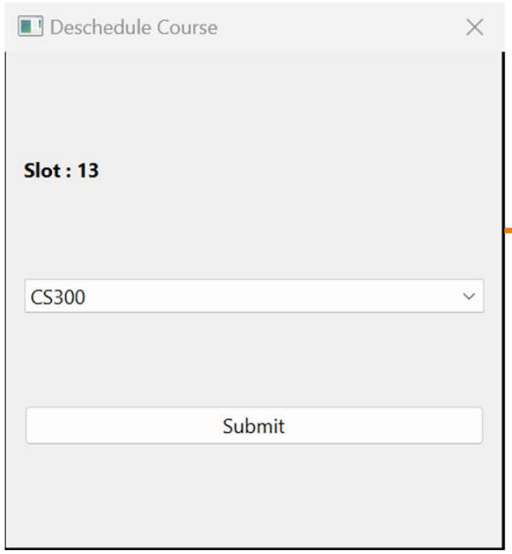
Overview of the De-scheduling Process:

SLOT	COURSES	TOTAL
11	LA354 , LA365 , LA312 , LA357 , CA250	161
12	CYL603/CY624 , BML616 , CSL604/CS620 , MAL500/MA508 , PHL508/PH512 , MT253	86
13	CS300 , EVL503/EE575 , DSL601/DS501 , IC250	271
21	CS102 , CA150 , MAL405/MA504 , MAL510/MA510 , LA327 , MEL614/ME615	106
22	LA315 , LA346	40

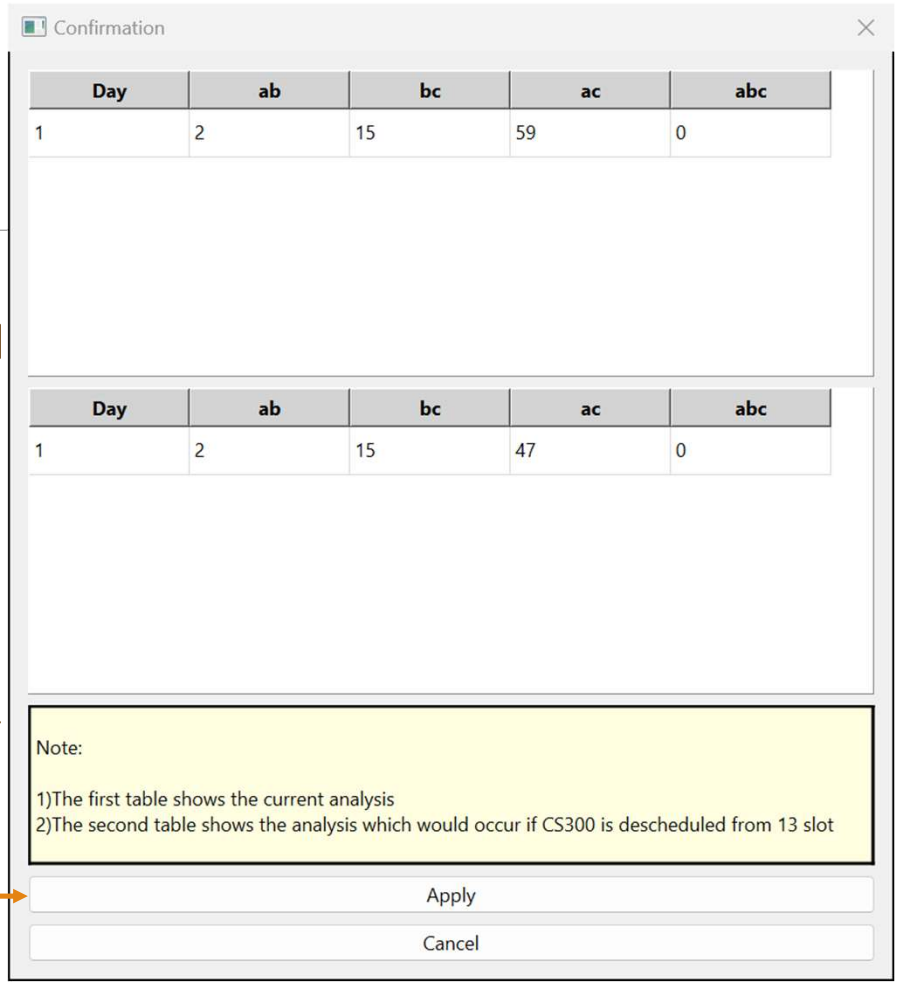
1) Select the slot from which you wish to de-schedule a course

