Objective function:

$5000X_1+5000X_2+5000X_3+5000X_4-X_5-X_6-X_7-X_8+\ldots\ldots\ldots\ldots +5000X_{720}$ (1)

Constraints:

- One teacher can be allotted 1 class in a time slot on the same day:
  $X_1+X_{145}+X_{289}+X_{433}+X_{577}<=1$ so on…for all teachers all days all time slots. (2)
- Total no. of classes of a particular subject should be 8 in a week
  $X_1+X_2+X_3+X_4+X_{25}+X_{26}+X_{27}+X_{28}+X_{49}+\ldots..X_{124} <=8$ so on for all subject/class (3)

- Maximum 2 classes of the same subject can be held on a day
  $X_1+X_2+X_3+X_4 <=2$ so on for all subject/day/class (4)

- Total no of classes in a day should be 4
  $X_1+X_2+X_3+X_4+\ldots.X_{24} <=4$ so on for all days (5)

- Avoid multiple classes in a single time slot for a class
  $X_1+X_5+X_9+\ldots X_{21} <=1$ so on. (6)

The constraints and the objective function are coded in R are solved using package LP solve as it is a linear programming problem with binary decision variables. The variables are equal to n*t*c*d.

Thus allotments are obtained for timetable scheduling through this for school classes.

The allotments obtained have scheduled the timetable according to the constraints we used. This case clearly shows how well and easily can be scheduled a timetable in a time saving and effortless way reducing manpower. The algorithm so developed here will be used as the background for the timetable scheduling in the company tool for schools and colleges. The interface is under construction by the organization. A number of other constraints according to the complexity of case can be added to the program and can be modified, one has to design a matrix appropriately is the first important task at hand. The intention of the algorithm to generate a time-table schedule automatically is satisfied. The algorithm incorporates a number of techniques, aimed at improving the efficiency of the search operation. It also addresses the important hard constraint of clashes between the availability of teachers. The non-rigid soft constraints i.e. optimization objectives for the search operation are also effectively handled. Given the generality of the algorithm operation, it can further be adapted to more specific scenarios, e.g. University, examination scheduling and further be enhanced to create railway timetables. Thus, through the process of automation of the time-table problem, many an-hours of creating an effective timetable have been reduced eventually. A similar approach is used for college scheduling problem where a single faculty can teach more than one subjects thus another constraint along with the above for avoiding a single faculty being allotted different subject/class in a time slot is introduced. A college timetable scheduling algorithm is also developed on similar lines in R.

IV. Conclusion and Future Scope:

A timetable scheduling algorithm is developed using Hungarian method and LPP in R software. The constraints can be varied according to using simple programming logic. Various packages of R come handy while developing an optimal solution. The algorithm developed will be used in the company analytical tool for schools and colleges and will be inbuilt into the software adding more utility and ease for the user (management, faculty, and students). Another dimension of

allotting classrooms in case of college timetable can be introduced and coded making it a more informative solution.

The work can be further extended to be used a college scheduling problem where which faculty is to teach which subject/subjects is already fixed. The allotment part in the school scheduling problem solved by Hungarian method can be skipped in this case and direct allotment matrix can be made and objective function realized and optimized. The only thing to keep in mind would be to add a constraint that would restrict the same faculty teaching different subjects to be allotted the same time slot. Also, the course preferences for classes can be incorporated by taking a different combination of large positive numbers in place of 5000 here. The dimension of classroom allocation is an important aspect that needs to be taken care of hence. This can be done by first obtaining the results of allotment and then optimizing it further on similar lines.

Heuristic optimization methods are explicitly aimed at good feasible solutions that may not be optimal where the complexity of the problem or limited time available does not allow an exact solution. Generally, two questions arise related to how fast the solution is computed and how close the solution is to the optimal one? The tradeoff is often required between time and quality which is taken care of by running simpler algorithms more than once, comparing results obtained with more complicated ones and effectiveness in comparing different heuristics. The empirical evaluation of heuristic method is based on the analytical difficulty involved in the problem's worst case result.

Solving Timetable Scheduling Problem by Using Genetic Algorithms: Genetic algorithms are adaptive systems inspired by natural evolution. They can be used as techniques for solving complex problems and for searching of large problem spaces. Genetic algorithms are belonging to guided random search techniques, which try to find the global optimum. Genetic algorithms are working with the set of potential solutions, which is called population. Each solution item (individual) is measured by the fitness function. The fitness value represents the quality measure of an individual, so the algorithm can select individuals with better genetic material for producing new individuals and further generations.

TABU Search Algorithm to Solve Class Time Table Scheduling Problem: Tabu search uses memorized ability to prevent from searching previously visited the area; therefore it is easier to obtain an optimal solution in a short time. Here we introducing modified approaches which do not allow violations of any hard constraints, and it produces only feasible solutions.

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