2) Click the “De-schedule Course” button





Confirmation Dialog Box appears



3) Select the course you want the de-schedule from the drop down and click Submit

4) Click “Apply” to de-schedule the course

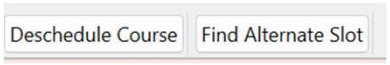
Finding Alternate Slots for a Course

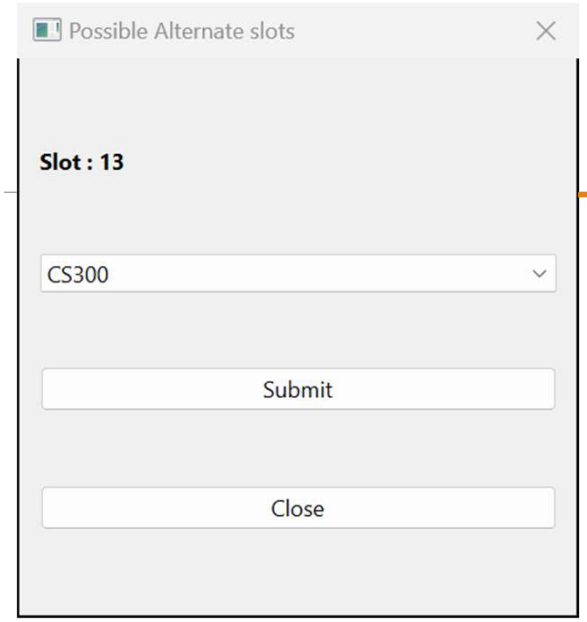
The user can find alternate slots for a scheduled course to explore alternate possibilities

SLOT	COURSES	TOTAL
11	LA354 , LA365 , LA312 , LA357 , CA250	161
12	CYL603/CY624 , BML616 , CSL604/CS620 , MAL500/MA508 , PHL508/PH512 , MT253	86
13	CS300 , EVL503/EE575 , DSL601/DS501 , IC250	271
21	CS102 , CA150 , MAL405/MA504 , MAL510/MA510 , LA327 , MEL614/ME615	106
22	LA315 , LA346	40

1) Select the slot in which the course is present

2) Click the “Find Alternate Slot” button





The alternate scheduling possibilities for the course are shown.

(the displayed slots won't have student conflicts)

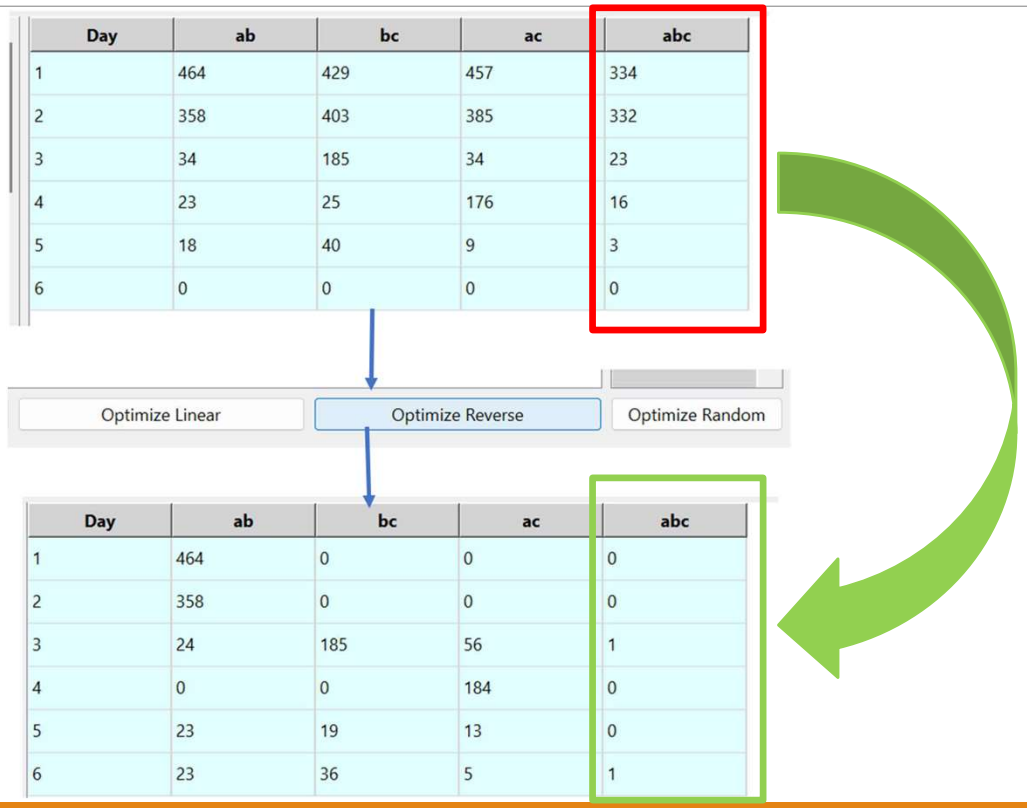
Possibility
CS300
12
32
41
52
63

3) Choose the desired course from the dropdown and click submit

Optimization

With the click of a button the user can minimize the number of students who have to give 3 exams in a day

Optimization is done using a special “Greedy” Algorithm



Day	ab	bc	ac	abc
1	464	429	457	334
2	358	403	385	332
3	34	185	34	23
4	23	25	176	16
5	18	40	9	3
6	0	0	0	0

Day	ab	bc	ac	abc
1	464	0	0	0
2	358	0	0	0
3	24	185	56	1
4	0	0	184	0
5	23	19	13	0
6	23	36	5	1

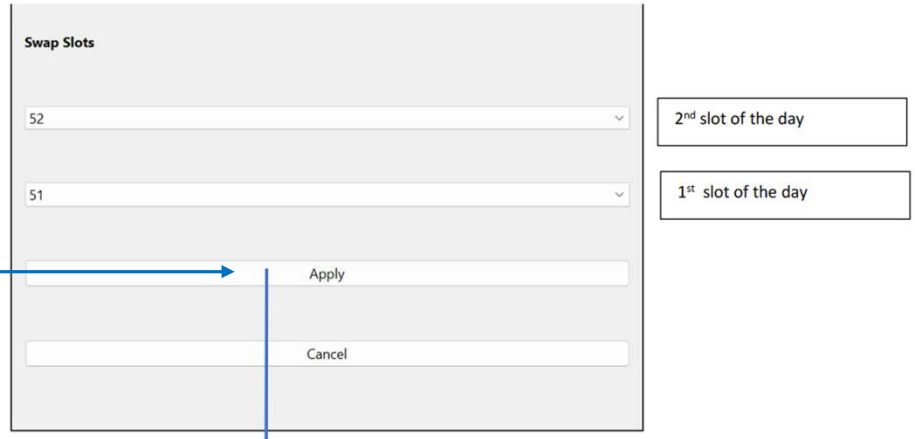
Swap Slots Feature

1) **Swap Slots** = Used to swap two exam slots (Example interchange 13 and 22).
The primary use of this is to change how students attempt exams throughout the day.
(Example transforming 'bc' value to 'ac' value by swapping the 2nd and 1st slot of the day.)

Day	ab	bc	ac	abc
1	464	429	457	334
2	358	403	385	332
3	34	184	31	23
4	23	25	176	16
5	18	40	9	3

bc = 40 means 40 students will have to give back to back exams in the 2nd and 3rd slot of the day

ac = 9 means 9 students will have to give exams in the 1st and 3rd slot of the day



Day	ab	bc	ac	abc
1	464	429	457	334
2	358	403	385	332
3	34	184	31	23
4	23	25	176	16
5	18	9	40	3

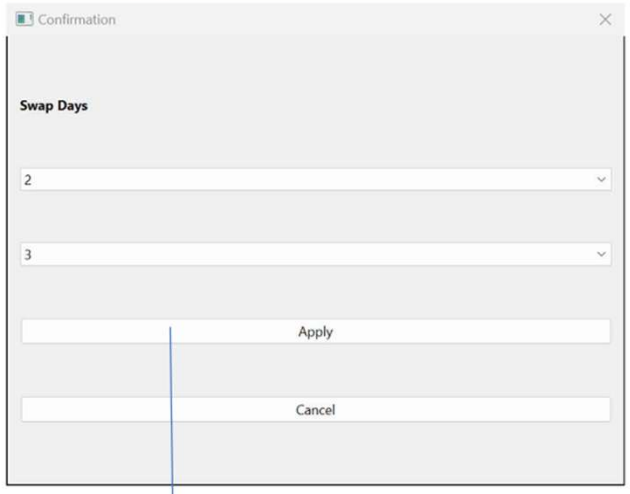
The user has complete control over how students attempt exams throughout the day.

Swap Days Feature

2) Swap Days = This swaps entire days with each other.

Example – swapping day 2 with day 3

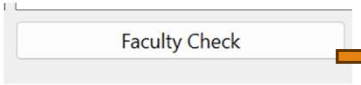
21	IC152 , CS253 , CS607 , CYL505 , DS252 , PH506 , EEL101 , TPL605 , TPL635 , TPL625 , PH511 , EEL603 , PHL610 , MAL405 , EV639 , PHP511 , CS620 , ME633
22	EE572 , ME213 , CS251 , DS201 , TPL616 , CA100 , MEP102 , LA356 , BML551 , EEP522 , EVL600 , MAL501 , MMP553 , MEL633 , PH512 , PHL508
23	CS252 , CS552 , DS200 , ME515 , ME557 , TP605 , LAN103 , TPL614 , EEP523 , MMP501 , TPL601 , MAL500
31	EE575 , MT253 , CA250 , MA510 , LA312 , LA357 , CYP102 , CYP502
32	EE573 , IC251 , ME653
33	ME372 , IC250



The user has control over the workload distribution throughout the examinations

21	EE575 , MT253 , CA250 , MA510 , LA312 , LA357 , CYP102 , CYP502
22	EE573 , IC251 , ME653
23	ME372 , IC250
31	IC152 , CS253 , CS607 , CYL505 , DS252 , PH506 , EEL101 , TPL605 , TPL635 , TPL625 , PH511 , EEL603 , PHL610 , MAL405 , EV639 , PHP511 , CS620 , ME633
32	EE572 , ME213 , CS251 , DS201 , TPL616 , CA100 , MEP102 , LA356 , BML551 , EEP522 , EVL600 , MAL501 , MMP553 , MEL633 , PH512 , PHL508
33	CS252 , CS552 , DS200 , ME515 , ME557 , TP605 , LAN103 , TPL614 , EEP523 , MMP501 , TPL601 , MAL500

Faculty Workload Report



Clicking this button will create an excel file (in the 'Faculty_Check_Reports' folder) which contains the information about faculties who have more than 1 Course in a particular exam slot.

This feature can be used to ensure that no faculty is overloaded on any given day

Example

	A	B	C	D	E	F	G
1	Slot	Instructor					
2							
3	11	Dr. I. Vinod Kumar Reddy	CS502	CSL504			
4	11	Dr. Gaganraj Gupta	CS559	CSL559			
5	11	Dr. Soumya Gangopadhyay	ME652	MEL655	MTL655		
6	11	Dr. Sudhanwa Patra	PH509	PHL509			
7	11	Dr. Md Mehboob Alam	MM554	MML554			
8	12	Dr. Rajesh Kumar Mundotiya	CS550	DSL501	DSL601		
9	12	Dr. Dhiman Saha	CS621	TPL611			
10	12	Dr. Rahul Jain	ME560	MEL651			
11	22	Dr. Purnendu Das, Dr. Kaushik Bandhopadhyay	CA100	MEP102			
12	22	Dr. Sesha Vempati	PH512	PHL508			
13	53	Ms. Hao Yu Lu	LA312	LA357			
14	62	Dr. Pawan Kumar Mishra	IC104	MAL101			
15	62	Dr. Kaushik Bandhopadhyay, Dr. Purnendu Das	MT252	MT551			
16							
17							

Export Schedule to Excel

Export Schedule to Excel

Creates an excel file which represents the exam schedule.(File can be found in the 'Schedules' folder)

This file can be modified and then sent to the students.

	A	B	C	D	E	F
1	Slot	Total Students	Courses			
2						
3	11	700	BML101			
4			CS502			
5			CS559			
6			CSL504			
7			CSL559			
8			CYL504			
9			DS251			
10			ME232			
11			ME652			
12			MEL655			
13			MTL655			
14			PH509			
15			PHL509			
16			CS254			
17			EE204			
18			MA509			
19			PHL607			
20			EEL622			
21			MM554			
22			MML554			
23						
24						
25	12	617	CS550			
26			CS621			
27			CYL506			
28			DSL501			

The numbers don’t lie

The End Semester examination Time Table was created using the “Exam Scheduling Software”

1) It took more than 4 days to create the Mid Semester Examination Time Table, whereas the End Semester Examination was made in under 4 hours using the software !

2)Due to **lack of optimization** in the first version of the Mid Semester Exam Timetable more than **200** students had to give 3 exams in a single day.

Using the special optimization algorithms of the software this number was reduced to **0.**
Not a Single student had to give 3 exams in a single day in the End Semester Examinations.

An Example of the benefits

The software analysis helped the staff to reduce the examination workload for the students

Day	ab	bc	ac	abc
1	4	1	126	0
2	12	5	32	0
3	61	1	121	0
4	0	0	107	0
5	0	22	184	0
6	2	18	139	0

The schedule was planned in such a way that the majority of the students who had to attempt 2 exams in a day were given a sufficient break between the two papers

An Example of the benefits

The software helped in prompt incorporation of suggestions and changes in the End Semester examination Time Table

Example:

Respected Sir,
It was observed for the students of 2nd year that the first and second day of the examination (24th and 25th) have very light workload (relatively easy courses), whereas the last two days of the exam (29th and 30th) have hectic workload (relatively harder courses)
for example , for the CSE branch of 2nd year -
24th = 2 credit IC250
25th = 2 credit CS253

29th = LAL249 (4 credit) + CS254 (4 credit)
30th = CS251 (4 credit) + IC251 (4 credit)

As a solution to this problem ,We request you to kindly swap the first and the last day (i.e. swap 24th april with 30th april) . This will balance the workload throughout the examination period and thus, immensely help the students of BTech 2nd year.

I have spoken with CRs of all the branches of 2nd year and no one has any issues with this proposal.

The presence of detailed analysis helped the staff to determine if the change is feasible.

The verification took less than 3 minutes.

This change was then applied in under 30 seconds by simply using the “Swap Days” feature of the software !

An Example of the benefits

After the first version of the End Sem TT was drafted a logistics issue prompted the academics to **shift an entire exam slot.**

Such a shift can have cascading effects on the entire schedule.

This seemingly humongous task was **just a matter of 20 mins** for the academic staff using the software .
They were quickly able to identify the slots which could be swapped and the courses which could be shifted with the help of the robust analysis provided by the software.

The Outcome

This software not only helps the Office of Academic affairs but also the Students and the Faculties of IIT Bhilai.

A Staff with better control over the time table would result in a better situation for the students and the faculties alike.

A Time Table which is balanced and not hectic for the students is now not just a fantasy, but **a reality** which can be achieved using this software

Special Mentions

I extend my sincere gratitude to Mr. Pawan Kumar Mishra, Assistant - Office of Academic Affairs for his invaluable guidance throughout the development of this software. His profound insights played a pivotal role in defining the features and functionalities of the software.

I deeply appreciate the support shown by the Office of Academic Affairs – IIT Bhilai. Their collective expertise and encouragement have been instrumental throughout the development journey of this software .